# JSP

## JOURNAL of SPACE PHILOSOPHY

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Fall 2017



KEPLER SPACE INSTITUTE

# Reflections on a Solar Eclipse[1]

**By Gordon Arthur**

On August 21, 2017, just after 9 am, Pacific Time, I was standing on the Capitol Mall in Salem, OR, waiting for what has been called the most accessible solar eclipse in a century to begin. I did not have long to wait: a few minutes later, a dark patch appeared on the top right of the sun as the moon began its transit. Soon it was obvious, through eclipse viewers, that things were under way. I was not alone, although the mall had not yet filled up completely. This was no surprise, but what was a surprise was that I was flanked on both sides by people I had never met, but who lived less than 10 miles away from me in Vancouver, BC, 350 miles to the north. I suggested we put up a Canadian flag.

There was a palpable sense of energy and excitement that built up as totality approached, probably helped by the fact that we had cloudless, blue skies and every chance of a superb view. Shortly before totality, the skies began to darken and the cheering began as the sun's light vanished and we saw a magnificent corona for 1 minute and 56 seconds. Then the sun's light flared as we reached third contact, and the daylight began to return. Moments later, we had full sunlight, and just over an hour after that, it was all over.

The 2017 eclipse from Madras, OR (photo credit: NASA)

It was a very different story the first time I saw a solar eclipse. That was in Penzance, on the south-western tip of England, on August 11, 1999. On that occasion, the weather was very different: it was cloudy, and while there were breaks in the cloud, it started raining about 10 minutes before totality, so I never saw the corona. However, since I was on the coast, I could see the sun reflecting off the waves out to sea and there were lots of seagulls around, getting confused and alarmed by the sudden dark. Neither happened in Salem, because there were no birds around and I was more than 50 miles inland. The drop in temperature was also much more noticeable in Penzance, but the rain probably contributed to that. However, each experience contributed something the other did not.

[1] I am grateful to Dr. Larry Downing for raising some of the issues I address in this article in a group e-mail on August 23, 2017.

The 1999 eclipse from Penzance, UK (photo credit: A Shade Greener)

Of course, this raises the question, why do it? To get to Penzance, I took a charter train that left London's Paddington Station at 1:35 am. To get to Salem, I drove from Vancouver to Portland, spent part of the night in a hotel, and then set off at 3:45 am to ensure I beat the traffic to Salem. The journey back to London was far easier, however: I just got back on the train and let the driver worry about getting me home. Getting into Salem proved much easier than getting out again: I stayed for lunch, but then hit a 40-mile backup that stretched almost all the way to Portland. When I got there, I hit the afternoon peak (and the peak in Vancouver, WA), before encountering a series of traffic jams that left me stranded overnight in southern Washington State (however, there are worse places to be stranded than the Holiday Inn ). I eventually got home almost a day later than planned (and according to the Canada Border Services Agency, I was far from alone in this). Given that neither eclipse lasted more than three minutes, some might see all this effort as a touch obsessive.

I had several motivations for going:

1. My bachelor's degree is in physics, and despite not applying for the available physics with astrophysics option, I have long had an interest in astronomy.

2. I felt that I missed out in 1999 due to the weather, and I wanted a second chance to see the corona.

3. I knew from what I have seen on TV that the full effect of an eclipse is quite a spectacle. Based on my experience now, I do not think watching it on TV comes close to doing it justice.

4. At least on land, this is a comparatively rare opportunity. With most eclipses taking place at sea, most people, even those willing and able to travel, get few opportunities to see eclipses.

It was more than just curiosity, however. It was a chance to see one of the glories of nature, or, I would say, the glories of God. Undoubtedly there was a sense of fascination, and a sense of awe, at the majesty of it all. It was a chance to step out

of the routine and, for a moment, to contemplate the wonders that surround us. I left Oregon tired, but uplifted.

The cover image for this issue reflects the public interest in this recent eclipse. Article 12, “Space Spiritual Dimension,” by Madhu Thangavelu, is also relevant. KSI will include this subject in its presentation at ISDC in Los Angeles in 2008 and in our future work.

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# ***DEDICATION***

***By the Kepler Space Institute (KSI) Board of Directors***

We dedicate this Fall 2017 issue of the *Journal of Space Philosophy* to the National Space Society (NSS, www.nss.org), and particularly the Board of Directors and leadership of this Global Space Community's most influential organization.

We summarize our KSI's work with the NSS at the International Space Development Conference – 2017, in St. Louis, in this issue.

Some members of KSI have worked with NSS leadership since its founding in 1987. Interaction with Mark Hopkins, the Chairman of the NSS Executive Committee, has been a professional and personal privilege. He told us during the ISDC 2017 St. Louis Conference that he has attended all thirty-six of those annual conferences. His summary comment to those attending that conference, published in the Summer 2017 issue of the NSS magazine, *AdAstra* was: "We are indeed winning, and along with those of us in the Space Advocacy community, all humanity."

# ***Preface***

***By Bob Krone and Gordon Arthur***

This issue comes at a time of heightened public interest in astronomy in the aftermath of the recent total solar eclipse that swept across the United States on August 21, 2017, drawing visitors from across the country and across the world. We acknowledge this with our cover, and with some reflections on the eclipse from one of the many who crossed a border to see it (Gordon Arthur). Perhaps this may develop into a more general public interest in space. We certainly intend to promote such an interest through our ongoing publication and academic activities.

It also features material we have covered more frequently, such as *Recursive Distinctioning*, *Space Solar Power*, *Peace*, and *Space Abundance*. We have returning authors, such as Louis Kauffman and Joel Isaacson, Mike Snead, George Robinson, Kim Peart, and Madhu Thangavelu, in addition to new contributors, such as Barry Elsey and Amina Amarova, John Strickland, and Ayse Oren.

Contributors, please note that Chicago University Press has issued a new version of the Chicago Manual of Style, and we will move to Edition 17 in the next issue (most of the changes are minor). We continue to seek articles from new contributors, and we encourage those considering sending us submissions to e-mail BobKrone@aol.com for further details.

Bob Krone, PhD, Editor-in-Chief
Gordon Arthur, PhD, Associate Editor


# JOURNAL OF SPACE PHILOSOPHY

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*Access to the Journal of Space Philosophy and free downloading of its articles is available at www.keplerspaceinstitute.com/jsp. Anyone on Earth or in Space may submit an article or Letter to the Editor to BobKrone@aol.com.*


# ***PRESS RELEASE***

***September 15, 2017***

***By the Journal Editors***

Kepler Space Institute (KSI) has released its tenth *Journal of Space Philosophy* issue. All these issues can be accessed and/or downloaded at:

www.keplerspaceinstitute.com

This issue contains the Summer 2017 paper created by Dr. Louis H. Kauffman and Dr. Joel Isaacson on "*Recursive Distinctioning* (RD)." Those two scientists are advancing the field of Nature's Cosmic Intelligence into a paradigm shift for information sciences. KSI will help them conduct their Third Annual RD Conference in September 2017.

This issue also contains original works by Mike Snead (*Space Solar Power*), George S. Robinson (*Post-Humans Communications*), Kim Peart (*Space as the Final Frontier for Peace*), Madhu Thangavelu (*Space Spiritual Dimension*), Barry Elsey and Amina Amarova (*Doctoral Research*), John Strickland (*Cis-Lunar Transport System*), The Krones (*ISDC-2017* and *Space Abundance*), Ayse Oren (*Future Space Architecture*), Hans Johnson and Bob Krone (*George E. Brown, Jr.'s Space Legacy*), and Gordon Arthur (*Reflections on a Solar Eclipse*).

KSI leadership is designing an academic program which will be covered in the Spring 2018 issue of the *Journal of Space Philosophy.*

## ***ABOUT KEPLER SPACE INSTITUTE***

***By Gordon Holder, VADM, US Navy (Ret.), Kepler Space Institute***

***Chairman of the Board***

Kepler Space Institute (KSI) is a relatively new member of the global Space community, having been incorporated in the State of Florida in 2012. In that same year, KSI founded the *Journal of Space Philosophy (JSP)*. I encourage readers to survey the ten issues of the JSP available free at www.keplerspaceinstitute.com. You will see why the KSI leadership takes pride in the research, education, and Space information accomplishments of those five years. And you will see the KSI vision for its future roles in capturing the abundance of resources Space holds for humans on Earth and as humanity expands into the Solar System and beyond.

In our view, Space exploration, Space development, and human settlement offers people of all cultures, nationalities, ages, politics, and races the most exciting breakthrough thinking – and hoping – possible today.

Gordon S. Holder is the Chairman of the Board of Directors for Kepler Space Institute. He had a distinguished 36-year career in the US Navy, retiring as a vice admiral in October 2004 after service served in Hawaii, Norfolk, VA, and Washington, DC, completing his career as director for logistics, Joint Staff and the Pentagon. Holder is the 2002-03 recipient of the National Defense Transportation Association Department of Defense Distinguished Service Award and the 2005 National Defense Industrial Association recipient of the Logistician Emeritus award for his work in logistics. Following his Navy career, he was a senior vice president and partner with Booz Allen Hamilton Inc., a global strategy and technology consulting firm in McLean, VA. He has served as a member of the board of directors for the National Defense Industrial Association and as chair of the NDIA Executive Logistics Division.

# Recursive Distinctioning

**By Louis H. Kauffman and Joel Isaacson: Howard Bloom Presentation**

**Editors' Introduction:** Scientist and author Howard Bloom presented at ISDC-2017, in St. Louis, on May 28, 2017, the most recent paper authored by Dr. Louis Kauffman and Dr. Joel Isaacson providing the description and current status of research on Nature's Cosmic Intelligence. The term for that autonomous phenomenon in the universe is *"Recursive Distinctioning (RD)*." See our Editors' Notes at the end of the article for more of the RD Story. *Bob Krone and Gordon Arthur*.

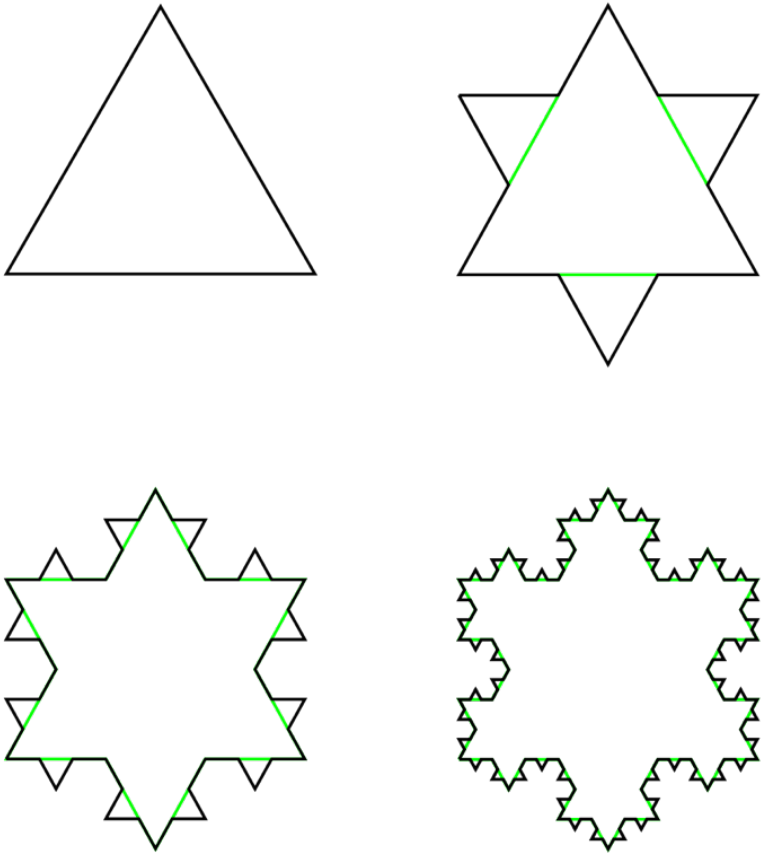
# Recursive Distinctioning

## by Louis H. Kauffman and Joel Isaacson

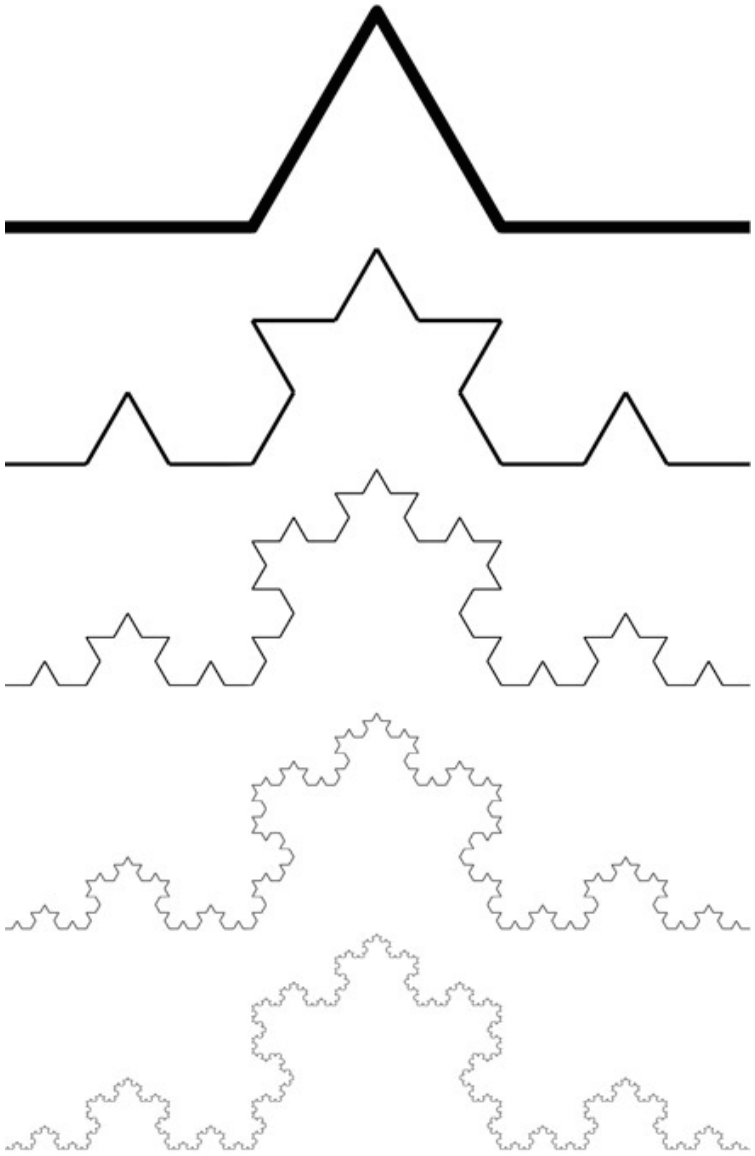
This slide show is based on a paper
"Recursive Distinctioning"
by Joel Isaacson and Louis H Kauffman,
and
joint work with
programming and exploring recursive distinctioning
by
Louis H Kauffman and Dan Sandin.

See
http://homepages.math.uic.edu/~kauffman/RD.html

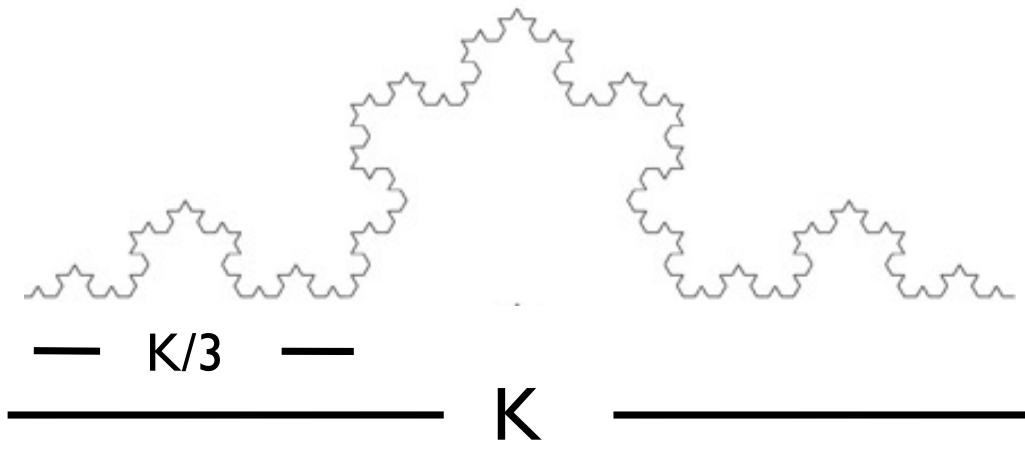
WE HAVE A TALE TO TELL.
And before we start telling it, some ideas are worth discussing.
Lets begin with the famous
Koch Snowflake.



Begin by
MAKING A
DISTINCTION
in each edge of the triangle by cutting out the middle third.
Replace the middle third by two edges of the same length. The new form has 12 edges.
Do this again
FOREVER.



If you apply this RECURSIVE DISTINGUISHING PROCESS (distinguish the middle third and construct two copies of the middle third to replace it) to one side of the triangle, you obtain the Koch Fractal, a form that is equal to FOUR COPIES OF ITSELF EACH SHRUNK BY ONE THIRD.




FOUR COPIES OF
ITSELF
EACH SHRUNK
BY ONE THIRD.

$K^D = 4 \times (K/3)^D$

$3^D = 4$

$D = \text{Log}(4)/\text{Log}(3) = 1.26186$

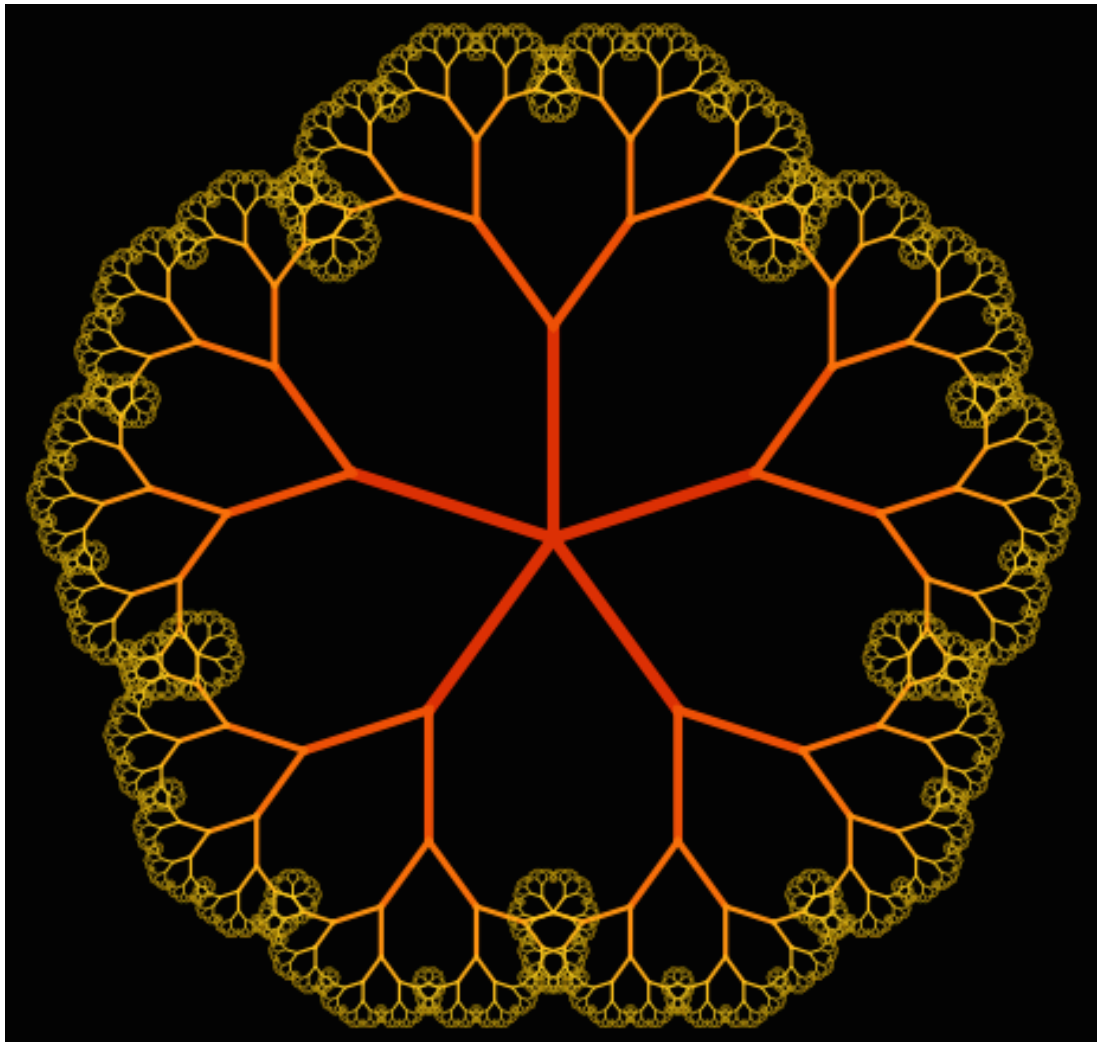
The Koch Fractal has
NON-INTEGRAL
DIMENSION.

The fractal makes a space of its own that is not one dimensional nor is it two dimensional. The dimension is a measure of the process of recursive distinguishing that has given birth to this recursive form.

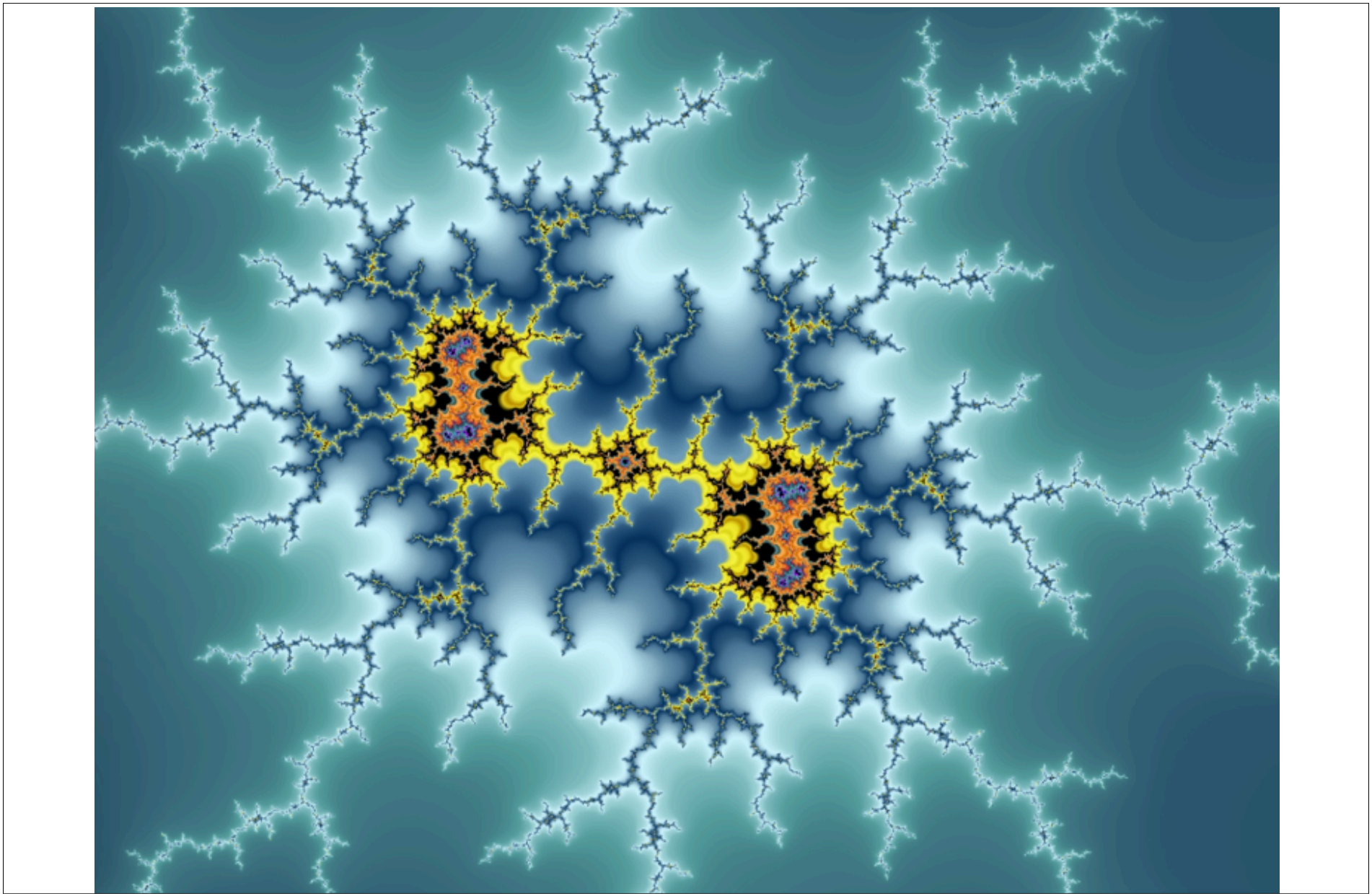
# Fractal Spacetime

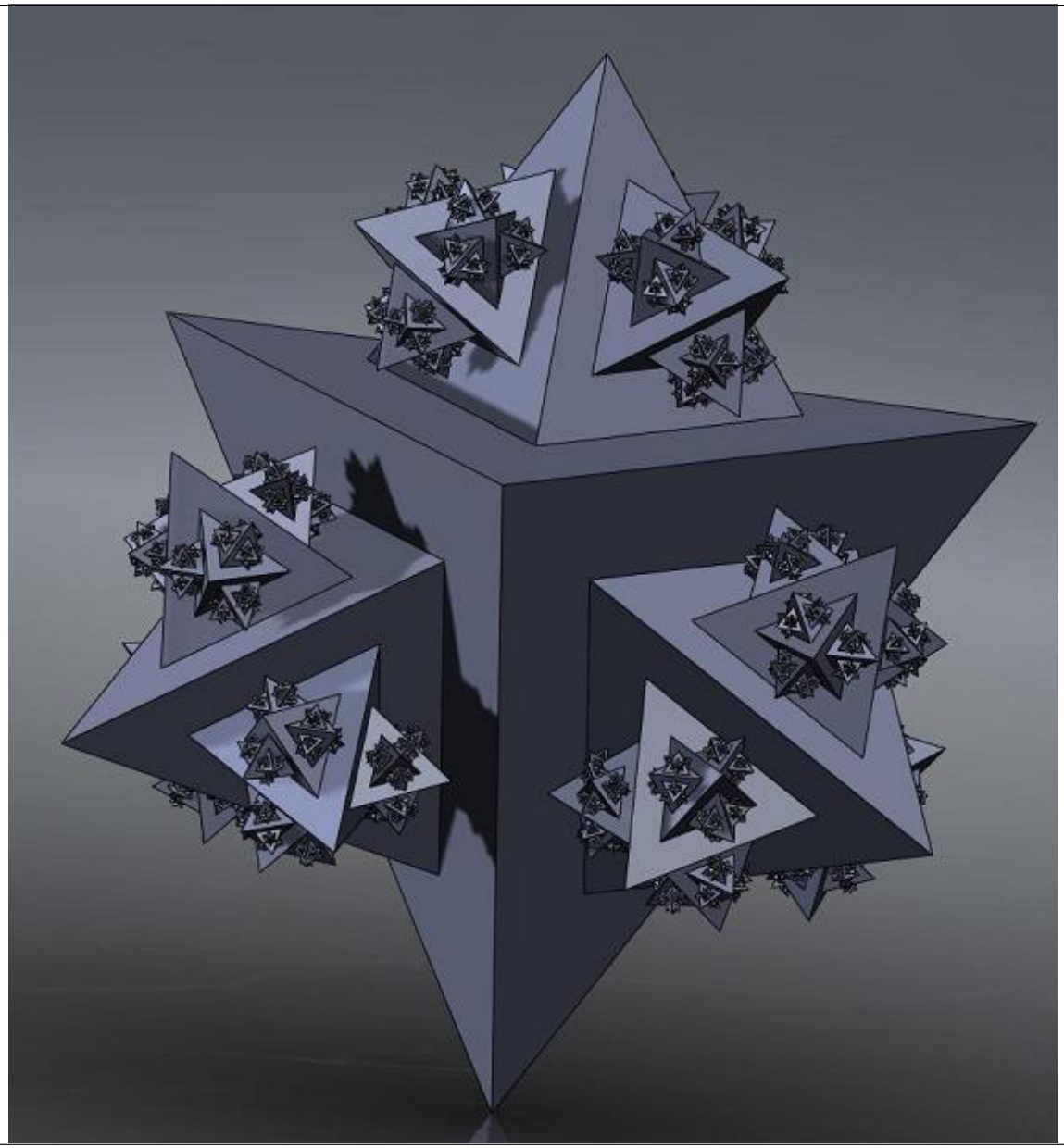
Spacetime itself may be a fractal and the true dimension of spacetime, a fractal dimension, greater than three but less than four! The problems of infinities and renormalization in physics may be resolved by this understanding.

## Fractal Spacetime is generated by an Ultimately Simple Process of Recursive Distinguishing.



Beautiful, self-similar
geometric forms
emerge from
the simplest of
distinctions
and a
recursive process
in which these
distinctions are
enfolded.





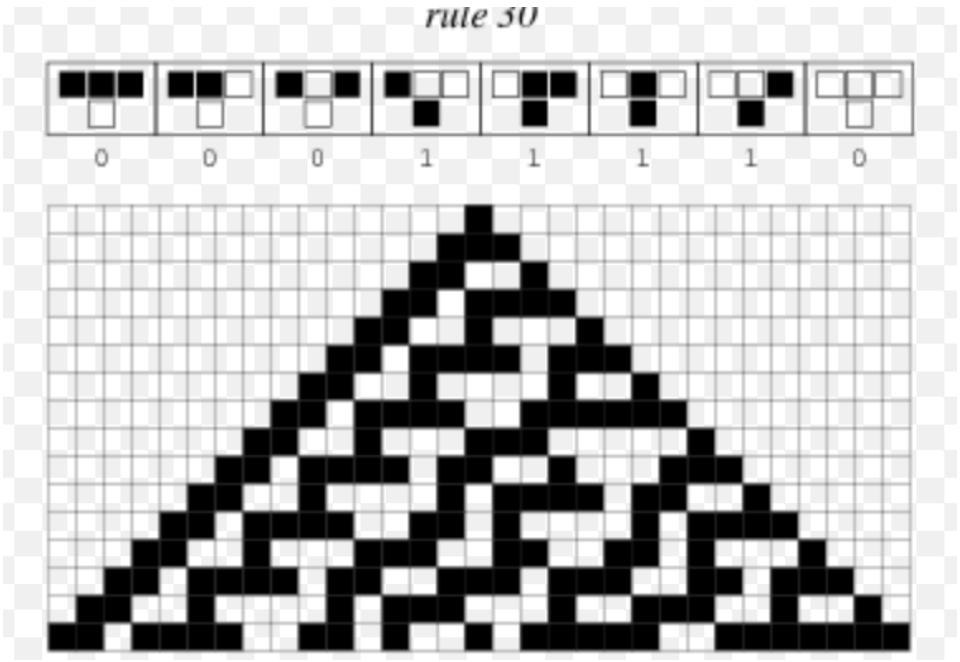
Higher dimensional analogues give us new insight into the nature of space and time.

Space is the distinction we apprehend.

Time is the process by which space becomes what it is now.

Recursive Fractal Distinguishing occurs in Biological Systems.

A simple growth rule, based on an elementary distinction --- and recursion --- generates a myriad of forms.




Wolfram Rule 30

Cellular Automata, based on very simple rules generate complex, fractal and even undecideable patterns.

Wolfram line automata use a distinction that is based on the different neighbor patterns for a given square. The replacement is a black square or a white square.

In Conway Life the rules apply in two dimensions.

A black cell is born if it has exactly 3 neighbors.

A black cell survives only if it has 2 or 3 neighbors.

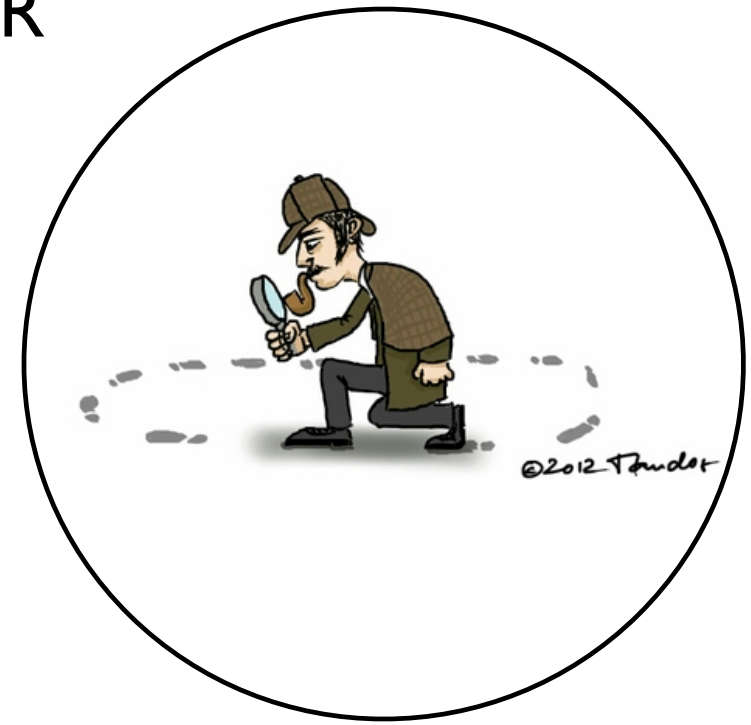
In all these situations, there is a set of distinctions such as black and white cells that are INDICATORS.
And there are rules that are based on distinctions about these indicators.

We ask about such recursive distinguishing:
HOW SIMPLE CAN IT BE?

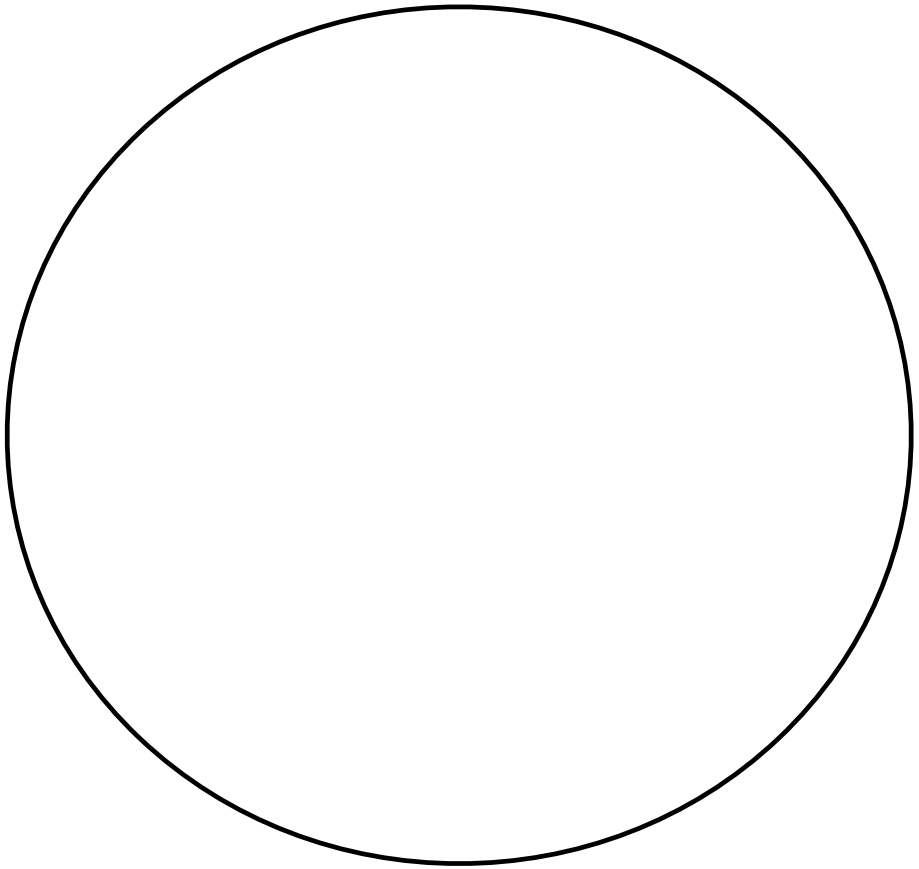
CAN THE RECURSION AND THE LANGUAGE OF INDICATION COME FORTH TOGETHER?

CAN WE ELIMINATE ARBITRARINESS AND KEEP THE DISTINCTIONS AS SIMPLE AS POSSIBLE?

TO MAKE A TRANSITION TO
EXTREME SIMPLICITY
PUTS
EXTRAORDINARY DEMANDS
ON YOU THE LISTENER
AND ON
THE
INVESTIGATOR
AS WELL.



# WHAT IS THE NATURE OF A DISTINCTION?



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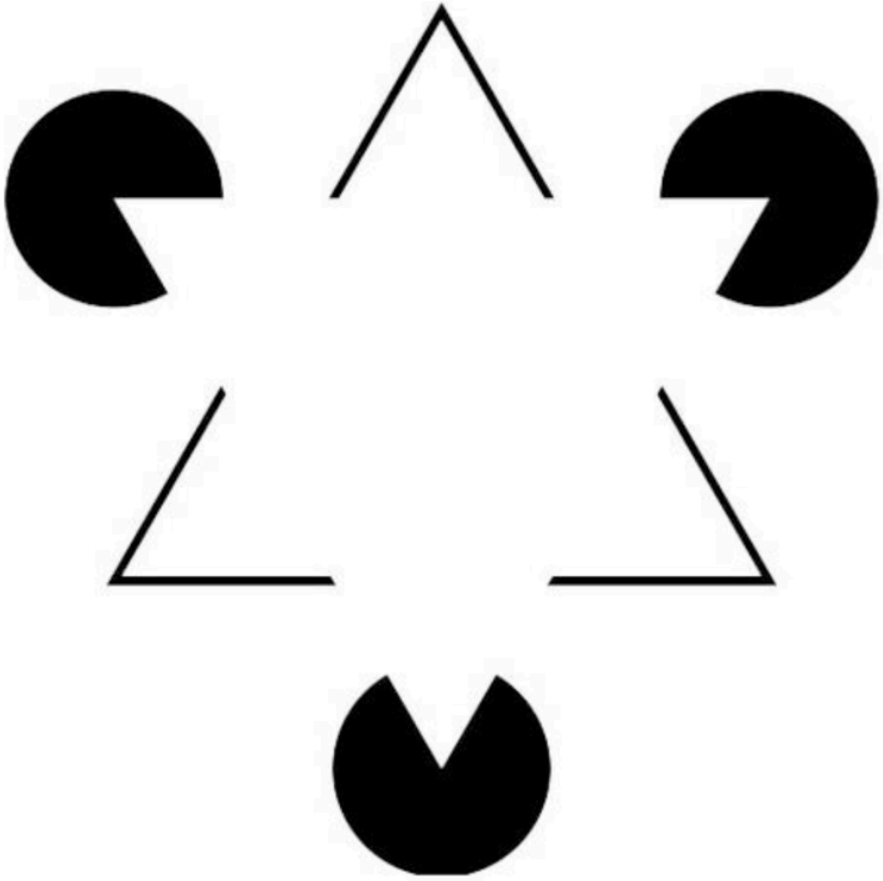

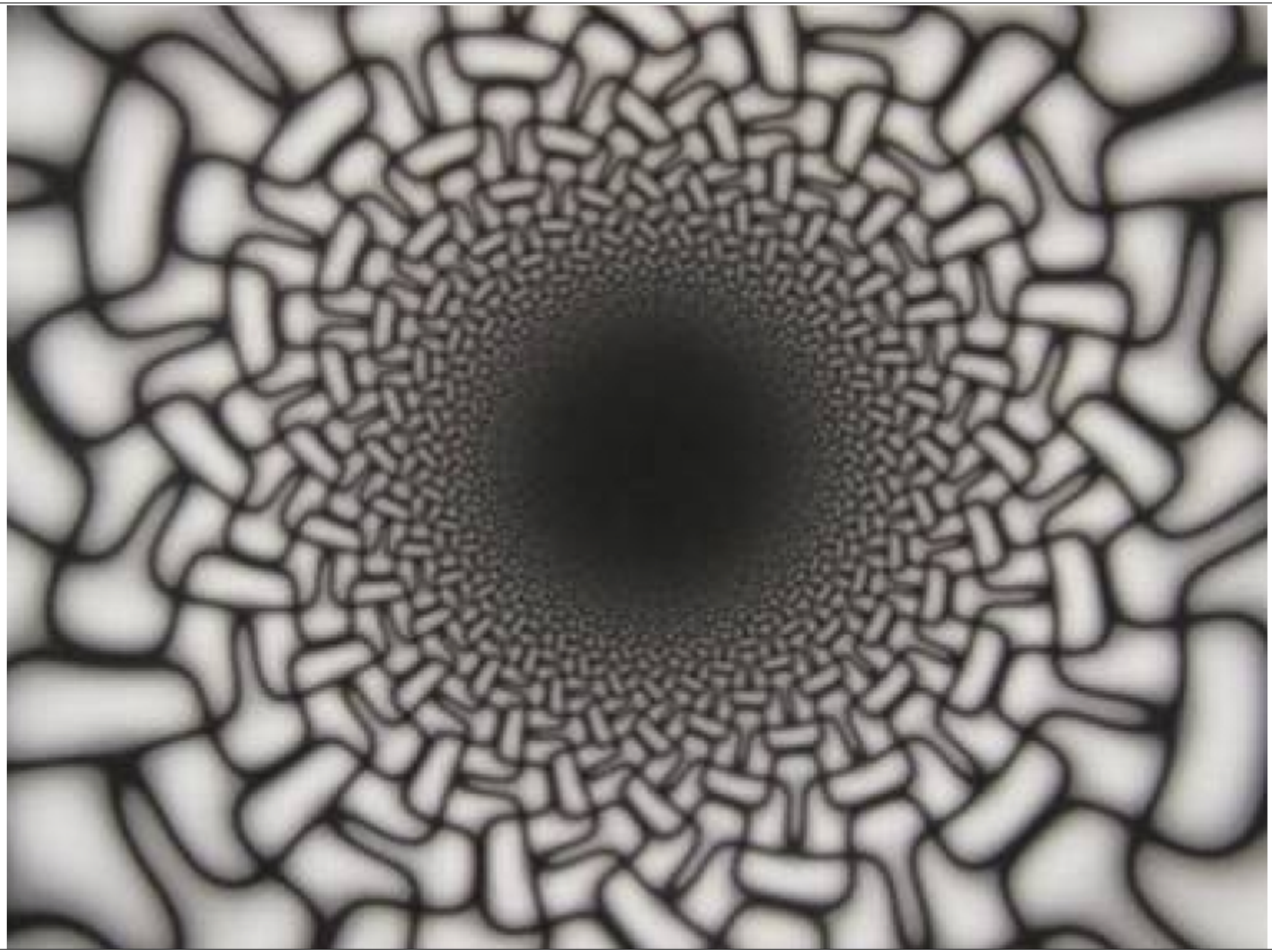

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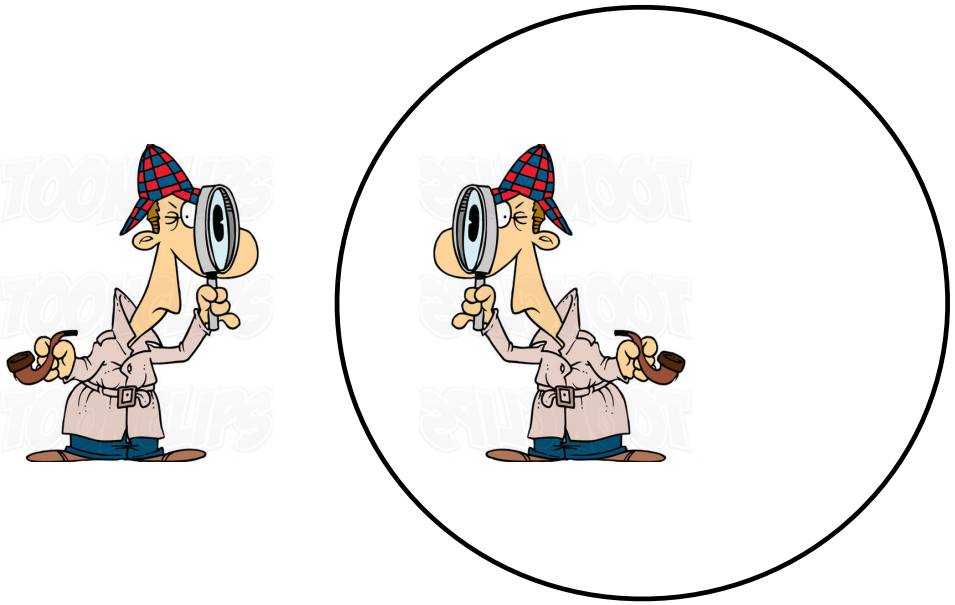
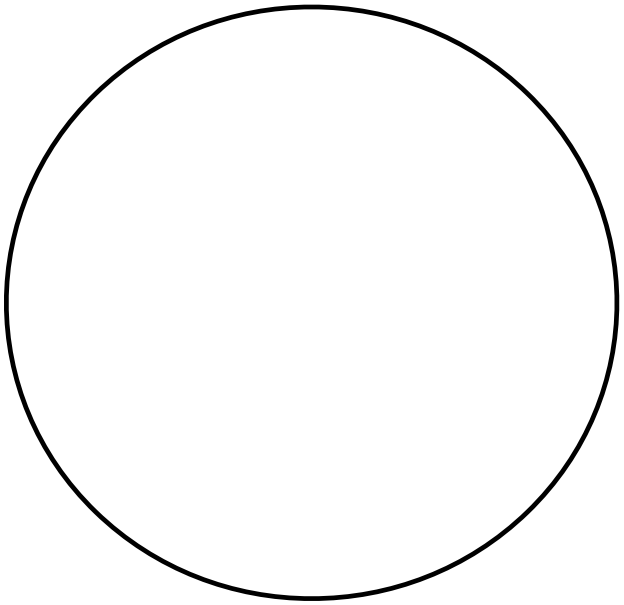


We make distinctions and we are often able to recognize them.

A circle makes a distinction in the plane between its inside and its outside.

We draw a circle and so make a distinction.

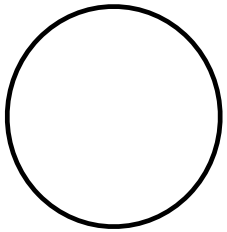


Finding a circle, we agree that it is a distinction.
We see that the circle makes a difference between its inside and its outside.
We see that for us the circle indicates a difference between its inside and its outside.

A circle could also be a SYMBOL, standing for a distinction.

A circle could also be a SYMBOL, standing for a distinction.

The Distinction



The Name of the Distinction

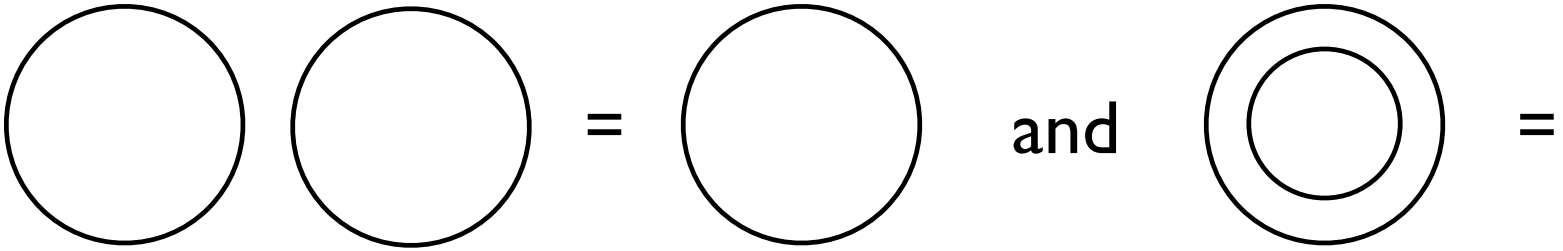
A symbol can MAKE a distinction.

A symbol can be the NAME of a distinction.

In the primordial event of a distinction, the distinction is its own name.

# G. Spencer-Brown's Laws of Form

These issues take a very strong direction of the English mathematician and philosopher George Spencer-Brown. Spencer-Brown developed a calculus based on distinctions that is seen to underly the development of logic and boolean algebra. This Calculus of Indications is based on the equations

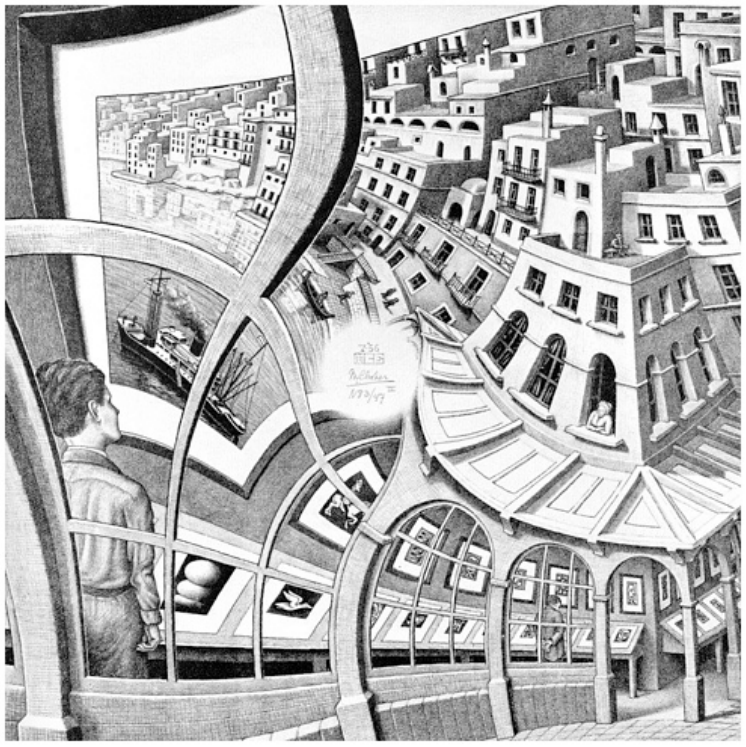



On the left side of the first equation, either circle is the name of the other, and so either can be erased.

In the second equation the two distinctions fit perfectly and so cancel to no distinction at all.

# THE PRIMORDIAL DISTINCTION IS ITS OWN NAME.

In the course of recursive distinguishing
the simplest examples will be distinctions
that describe themselves.



As we shall see, we may begin
with distinctions that
describe other distinctions,
but they will soon be
describing themselves in
endless recursion.

Recursive Distinctioning is what it says.

One has a distinction or a field of distinctions.
Such a field of distinctions can be made specific
by arranging patterns in a line, on a lattice or a graph.

For example, one might have a string of letters
such as
AAAABAAAA

We will describe this pattern with a special
alphabet
{ =, [, ], O}

A letter will receive "[" if it is equal to the letter on the right and unequal to the letter on the left.

A letter will receive "]" if it is equal to the letter on the left and unequal to the letter on the right.

A letter will receive "O" if it is unequal to the letter on the left and unequal to the letter on the right.

A letter will receive "=" if it is equal to the letter on the left and equal to the letter on the right.

...A A A A A A A A B A A A A A A A A...

...= = = = = = = = ] O [ = = = = = = = =...

...= = = = = = ] O O O [ = = = = = =...

...= = = = = ] O [ = ] O [ = = = = =...

...A A A A A A A A B A A A A A A A A...
...= = = = = = = = ] O [ = = = = = = = =...
...= = = = = = = ] O O O [ = = = = = =...
...= = = = = = ] O [ = ] O [ = = = = =...

A single distinction (the letter B in the row of same A's) has been described and the description itself described two more times.

At the first description, a "protocell" ]O[ appeared and this cell underwent a "mitosis" in the next two iterations.

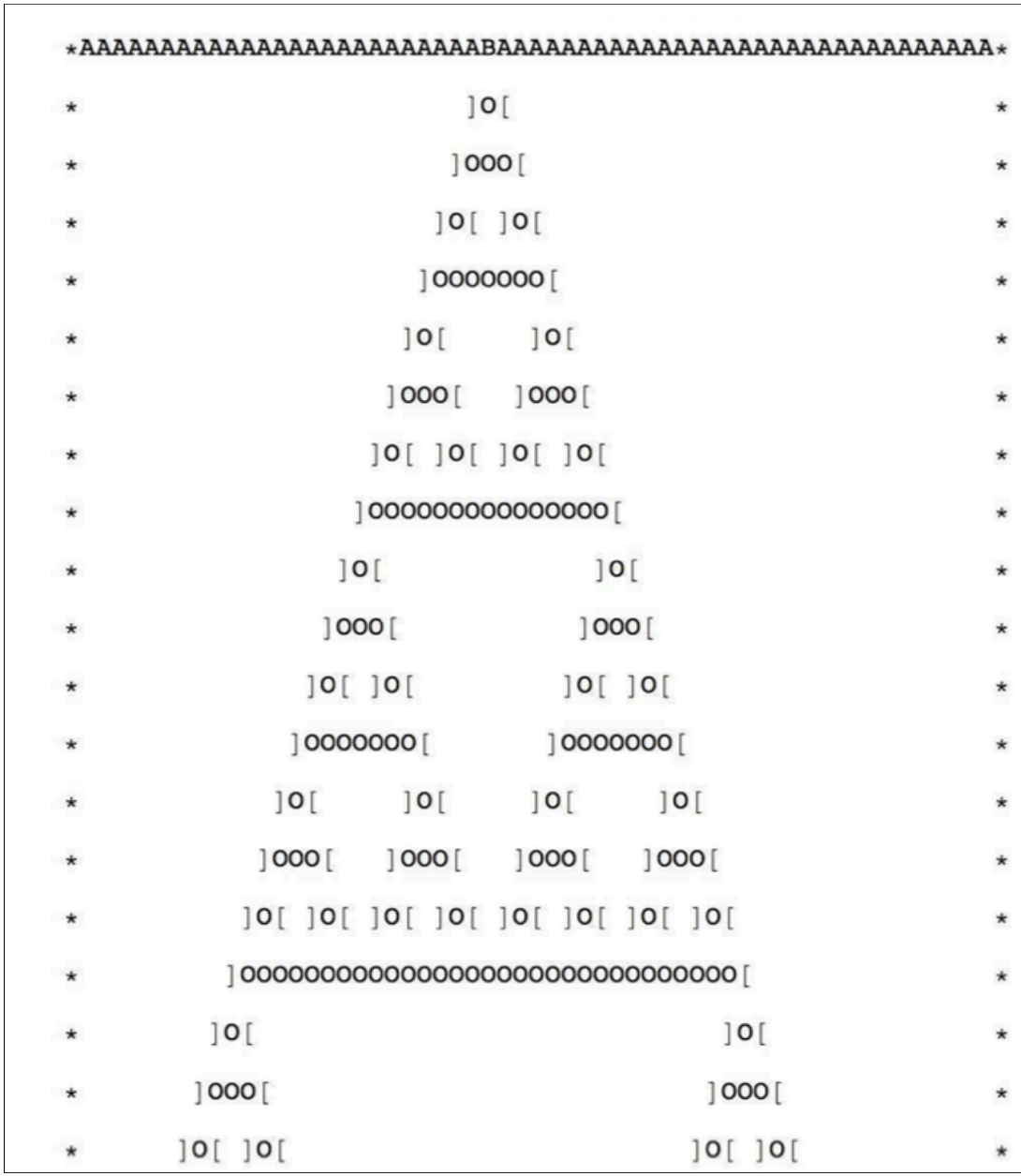
In the context of recursive distinctioning, recursive re-description, a simple local distinction gives birth to an entity ]O[ that can reproduce itself!

...= = = = = = ] O [ = = = = = = ...

...= = = = = ] O O O [ = = = = = ...

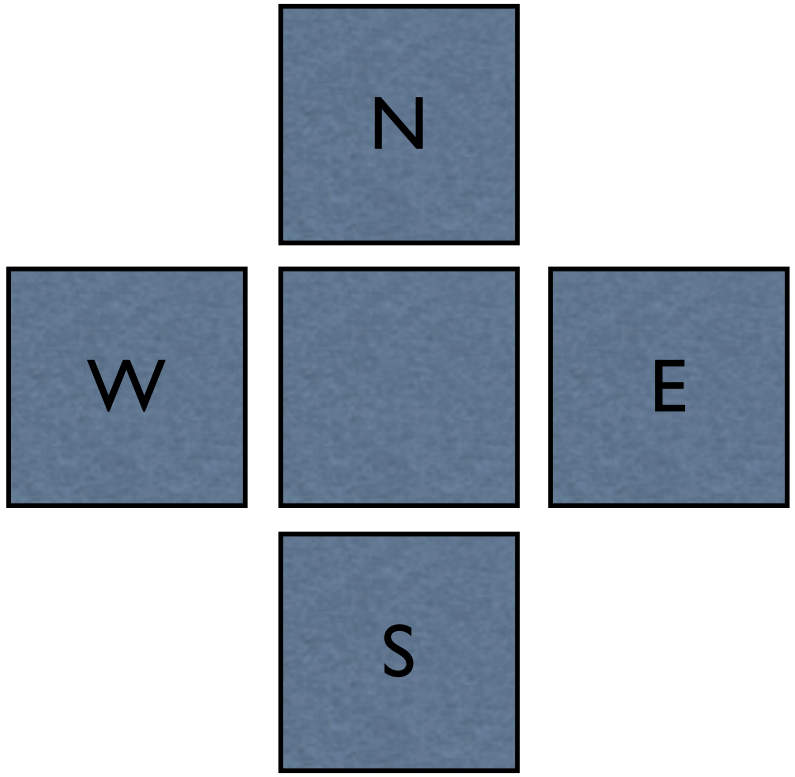
...= = = = ] O [ = ] O [ = = = = ...

Philosophically speaking, this is the whole talk. We wish to make the case that the RD process is fundamental and primordial. The fact that it can do something this significant at once, in the simplest case, proves our point.

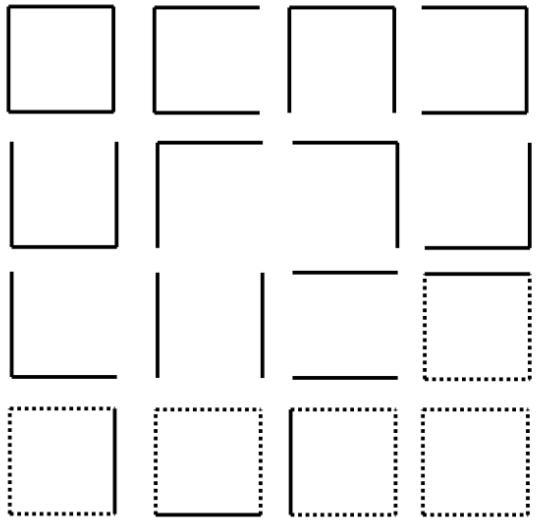



Here is another take on the same process where "=" has been replaced by no marking.

In working with a two dimensional lattice we use a natural sixteen letter alphabet. The letters in this alphabet generalize our small one-dimensional alphabet, and indicate distinctions to the north, south, east and west.

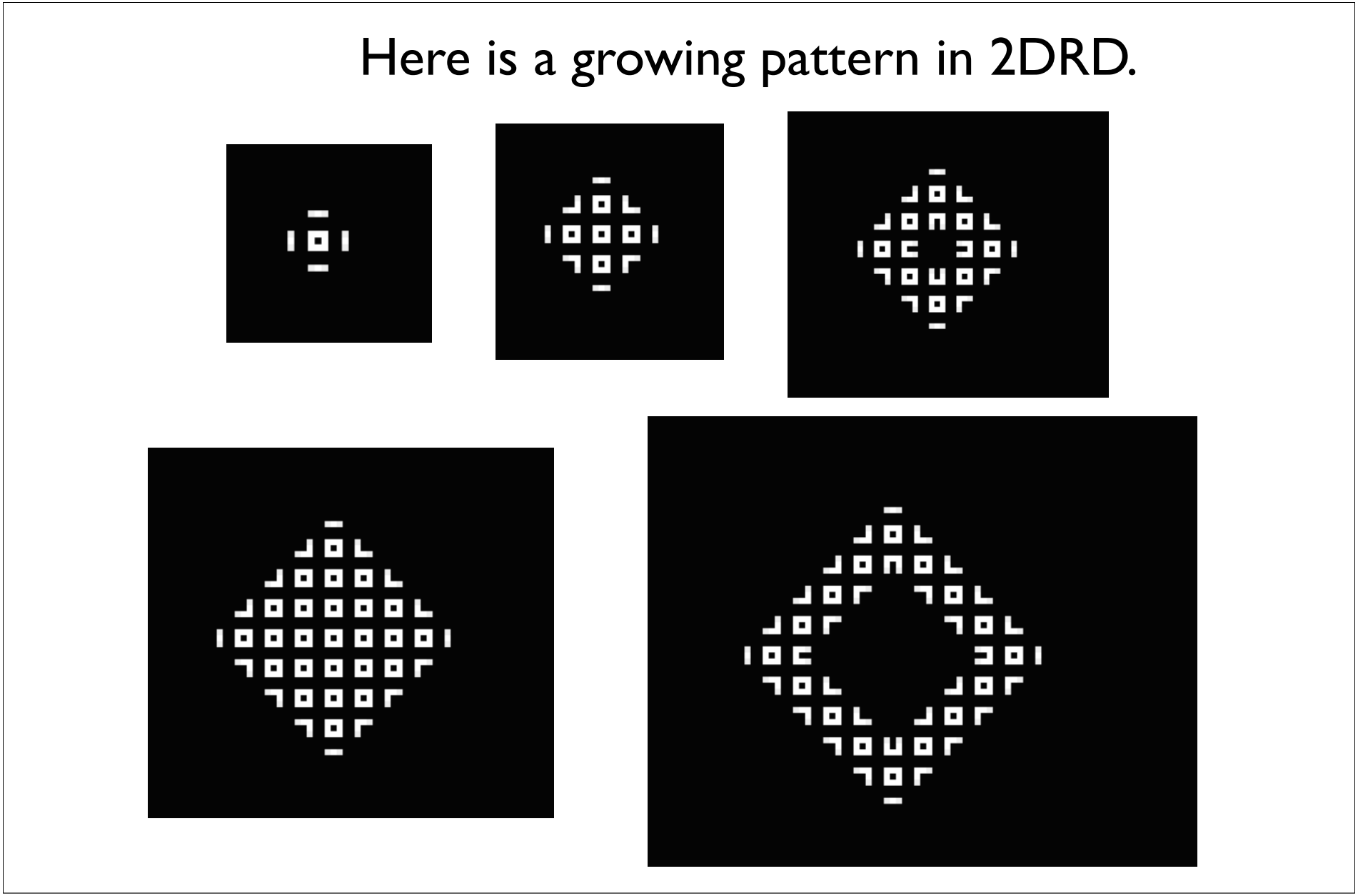


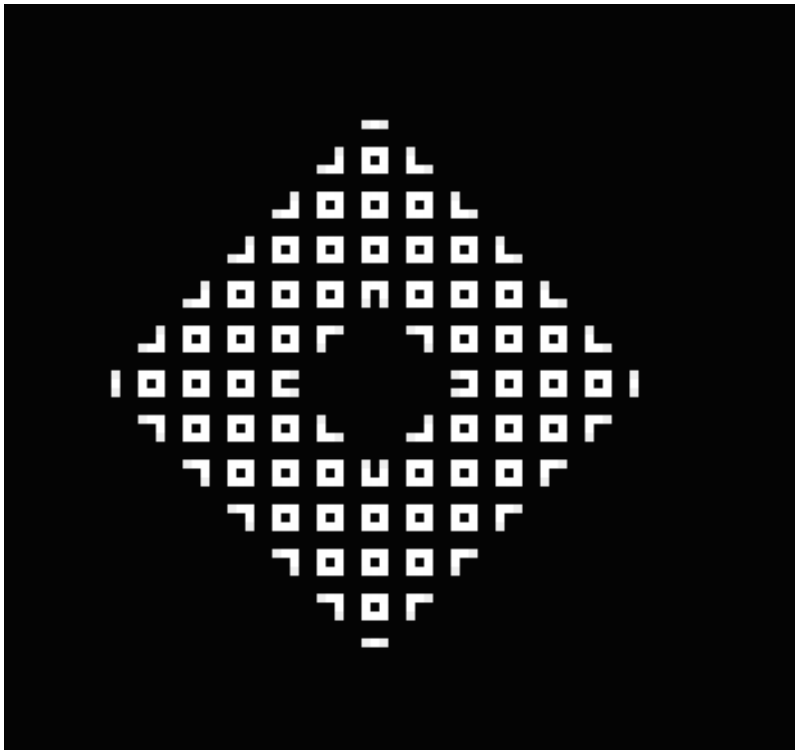
Here is our sixteen letter alphabet.

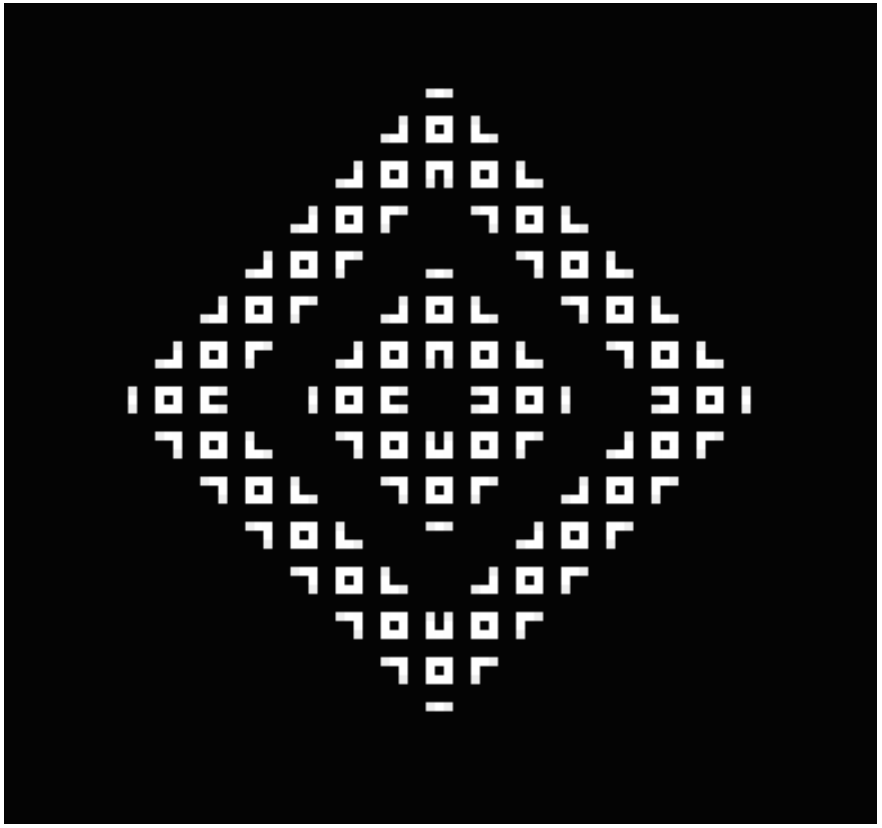


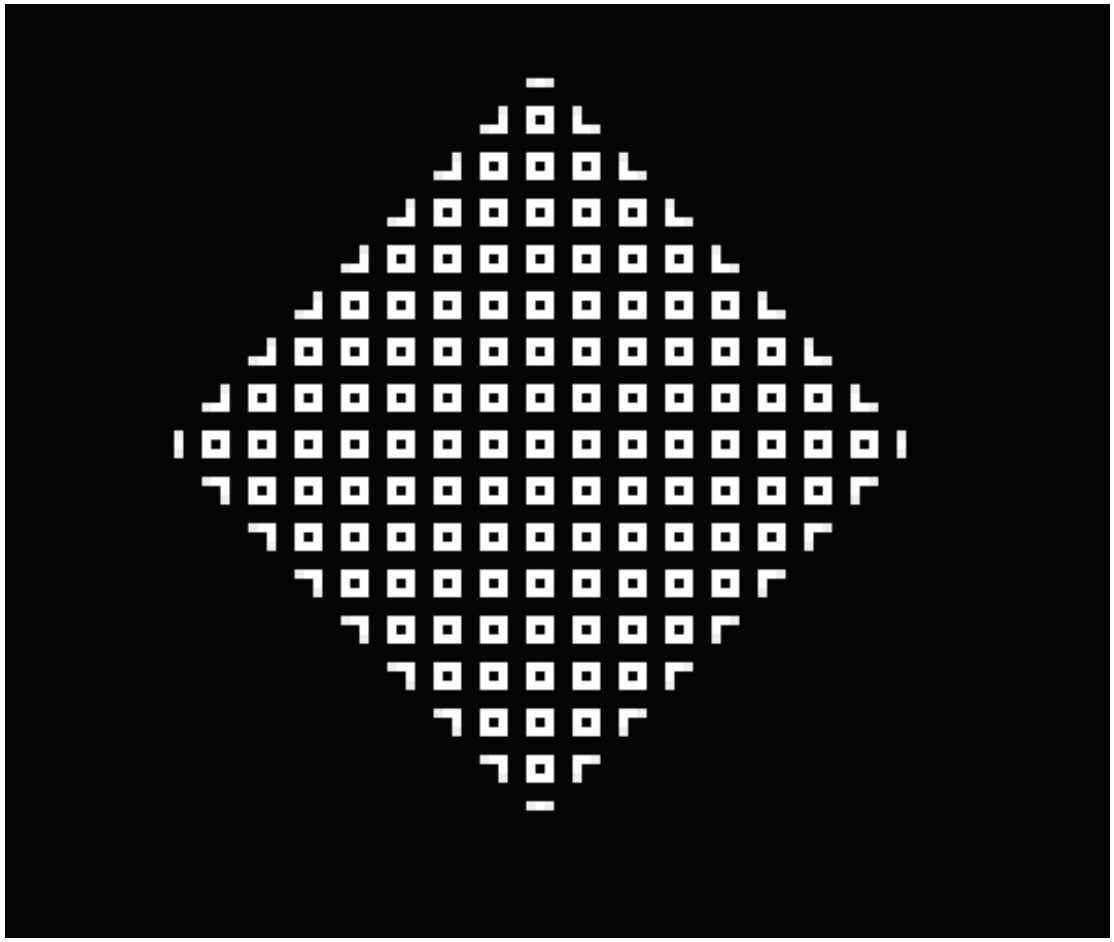
Each icon indicates difference with solid edges and equality with blank or dotted edges.

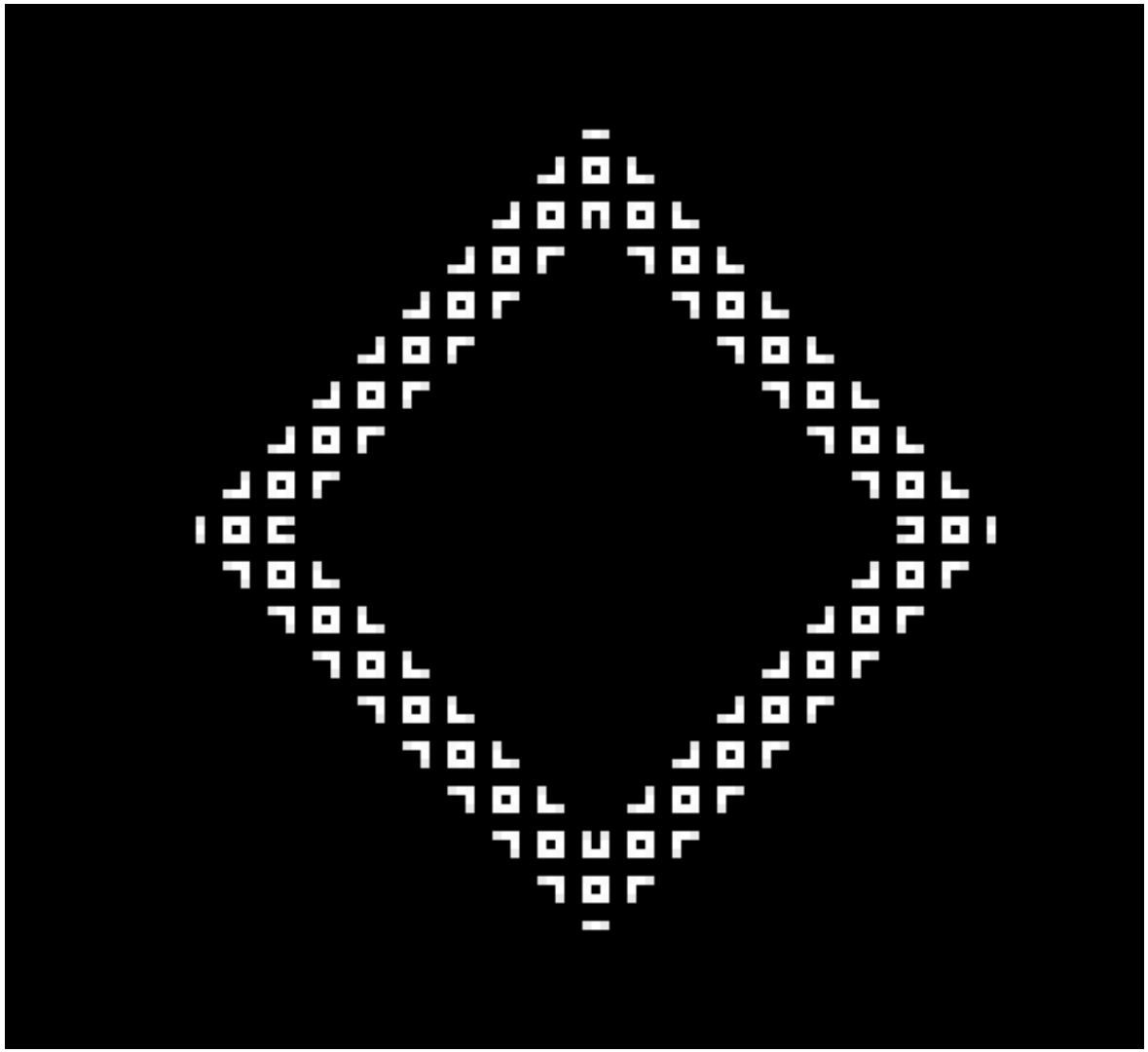
Each icon makes a distinction in that it is different from all the other icons.

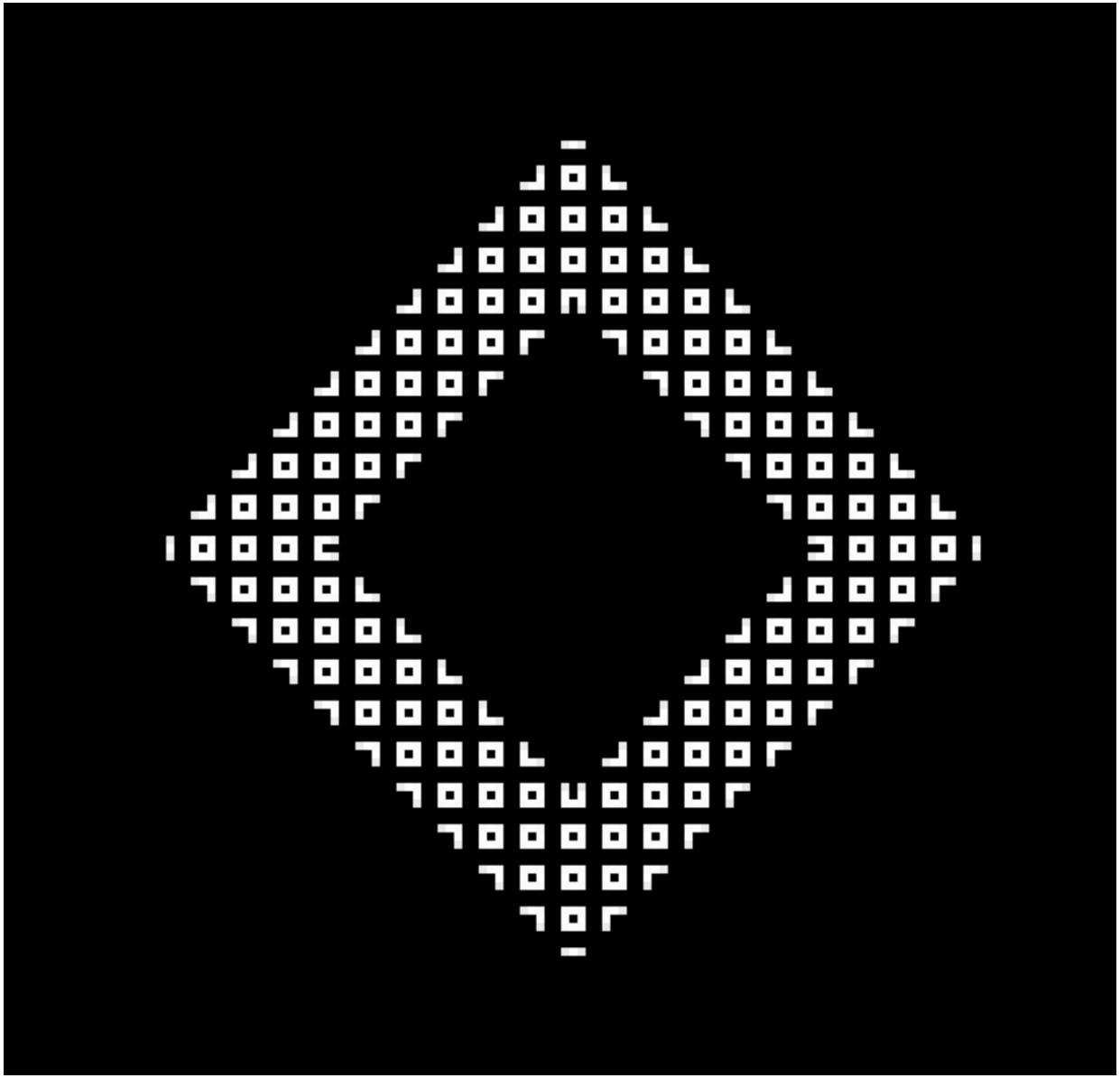

Here is a growing pattern in 2DRD.

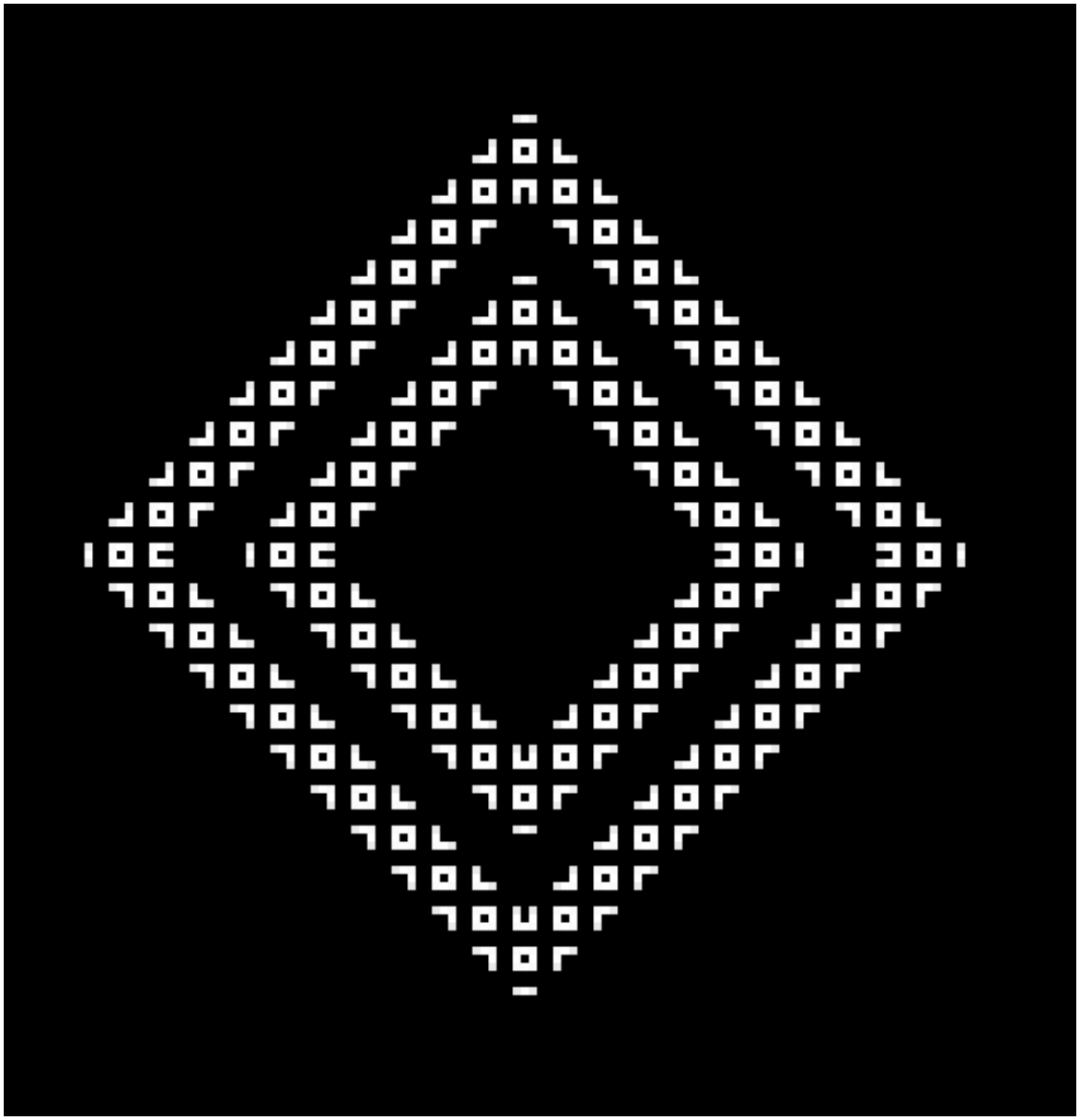


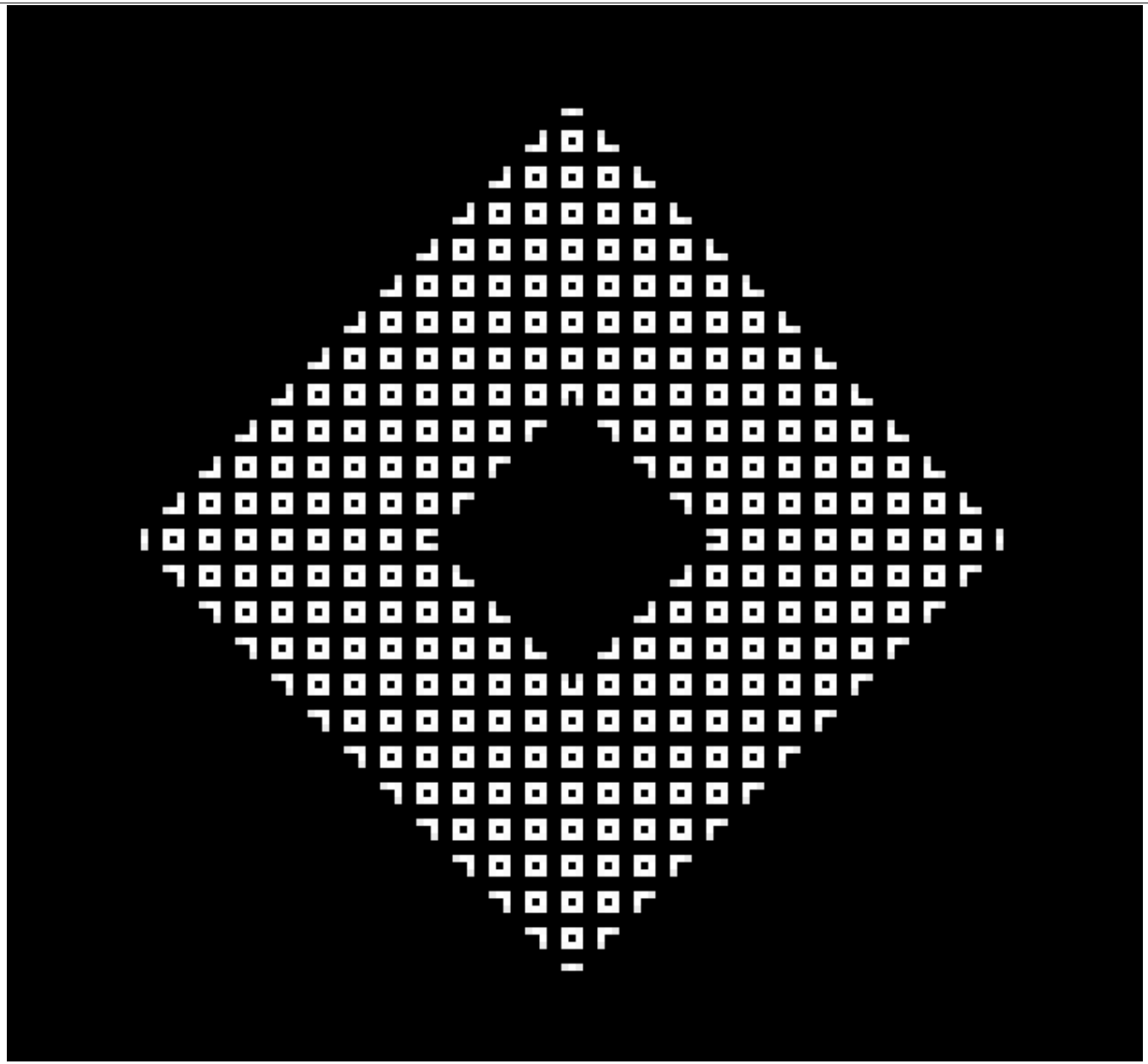


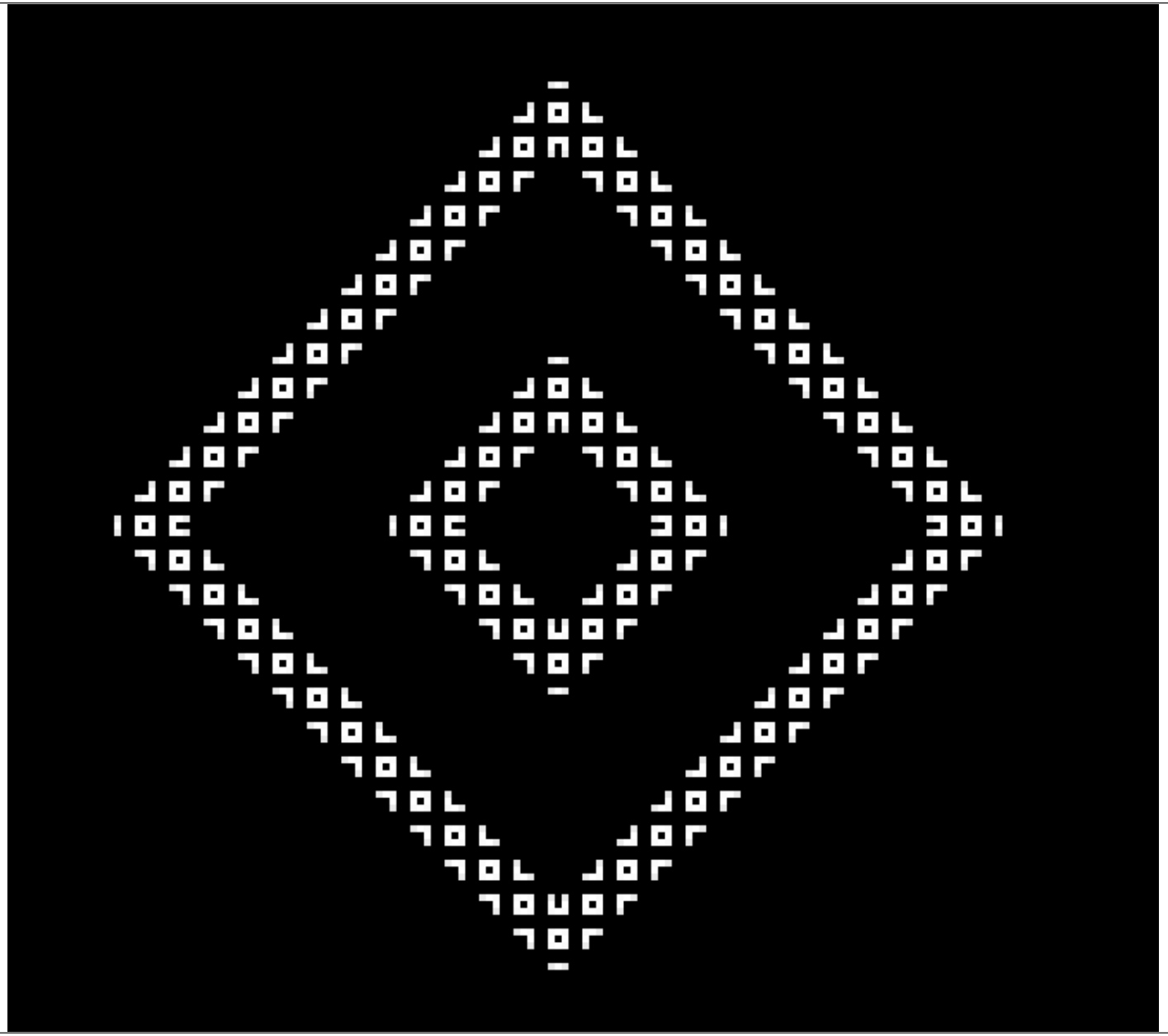


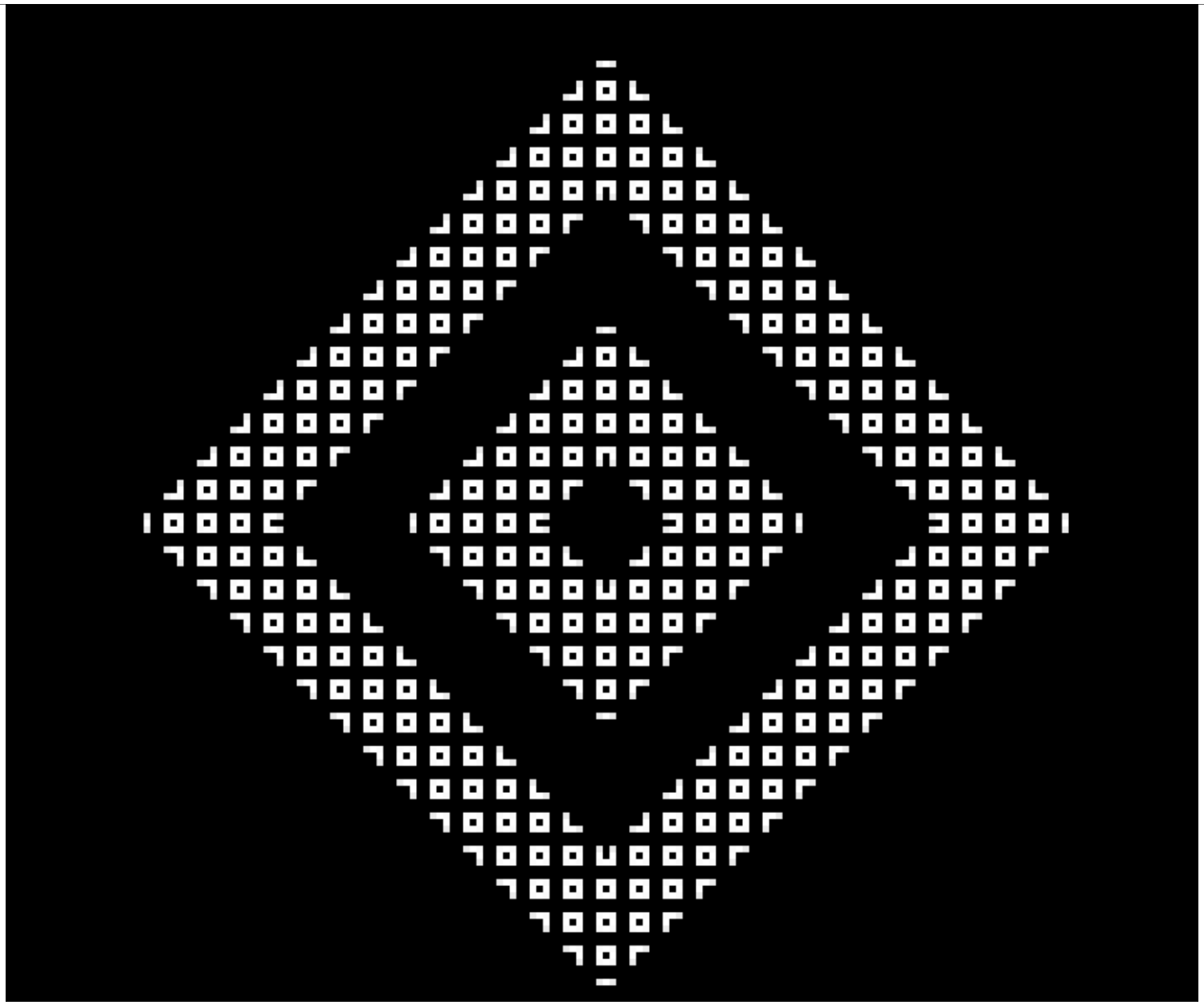


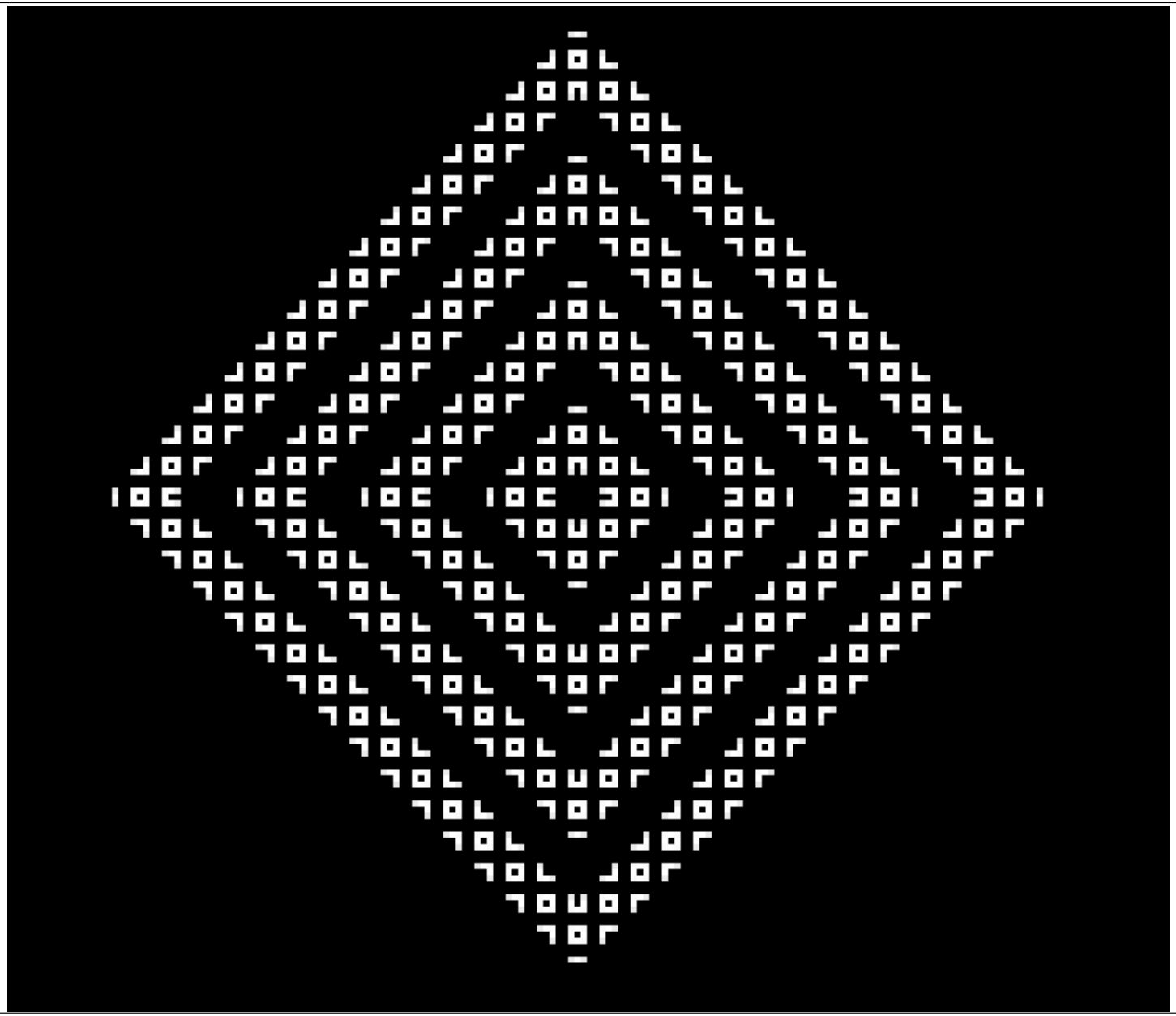


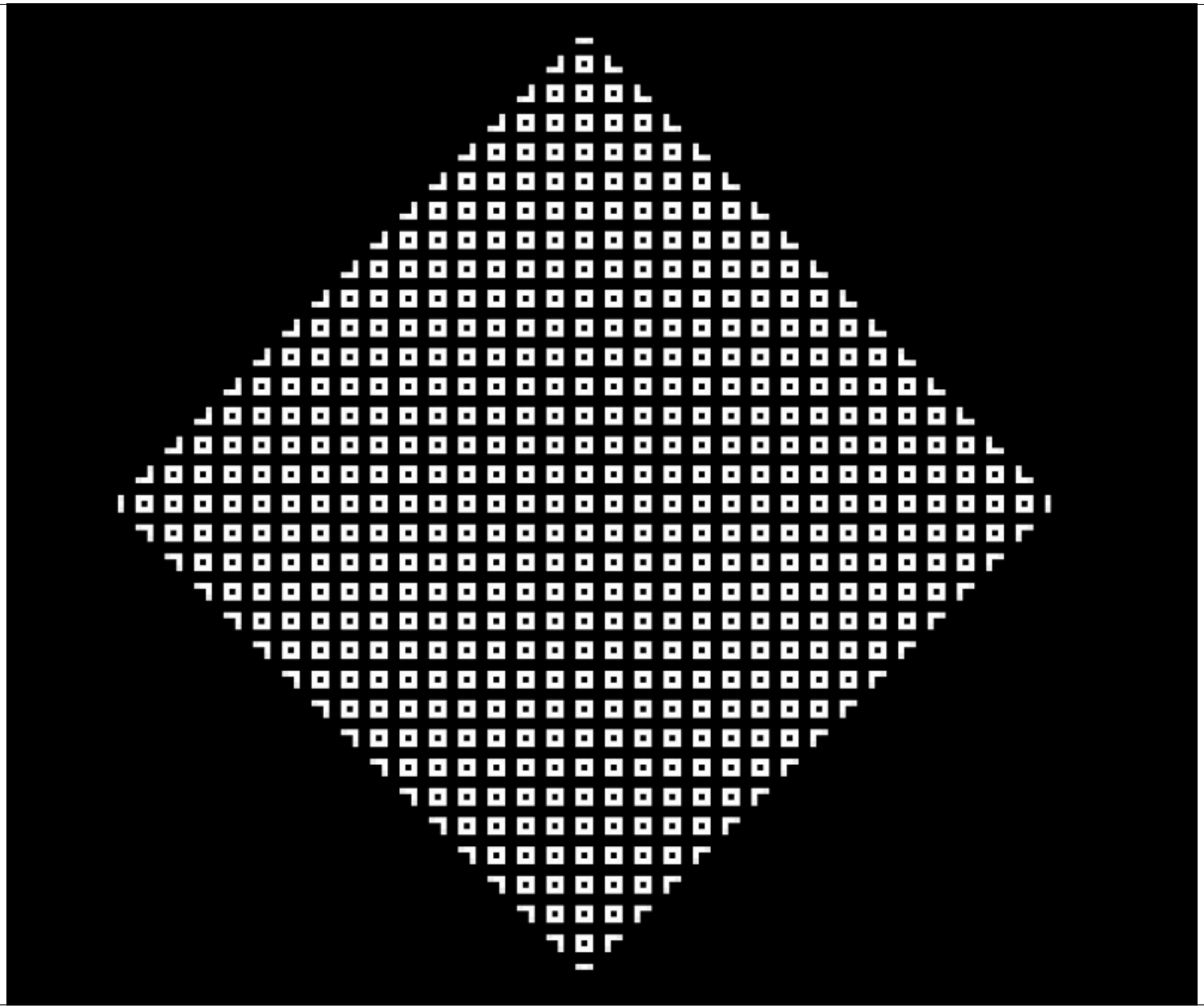












# Applications

Here we have studied the simplest examples of recursive distinguishing.
We have kept the examples pure.
The language of distinctions refers to the local distinctions experienced by an occupant of one 'room' in the RD lattice.
The new occupants of the lattice are those very elements of language.

We imagine much more complex examples of RD. For example, you can consider any conversation that you have, and how each person transforms the language of the other in a sequence of recursive moves.

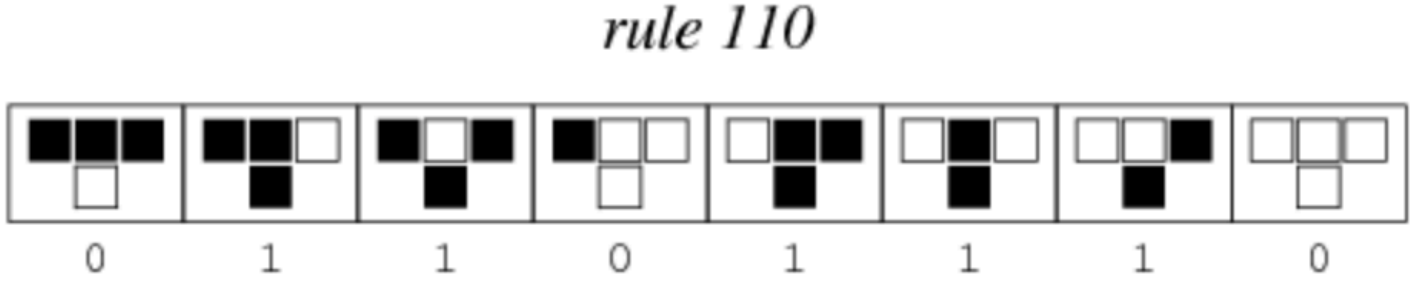
So we conclude that the RDs can do elementary mathematical operations, but it may require some extra observations of them to elicit the patterns that are implicit within them.

This means that we have to work on this, and use some creativity to figure out how to hook up elementary RDs to make a bigger more conscious entity.

We feel that the balance of language and form that is part of the RD is very important to the design.

But, you say, what about all those cellular automata. They have a lot of potential applications. Can you see them as RD?

The answer is YES! Consider the Wolfram Rule 110.

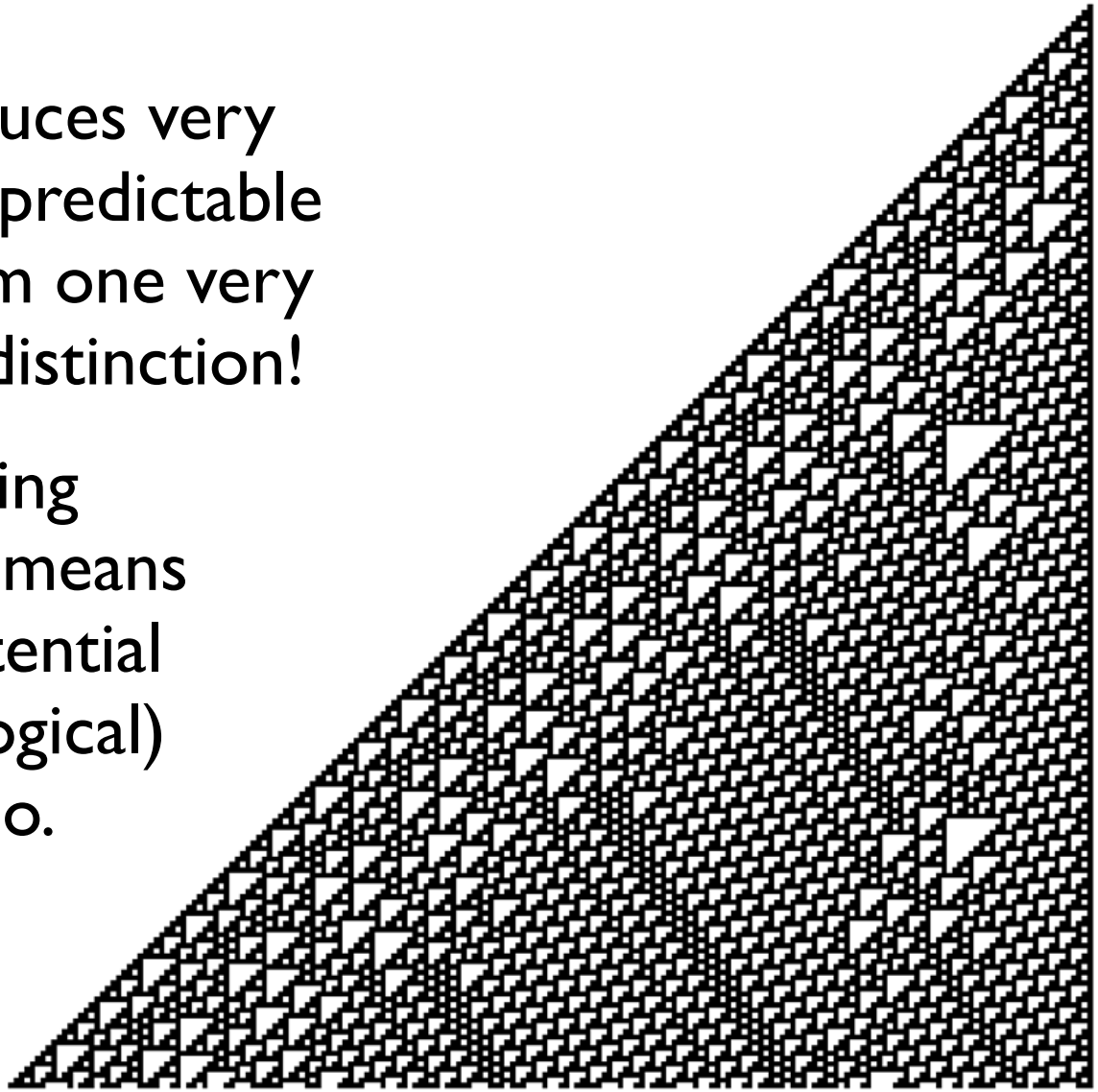



Rule 110 makes a binary distinction on the set of eight binary triples shown above. It assigns 0 to three of them and 1 to the other five.

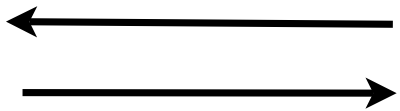
Once this distinction is in place, one runs this just like our RD except the language is very simple, just 0 and 1, and it always refers to this single distinction.

Rule 110 produces very complex and unpredictable patterns, all from one very assymmetrical distinction!

Rule 110 is Turing Universal, and this means that it has the potential to do what any (logical) machine can do.

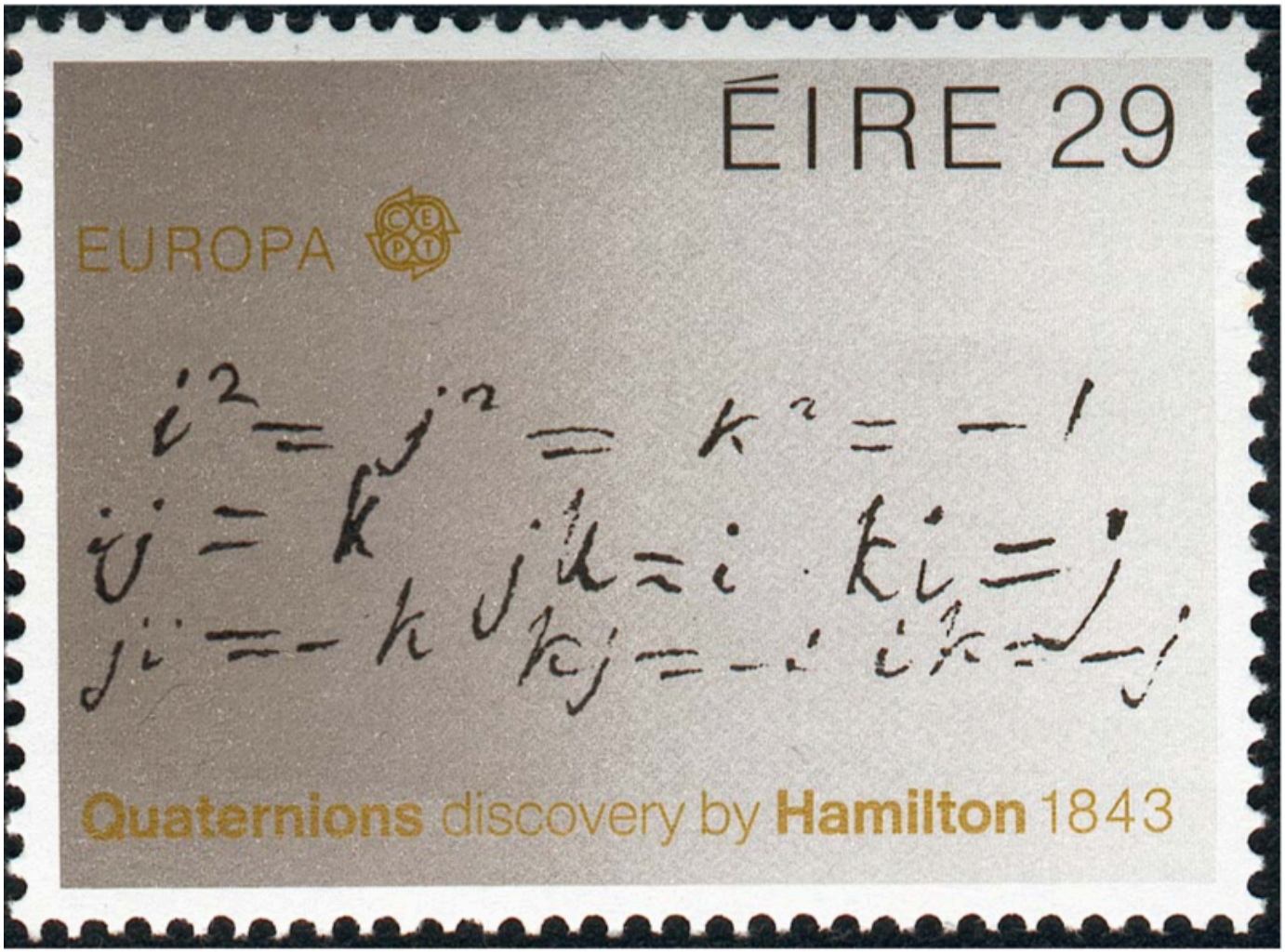


So there is no question that RD has applications.
Many of them already exist but are not often thought about from our point of view.

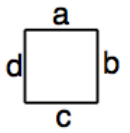
Language  Distinction

So having found the ground of this way of working, lets get to work!

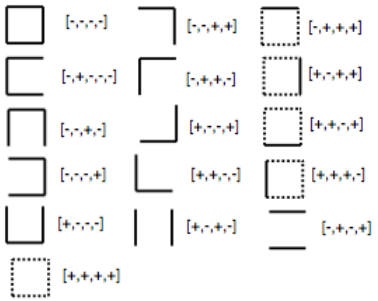
# Quaternions



# The Logical Underpinnings of the Sixteen Letter Alphabet are related to the structure of SpaceTime and the Quaternions

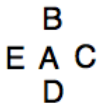



[a,b,c,d] Coding and XOR operations for the alphbet.

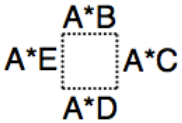


x*y = XOR(x,y) for individual +, - values. If X and Y are alphabet elements, let XY denote the XOR of their vectors, and express it as an element of the alphabet.

Then XY is marked exactly when X is different from Y. Let X*Y denote +1 when X = Y and -1 when X is not equal to Y. Note the -1 corresponds to a dark line.




Given this neighbor condition for A in a 2D RD, then A is replaced by the following letter of the alphabet.




In this way, the logical operations determining difference generate this alphabet from the neighbor relations.

It is remarkable that the sixteen-letter alphabet, devised by Isaacson long ago for RD purposes, was rediscovered by Bernd Schmeikal in a spacetime/logic context.

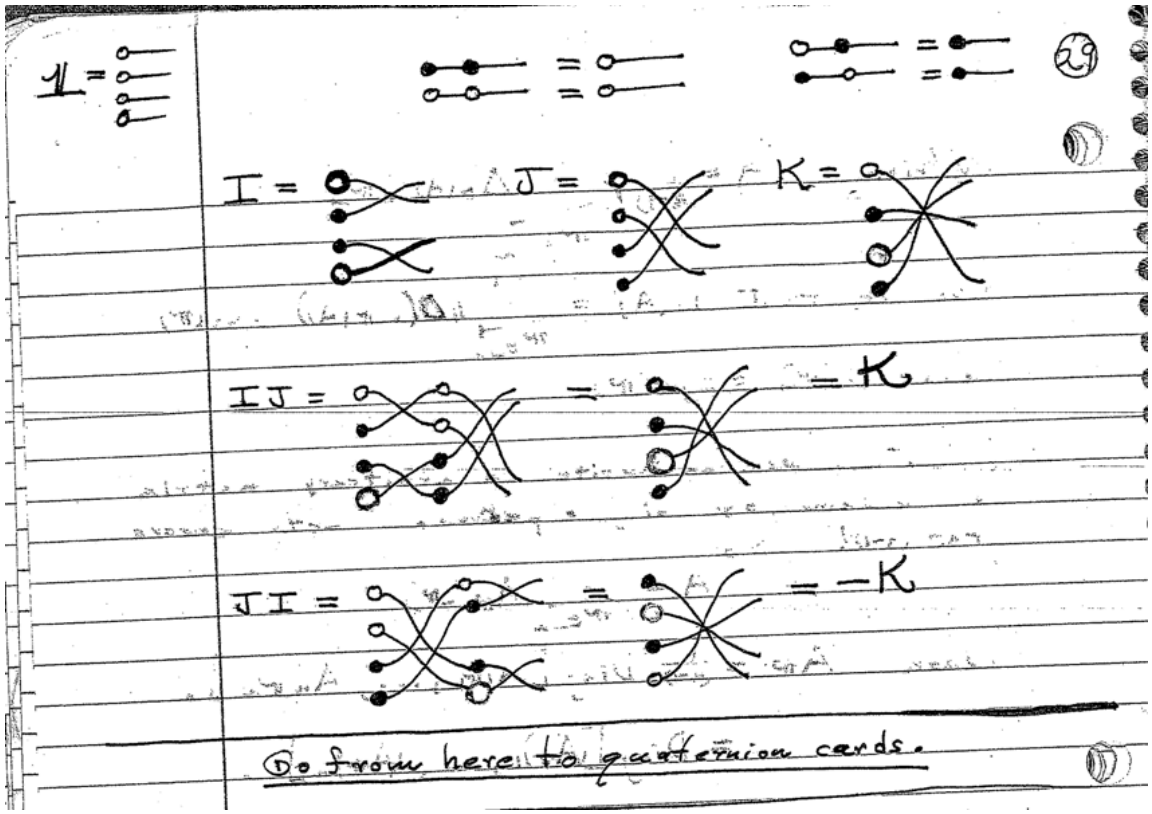
For an account of this (and other references), see the paper

*Journal of Space Philosophy* 5, no. 1 (Spring 2016)
**Basic Intelligence Processing Space By Bernd Schmeikal**

The version of the quaternions in relation to the sixteen-letter alphabet shown here is equivalent to an iterant formulation of quaternions due to Kauffman.

Louis H Kauffman, Iterants, Fermions and Majorana Operators. In "Unified Field Mechanics - Natural Science Beyond the Veil of Spacetime," edited by R. Amoroso, L. H. Kauffman, P. Rowlands. World Scientific (2015), pp. 1-32.

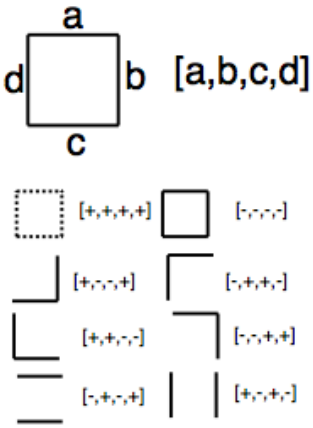
The "Quaternion Card" scheme described here was invented by Kauffman in 1996. See old notes https://dl.dropboxusercontent.com/u/11067256/Hitchlin.pdf



Kauffman made a set of cards with markings at their corners to represent the "iterant" representation of quaternions shown on the previous slide. The idea of using the alphabet was inspired by Isaacson and by Schmeikal.

We have the impression that the sixteen-letter alphabet is fundamental and that Bernd Schmeikal's articulation of it in terms of the Clifford algebra of Minkowski spacetime will be significant both for physics and for RD.

# This slide shows how the sixteen-letter alphabet can generate the quaternions. We do not explain it here.




Quaternion Iterant Coding.

A = (ab)(cd)

B= (ad)(bc)

C = (ac)(bd)

(180 degree turns)

(generators of the Klein Four-Group)

I = A

J = B

K = C

X G = G X^G (iterant multiplication)

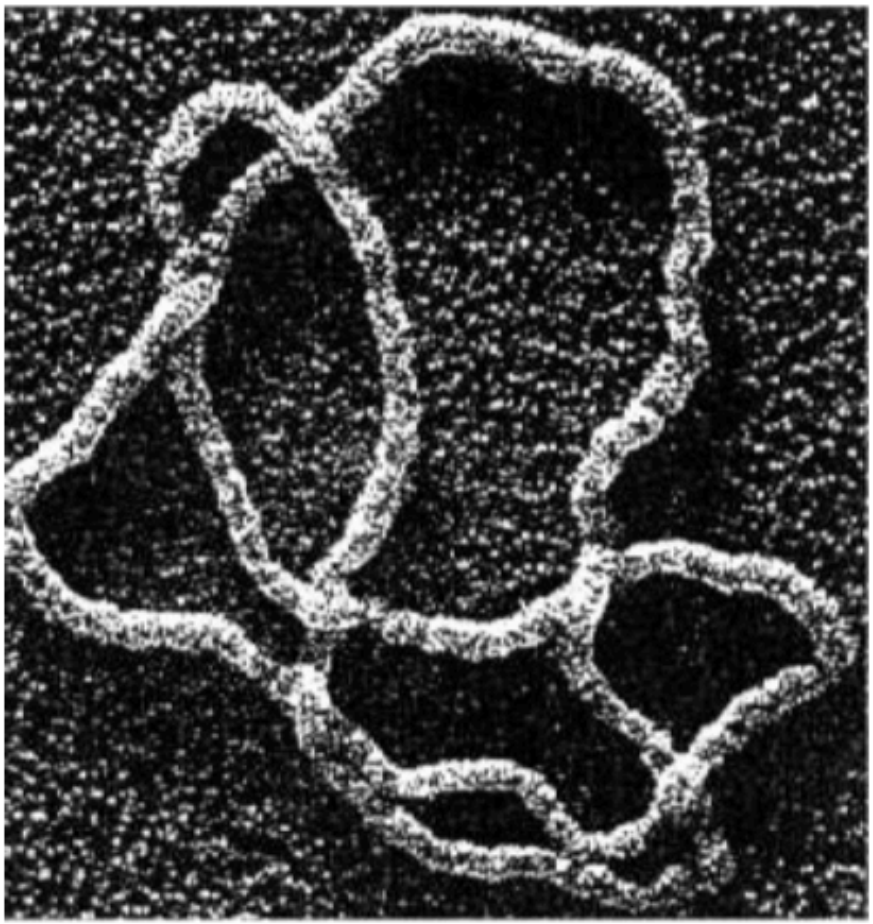
JJ= B B = BB = = -1.

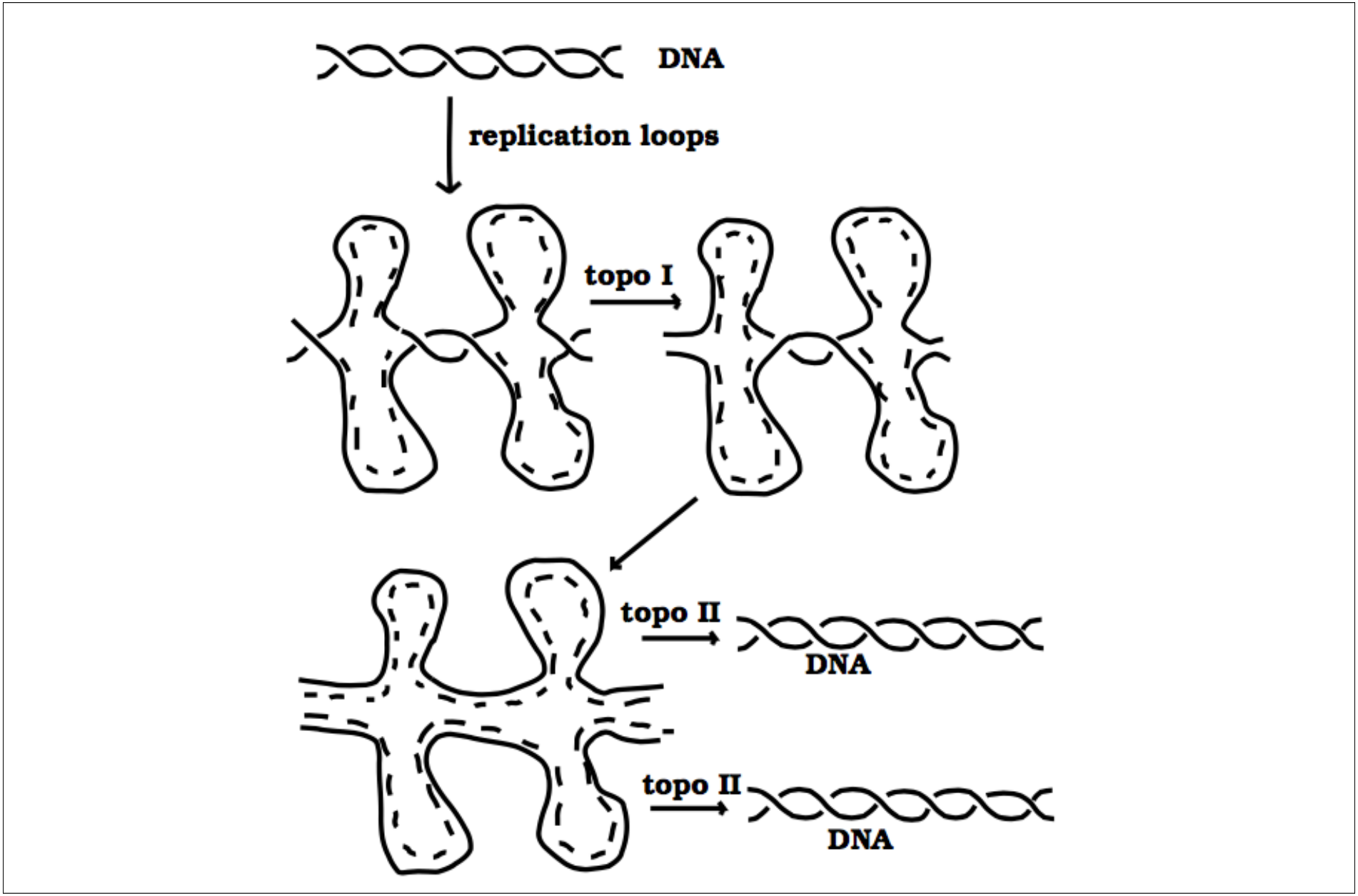
IJ = A B = AB = C = K

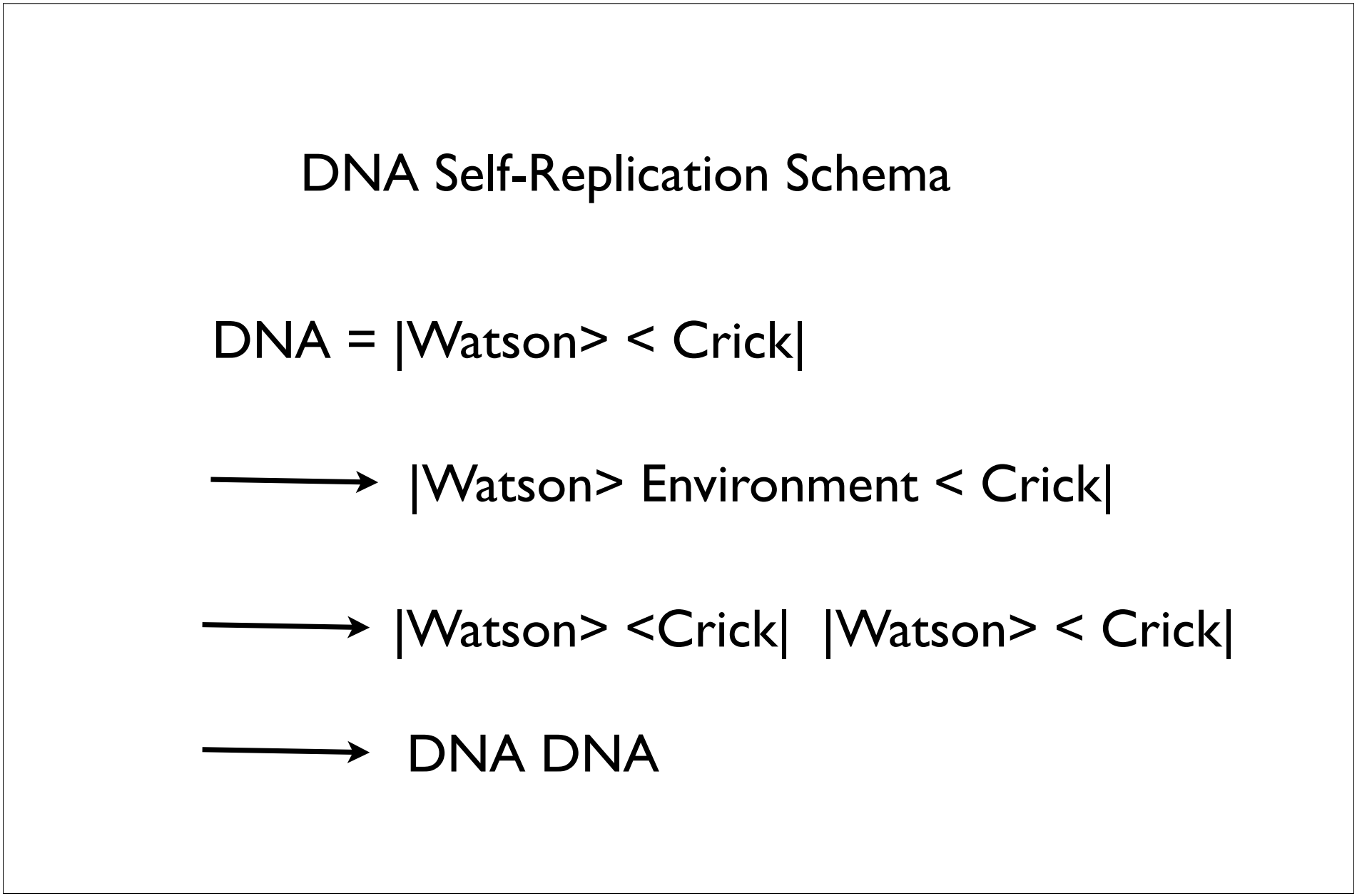
JK = B C = BC = A = I

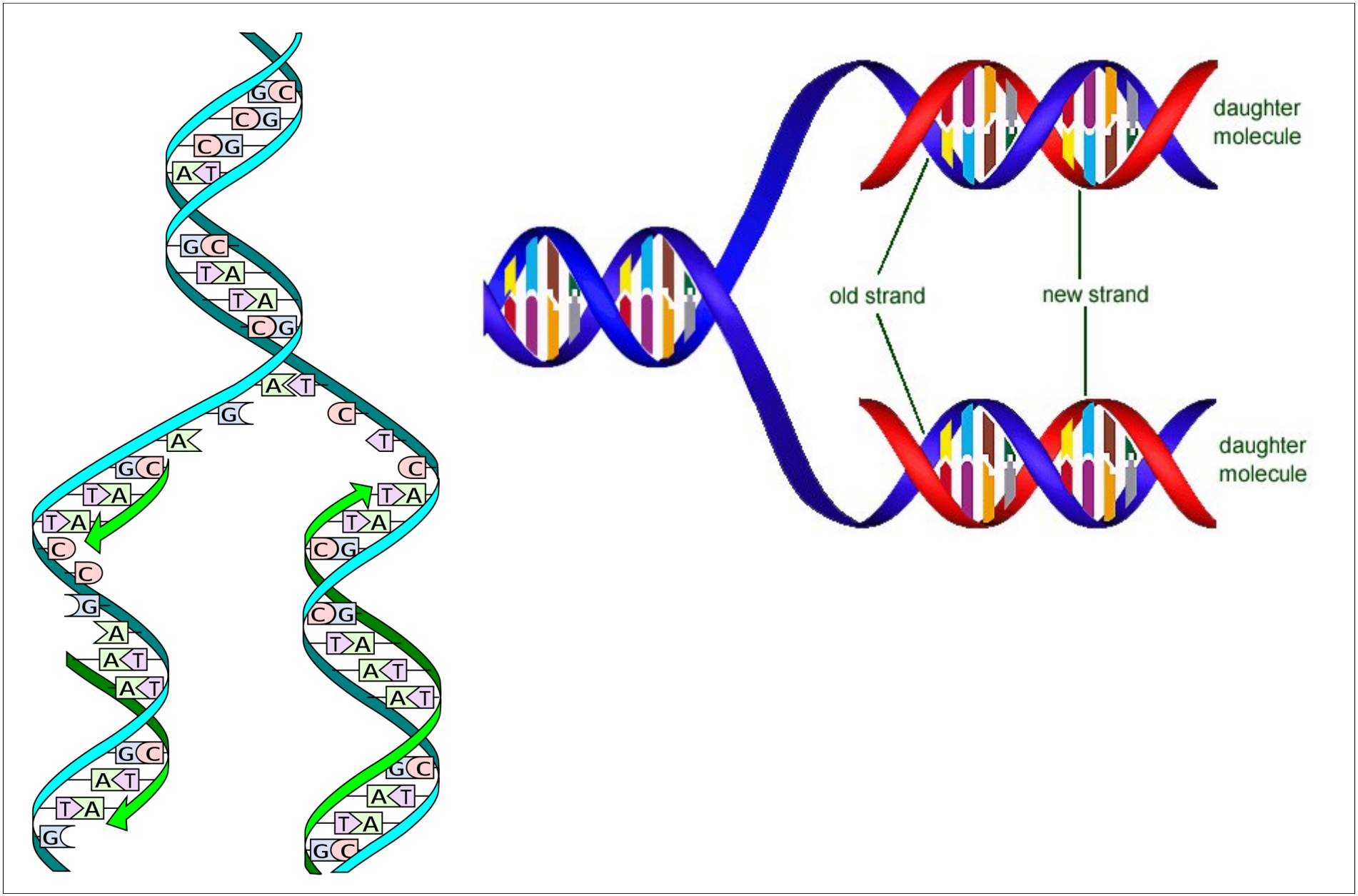
KI = C A = CA = B = J

# DNA Replication and the One-Dimensional Recursive Distinctor




DNA
replication loops
topo I
topo II
DNA
topo II
DNA


DNA Self-Replication Schema
DNA = |Watson> < Crick|
|Watson> Environment < Crick|
|Watson> <Crick| |Watson> < Crick|
DNA DNA


daughter
molecule
old strand
new strand
daughter
molecule

RD Self-Replication
is analogous to
DNA Self-Replication.

1. ========]O[========= .

2. ========]OOO[========

3. ======]O[=]O[=======

Recursive distinctioning is a potentially explosive topic whose basic principles apply at all levels of biology, cognition, information science and computation.

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**Editors' Notes:** Kepler Space Institute (KSI) takes pride in continuing to document the story of Recursive Distinctioning (RD) from its discovery in 1964 by Dr. Joel Isaacson, to his patenting of its characteristics in 1981, to repeated publications in the *Journal of Space Philosophy* beginning with "Nature's Cosmic Intelligence" by Joel Isaacson, in the Fall 2012 issue, followed by the Special Science issue on Recursive Distinctioning, Spring 2015, the Fall 2016 issue, and now this Fall 2017 issue. KSI has sponsored three annual RD conferences by the RD Science Team in 2015, 2016 and 2017.

This article brings readers up to date on the RD presentations at the International Space Development Conference in St. Louis, May 2017. *Bob Krone and Gordon Arthur*.

# Making President Trump the Needed Champion of GEO Space Solar Power

**By Mike Snead**[1]

**Abstract**

Today's worldwide substantial dependence on fossil fuels for industrialized prosperity has created general energy insecurity, brought widespread energy impoverishment, and increased the risk of warfare to secure vital fossil fuel resources. This use of fossil fuels has also created a significant environmental security threat due to reasonable uncertainty that the now abnormally high and rising atmospheric carbon dioxide concentration could harm the environment and, consequently, civilization. Space-based solar power platforms, built in geostationary Earth orbit (GEO), were identified in 1968 as a means of providing sustainable electrical power to ground receiving stations distributed around the world. President Trump's focus on achieving American energy independence and on creating a new international agreement to address anthropogenic carbon dioxide emissions has created the political circumstances where President Trump could champion undertaking GEO space solar power as a major initiative of his administration.

Key words: President Trump, United Nations Framework Convention on Climate Change, Paris Agreement, carbon dioxide, $CO_2$, sustainable energy, fossil fuels, GEO space solar power, energy impoverishment, sustainable development.

## Introduction

> *In the midst of chaos, there is also opportunity.*
> *—Sun-Tzu*

For the first time ever—yes, ever—the political, technological, and economic opportunities to create an American-led spacefaring industrial revolution, accompanied by large-scale human space settlement, now exist. The need for this revolution is to open O'Neill's "high frontier" to build thousands of space solar power platforms in geostationary Earth orbit (GEO) to transmit (nearly) continuous, pollution-free electrical power to receiving stations all over the Earth. I refer to the space-based component of this worldwide, sustainable energy infrastructure as GEO space solar power.

Humanity has run out of excuses for not adopting space-based sustainable energy to power our civilization. The political opportunity to undertake GEO space solar power is at hand provided we convince President Trump to champion GEO space solar power. Without his strong support, GEO space solar power and this vitally needed transformation of our civilization will most likely not happen. The purpose of this article is to explain why convincing President Trump to be the champion is consistent with his stated views on energy and environmental security—views that most Americans probably share—as well as his apparent openness to undertaking big, bold ideas to make America great again.

[1] Professional engineer; President, Spacefaring Institute LLC; Associate fellow, American Institute of Aeronautics and Astronautics.

**The Sustainable Energy Security Challenge**

Almost everyone in the world wishes to live well. By this I mean having, at least, what Americans think of as a middle-class standard of living. What is preventing this from happening is the lack of a worldwide sustainable energy infrastructure providing the affordable per capita energy supply needed to have a middle-class standard of living. That this is not happening, including in the United States, is due to our substantial reliance on fossil fuels for energy. The limited supply of non-sustainable fossil fuels automatically creates "haves" and "have nots" because the marketplace seeks to balance limited supplies with a price-dominated distribution of these limited resources. As a result, most industrialized and industrializing nations, including the United States, suffer fossil fuel energy insecurity that is addressed through, at times, awkward political/economic alliances and the threat of warfare, if not actual warfare. Peacefully resolving this fossil fuel energy insecurity, by transitioning to plentiful space-based sustainable energy, is the energy security challenge America must lead the world in addressing.

**The Opportunity for a Champion**

While identifying the need for sustainable energy security is not new, what has changed is that a real opportunity to begin the changes necessary to achieve this security is now at hand with President Trump. To achieve true energy security worldwide, the world must fundamentally change to adopt sustainable development powered by, obviously, sustainable energy. Reasonable people understand the need for this to happen including, we must assume, President Trump and key members of his administration. Run-of-the-mill politics over the last half-century have not put the United States or the world on a practical path to eliminating energy impoverishment and achieving true energy security. President Trump is, certainly, a counter-establishment president. He approaches solving problems differently, making this a key personal attribute during his campaign. He reemphasized this point, at the end of his inauguration speech, by saying, "Finally, we must think big and dream even bigger."

President Trump appears to have carried his openness to "big ideas" into the White House. Unlike any time since GEO space solar power was conceived in the late 1960s, the opportunity to sell this remarkable "big idea" to the president of the United States now exists. If adopted and initiated effectively, it would certainly become an acknowledged successful legacy of his administration. The opportunity to get President Trump to champion GEO space solar power must not be ignored.

**GEO Space Solar Power**

About a century ago, the idea of using GEO to locate transmitters to broadcast to the Earth first emerged. A GEO satellite moves around that orbit at the same angular rate as the Earth rotates each day (Figure 1). Thus, to an observer on the ground, a visible GEO satellite remains constantly in view with its position stationary. This feature has been used since the 1960s to relay telephone, radio, and TV broadcasts to receivers located within the broad swath of ground that can "see" the GEO communication satellite.

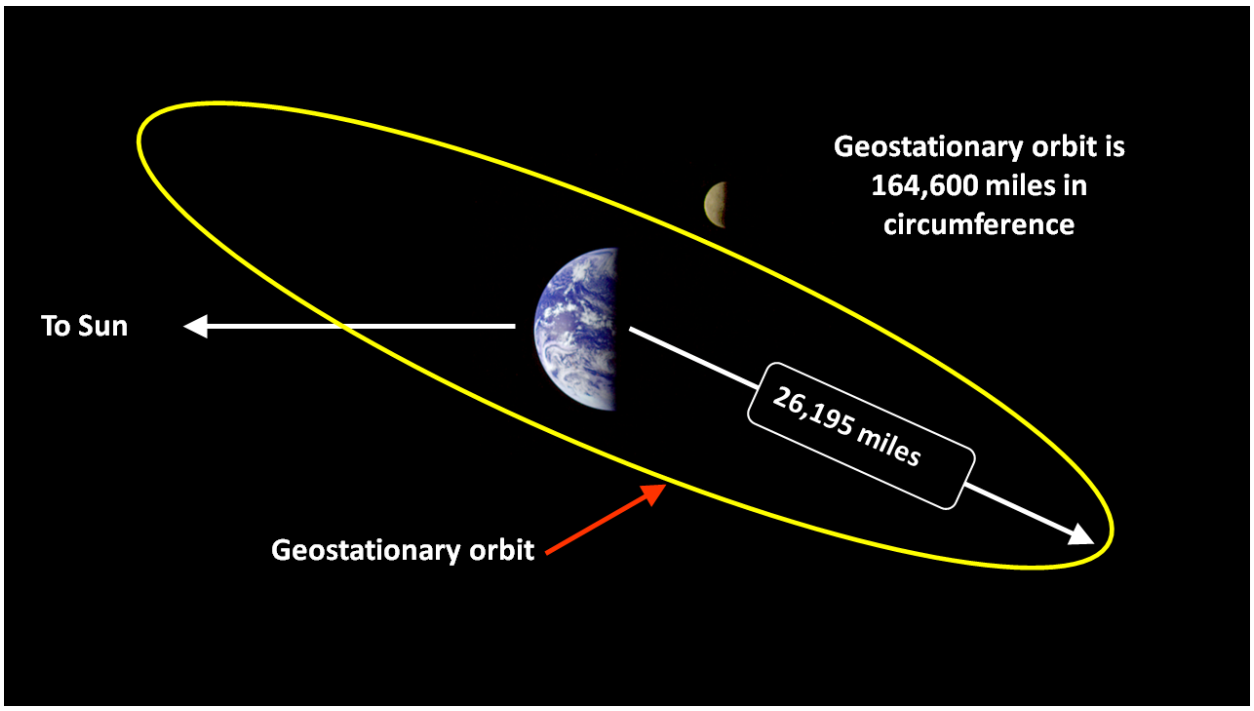


Figure 1. Illustration of geostationary Earth orbit.

In the 1940s, a science fiction story told of converting sunlight into electrical power and transmitting this power through space via high-power radio waves. Dr. Peter Glaser linked this idea with that of GEO communication satellites to originate the GEO space solar power satellite (platform) concept in a 1968 *Science* article followed by a patent in 1973. While fundamentally similar, there are two primary differences between a GEO communications satellite and a space solar power platform. The first is that the communication satellite's transmission power level is modest to meet the needs of transmitting information. Obviously, a power platform will need to transmit at a much higher power level. The second difference is that the communication satellite's signal is broadcast over a large area of the ground to enable widespread reception. The power platform's signal is, instead, tailored to match up with an antenna at a ground receiving station to establish a continuous transfer of power specifically to this ground site (Figure 2).

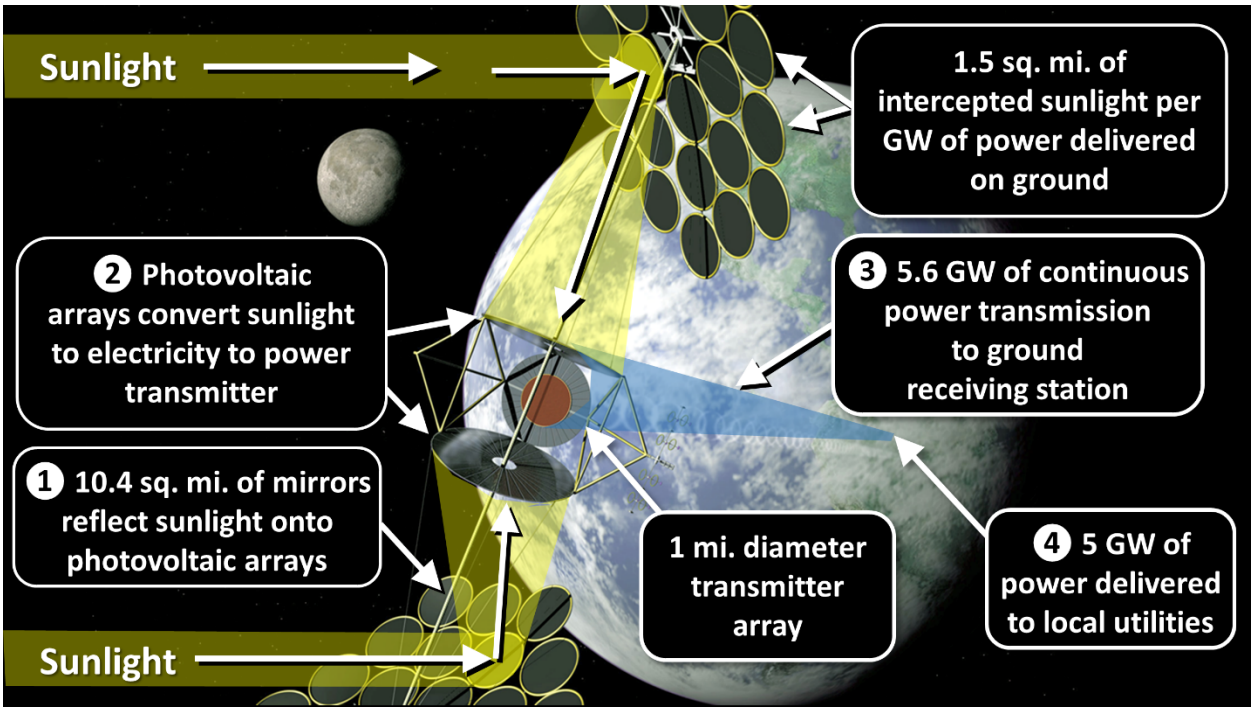


Figure 2. Illustration of a possible GEO space solar power platform capturing sunlight and converting this into electrical power transmitted to a ground receiving station (original illustration credit: NASA).

Figure 2 highlights the basic features of a generic space solar power platform. Mylar mirrors intercept sunlight, reflecting this sunlight to photovoltaic arrays where the solar power is converted into electrical power. (Some designs focus the sunlight to create high temperatures to generate electrical power.) The electrical power is carried by power cables to the transmitter array, where the power is converted into a radio signal. Using the large transmitter array, the signal is directed to a particular ground receiving station on the Earth's surface—one of thousands that will be built all around the world.

As water vapor and the other gases making up the atmosphere absorb some frequencies (wavelengths) of radio signals, the baseline NASA design selected a radio signal frequency of 2.45 gigahertz (GHZ). This is in what is referred to as the "microwave" band of the spectrum—a part of the spectrum widely used for industrial processes. At this frequency, very little of the power in the radio signal is absorbed in the atmosphere, creating an "electromagnetic window" to transmit power efficiently through the atmosphere to the ground receiver. However, as this frequency is very close to that used in microwave ovens, NASA took great care in defining a baseline system design that provides needed public safety (Figure 3).

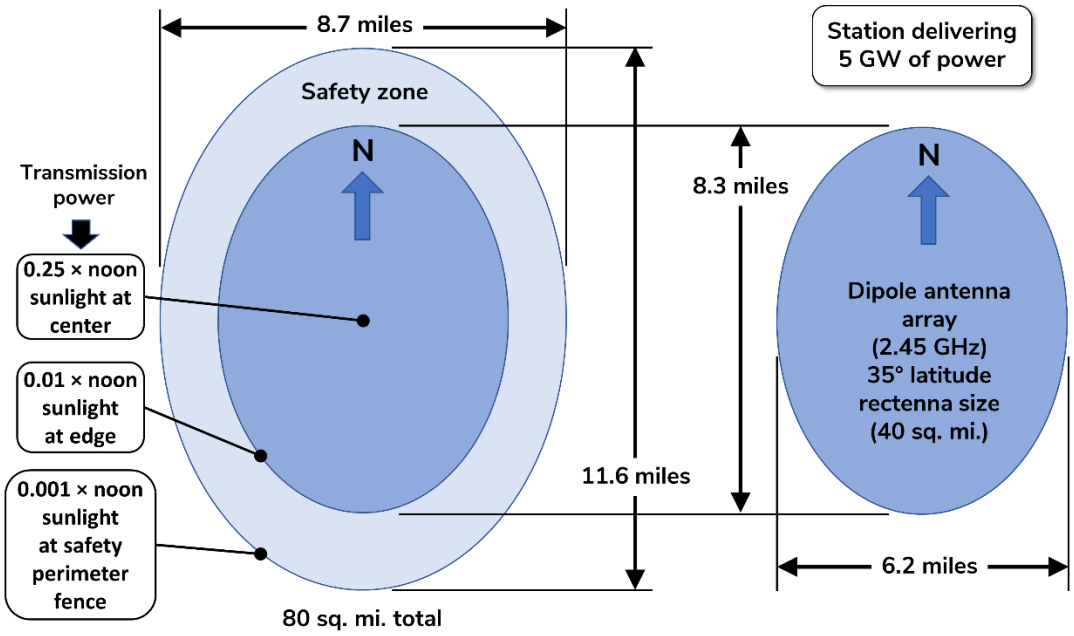


Figure 3. Space solar power ground receiving station layout based on the 1980s baseline design in the NASA report. The shape is for a receiving station located at a latitude of 35°. The elliptical shape is due to the signal striking the ground at an angle. If the station was located at the equator, it would be circular.

Figure 3 shows the configuration and size of a ground receiving station tailored for the 2.45 GHz signal frequency. Besides the choice of the frequency, the size of the transmitting array, the long distance to the ground, and the physics of radio transmission establish the needed size of the receiving array as well as the distribution of power within the signal when it reaches the ground. The strength of the signal is highest in the middle and falls off away from the center. As seen in Figure 3, with a proper design, the peak power level in the signal is 25% of sunlight at noon at the equator. At the edge of the actual receiving antenna array, the power level is only 1% of noon sunlight, while at the safety perimeter fence, it is only 0.1%.

The antenna array receives the power signal, converts this into alternating current (AC) power, and sends this power to local utilities and end-users using the standard electricity transmission and distribution system. Each ground receiving station would provide (nearly) continuous electrical power equal to five nuclear power plants or 2.5 Hoover Dams. This power is continuous except for brief periods in the couple of weeks before and after the spring and fall equinoxes when the space solar power platform briefly enters the Earth's shadow at local midnight as the platform orbits the Earth. Backup power generators would meet demand during these times. Space-based sustainable power would be continuously supplied over 99% of the year.

The total land area needed for a 5-GW receiving station in the central United States is about 80 square miles, or about 16 square miles per GW. The 2-GW Hoover Dam uses

Lake Mead to store the water used to provide hydroelectricity. Lake Mead covers about 250 square miles or about 125 square miles per GW of nameplate generation capacity. The baseline ground receiving station design is more economical in land use than hydroelectricity using reservoirs or, as discussed later, ground solar energy or wind energy.

GEO space solar power has the scalable potential to meet the world's energy needs. The circumference of GEO is about 165,000 miles. With a spacing of 10 miles, 16,500 5-GW space solar power platforms, providing 82,500 GW of continuous electrical power, could feasibly be built. If these platforms are doubled-up to generate 10 GW each, this would increase the GEO sustainable power potential to 165,000 GW.

**American and World Power Needs in 2100**

In a sustainable energy infrastructure, electricity is the primary form of energy. Electrical power, measured in watts, is how the electricity generated is measured. Electrical energy, expressed in watt-hours, is how the total amount of electrical power used is metered. When discussing electrical power, "kilo" (k) is used for 1 thousand, "mega" (M) is used for 1 million, and "giga" (G) is used for 1 billion.

A typical countertop microwave oven uses 1,000 watts or 1 kilowatt (kW) of electrical power. If this operated continuously for one day, it would use 24 kW-hours (kWh) of electrical energy. If it were to run continuously for one year, it would consume 8,760 kWh or 8.76 megawatt-hours (MWh) of electrical energy.

As the world's transition to sustainable energy will take time, I use the year 2100 as the target for completion. This is consistent with the Paris Climate Agreement's general timeline for ending the use of fossil fuels worldwide. The goal would be to ready the world for the 22nd century in terms of having achieved worldwide sustainable development powered by sufficient sustainable energy.

The future power needs of a nation or the world require only two inputs: the population size and the per capita energy need.

From a population of about 320 million currently, the American Statistical Association projects that the US population will likely grow to 450 million by 2100. For the world, with a current population around 7.5 billion, the population may grow to over 10 billion by 2100. We will use a world population of 10 billion in 2100 for this discussion.

The historic peak per capita energy use in the United States occurred in 1979, just prior to the long, severe economic recession resulting from sharp oil price increases in the aftermath of the Iranian Revolution. Since 1979, the annual per capita energy use has been declining, but at a very slow pace. For example, in 2000 when the economy was prosperous, per capita energy use had only declined a total of 2.6% from the 1979 peak twenty-one years earlier. When averaged over this period, the annual reduction was only 0.12% per year. To project the US total energy need in 2100, I assume that the American per capita energy need will have declined 20% from the 1979 peak.

When America's transition to sustainable energy is completed by 2100, its energy infrastructure will produce primarily electrical power. I have estimated that Americans will need a per capita continuous electrical power supply of 10,000 watts or 10 kW in 2100 to provide the energy used directly and to provide the goods and services consumed, including synthetic fuels.[2] Thus, each gigawatt—1 billion watts—of continuous power would meet the total needs of 100,000 Americans in 2100. From this estimate, 450 million Americans in 2100 would need a continuous power supply of 4,500 billion watts or 4,500 GW. For comparison, America today has an equivalent continuous generation capacity of about 472 GW—1.5 kW per capita—of which only one third, or 157 GW, is not generated using fossil fuels. Thus, by 2100, America needs to build nearly 4,500 GW of new sustainable generation capacity. Only GEO space solar power has this potential.

To estimate the world's sustainable energy need in 2100, I base my estimate on the per capita energy needs of Germany and Japan. Not having America's fossil fuel resources, they have a more frugal style of living with a higher population density. They have, however, a very high standard of living which makes their per capita energy use suitable for use as a target for setting worldwide sustainable development goals. Hence, for 2100, I assume a worldwide per capita continuous sustainable power supply of 5,000 watts or 5 kW to provide for sustainable development achieving broad middle-class prosperity. This is an average, of course. Those living in warm climates may use less on average, while those living in colder or hotter climates may use more. Thus, by 2100, a world with 10 billion people will need in the ballpark of 50,000 GW of sustainable generation capacity to enable most people to have a middle-class standard of living. Again, only GEO space solar power has the potential to meet this need.

As noted in the above illustration of a 5-GW GEO space solar power platform, 10.4 square miles of space mirrors will be used to reflect the sunlight onto the photovoltaic arrays. These mirrors will likely be lightweight, aluminized plastic film like that used to make shiny helium balloons. As mentioned above, each gigawatt of continuous power delivered would meet the needs of 100,000 Americans. This means that it only takes about 600 square feet of mirror to supply an American with the sustainable power necessary for a prosperous, middle-class standard of living. Think about this for a moment. America's sustainable energy independence can be realized by deploying the equivalent of a 24-foot by 24-foot aluminized plastic film mirror into GEO for each American. This is about the floor area of a typical two-car garage.

[2] Currently, the United States has the equivalent of 1.5 kW of continuous electrical power generating capacity per capita from all sources. Today, combustible fuels used by the end-consumers almost entirely come from fossil fuels. Even with a sustainable energy infrastructure, combustible fuels will still be needed for transportation, industrial processing, and, most likely, home heating and cooking. When estimating sustainable energy needs, hydrogen produced from water using electrolysis is assumed to be used to replace combustible fossil fuels. Producing hydrogen in this manner is quite energy intensive. This is why a total need for 10 kW per capita of continuous sustainable power is needed in 2100—to provide both the electricity used directly and that needed to produce hydrogen fuel.

**Terrestrial Renewable or Nuclear Energy Sources Are Not Practical**

While there are many terrestrial alternatives to fossil fuels, only three could possibly be scaled up to replace fossil fuels: wind power, ground solar power, and nuclear power. For the following reasons, none of these terrestrial alternatives are practical for America.

- Wind farms are not dispatchable, like coal-fired or nuclear power plants, but are a variable electrical power source. It is not unusual for wind farms to produce little power at times, especially in the hot summer months when the demand for electricity is usually the greatest. This variability introduces significant complexity when trying to use wind electricity as an assured national energy source. In addition to this variability, wind power is also a diffuse power source. Thus, even when using modern 500-foot-tall wind turbines, each wind turbine would, on average, supply the annual energy needs of about only 50 Americans in 2100. For optimum power generation, about four turbines would be located per square mile of commercial wind farms. Thus, each square mile would meet the annual energy needs of only about 200 Americans in 2100. To meet the needs of 450 million Americans, 2.25 million square miles—about 75% of the contiguous United States—would need to be converted into wind farms. The scale of the necessary wind farms is shown in Figure 4. This is not a practical political or environmentally-friendly solution.

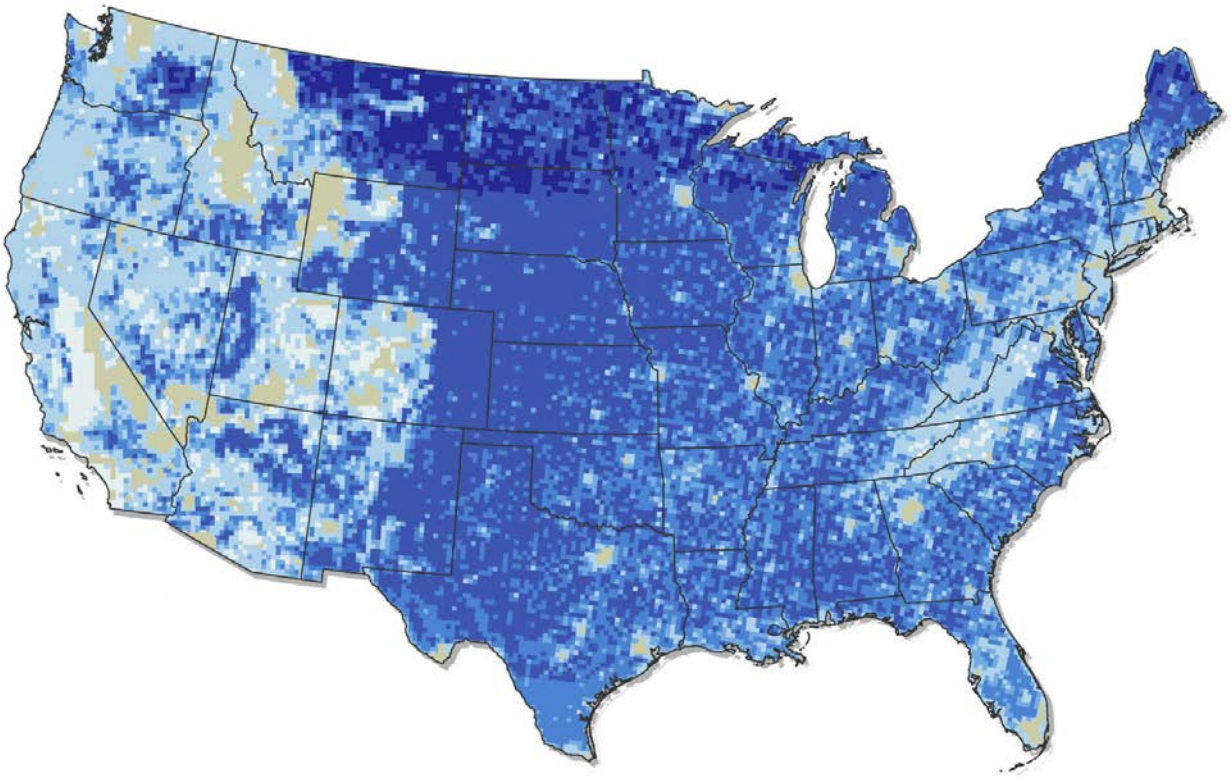

Figure 4. Wind farms would need to be built in all areas shaded darker blue (credit: US National Renewable Energy Laboratory).

- Commercial ground solar farms are also a variable electrical power source requiring a complex system to turn variable ground solar-electricity into an assured national energy supply. Due to the day-night cycle and the impact of weather, a typical solar farm will produce its nameplate power only about 20% of the time. Commercial solar farms would, per square mile, supply sufficient variable electrical energy to meet the annual energy needs of about 2,000 Americans in 2100. Thus, 225,000 square miles of actual solar farms would be needed in 2100 to meet the total energy needs of 450 million Americans. The best place to locate commercial solar farms is in the American Southwest—southern California, New Mexico, Arizona, Nevada, Utah, Colorado, and western Texas. The National Renewable Energy Laboratory has found that only about 87,000 square miles of land in these states is suitable for commercial solar farms without major grading to level the landscape. This is not a practical political or environmentally friendly solution.

- While it would be appropriate for the United States to replace its current nuclear power plants with updated designs with improved safety and lower operational costs, these total only about 100 GW of generating capacity. A new nuclear power plant is expected to operate for 120 years. Thus, each new plant needs a 120-year supply of natural uranium to fuel the plant. The most optimistic estimate of the available domestic uranium supply would meet the lifetime needs of only about 100-150 1-GW nuclear power plants. To expand the fuel supply would require breeding plutonium or the uranium U-233 isotope—both capable of being used for nuclear weapons or dirty bombs. Each plant will need about one metric ton (tonne) of plutonium or U-233 each year. The 4,500 GW of power needed in 2100 would require the annual production of 4,500 tonnes of plutonium or U-233. To meet the world's energy needs in 2100, this would expand to roughly 50,000 tonnes per year. If the United States adopts a program of fuel breeding, much of the rest of the world will likely follow suit. This would create significant nuclear weapon proliferation threats and would generate large quantities of nuclear waste each year. This is not a practical solution for many reasons.

As mentioned previously, a 5-GW ground receiving station would require about 80 square miles of land area. Providing 4,500 GW of space power would require 900 ground receiving stations utilizing a total of 72,000 square miles. This compares quite favorably with the 2.25 million square miles needed for wind farms or the 225,000 square miles needed for ground solar farms.

**Ending World Energy Impoverishment**

Impoverishment breeds discontent and fuels hostilities between peoples. Billions of people lack the fossil fuel resources or the economic wherewithal to escape energy impoverishment. Modern forms of energy are the lifeblood of modern agriculture and industrialization—the foundations of a middle-class standard of living. Thus, billions are

excluded from having a modern style and standard of living because of energy impoverishment.

Energy impoverishment cannot be ended using fossil fuels. The fossil fuel marketplace is all about selling inherently limited supplies of a non-sustainable commodity. Eliminating energy impoverishment requires a sustainable energy solution. Doing this with GEO space solar power will involve building 10,000 5-GW GEO platforms and an equal number of ground receiving stations almost all over the world. As noted, each 5-GW receiving station would be equivalent to 2.5 Hoover Dams operating continuously. Thus, the equivalent of 25,000 Hoover Dams would be built all around the world during the transition to sustainable energy. Considering what a single Hoover Dam did electrifying the American Southwest in the 1930s, the thought of the sustainable development potential of 25,000 Hoover Dams being built by 2100 is staggering. With each ground receiving station supporting 1 million people, hundreds, if not thousands of modern cities, embracing sustainable development and housing upwards of 10 billion people, could be built, readying the world for the 22nd century. As indicated—but worth repeating—only GEO space solar power has this potential.

**Achieving True American Energy Independence**

President Trump made making American energy independent an important campaign promise. As president, he has expanded on this promise to include achieving American dominance of the energy marketplace. Noteworthy is that in his remarks, President Trump reiterated his openness to big, bold ideas—ideas tied to achieving energy independence and dominance.

> With these incredible resources, my administration will seek not only American energy independence that we've been looking for so long, but American energy dominance. When it comes to the future of America's energy needs, we will find it, we will dream it, and we will build it. (President Trump, June 30, 2017)

Informed Americans understand that the value of any short-term energy independence, achieved through increased domestic fossil fuel production, will be fleeting as it will be based on non-sustainable energy sources. Eventually, discoveries of new oil and natural gas fields will fall, soon to be followed by decreases in production. This is what happened with conventional oil and natural gas production from 1970 up until the start of the fracking revolution in 2008. Growing dependence on imports forced America's involvement in the Middle East at great sacrifice. At some point later this century, just as happened in the 1970s, the need for increasing oil and natural gas imports will return, casting our children and grandchildren back into the quagmire of securing sufficient affordable oil and natural gas imports to keep America prosperous. Today's Americans have a moral obligation to enable our future generations to avoid what we most certainly know will be a disastrous future.

For President Trump's goal of America becoming energy independent to be achieved, the need to transition to sustainable energy is obvious. The fracking revolution has, quite simply, bought America precious time to undertake this transition in an orderly manner

that does not harm the economy. Building roughly 4,500 GW of sustainable electrical power generation capacity, plus the new infrastructure to produce hydrogen or synthetic carbon fuels, will not happen in short order—this will be the work of several generations. The increase in technically recoverable oil and natural gas achieved through improved technologies and reduced regulations will enable America to make this transition by 2100 while maintaining affordable energy supplies. America is now "fat" with oil, natural gas, and coal, making this exactly the right time to begin the needed transition to true energy independence with sustainable energy.

Some will argue for delay—as some protectors of the status quo always do. Imagine that a solid engineering plan came forth to transition America to sustainable hydroelectricity in an environmentally acceptable way. Starting now, America would undertake building 4,500 GW of new hydroelectric facilities, making America energy secure with clean sustainable energy by 2100. Would there be any likely political or business opposition to supporting this plan? No, certainly not, as it would relieve America of the costly burden of relying on energy imports. However, had such a plan arisen in the 1890s, forty years before the first major dams were built, this plan would have been met with strong skepticism. In the 1890s, the industrial mastery to build large concrete dams did not exist. Yet, by the 1930s—two generations later—America had this capability, producing the Hoover Dam, the Grand Coulee Dam, the Bonneville Dam, etc.

Today, skepticism of America's ability to undertake GEO space solar power is without merit. It has now been nearly forty years since NASA—the NASA that undertook the Apollo program—conducted a thorough, $50 million (then-year dollars) evaluation of the GEO space solar power concept, finding that the American aerospace industry had the industrial mastery to build the GEO space solar power platforms. What was lacking was the enabling spacefaring logistics infrastructure. This was two generations ago—before there were even personal computers. Today, America's aerospace industry can build the spacefaring logistics infrastructure necessary to create the new American space mining, space manufacturing, and space power industries that will build up to 4,500 GW of American GEO space solar power by 2100. What this means is that proceeding with GEO space solar power is, now, a political decision—a big idea that will bring America true energy independence while beginning an American-led human spacefaring industrial revolution.

President Trump is not, however, content with achieving energy independence; he wishes for American dominance in world energy markets. Dominance can happen in many ways. The fracking revolution is providing, at least for a short period, American dominance of world oil and natural gas prices as America reduces its imports and becomes a net energy exporter.

An American-led spacefaring industrial revolution will put America in a dominant position for providing the world with much of the 50,000 GW of GEO space solar power needed to eradicate energy impoverishment and to enable worldwide sustainable development. Of course, this will be undertaken through commercial contracts of American space mining, space manufacturing, space power, and spacefaring logistics industries working with partners around the world. But, through the early development of key intellectual

property, space industrial capabilities, employee experience and expertise, and key spacefaring operational capabilities, American dominance of these industries for generations can be achieved. America has done this in military and commercial aviation for several generations. Under President Trump, America has relearned the lesson of not giving away industrial and intellectual leadership. There is no reason why America cannot dominate an emerging world energy market using GEO space solar power. America builds and sells nuclear power plants and gas turbine generators to other countries. There is no reason why this cannot be done with GEO space solar power platforms.

Each 5-GW ground receiving station will provide about 8,760 million kWh of electricity per year. Today, the electricity from a coal-fired power plant sells for about four cents per kWh. At $0.04 per kWh, each 5-GW system will generate $438 million in revenue per year. The 900 GEO space solar power systems for the United States would bring in nearly $400 billion a year from wholesale electricity sales. The 10,000 systems needed for the world would generate nearly $5 trillion in annual revenue. Today, a new 1-GW nuclear power plant costs about $5 billion. The purchase price of 50,000 GW of space power would be expected to be at least $250 trillion. These back-of-the-envelope estimates indicate the immense new world market for space power that will start this century. President Trump's energy independence and dominance goals can make the United States a leader in this new emerging market.

**Resolving the Carbon Dioxide Emissions Environmental Security Threat**

A controversial decision by President Trump was to withdraw the United States from the 2015 Paris Climate Agreement. This agreement was the latest attempt to define a protocol responsive to the United Nations Framework Convention on Climate Change (UNFCCC) treaty's objective. Here is the treaty's objective with the key phrase in italics:

> The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt [such as the Paris Agreement] is to achieve, in accordance with the relevant provisions of the Convention, *stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system*. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

Using measurements of ancient air trapped in tiny air bubbles in glacial ice in Antarctica and Greenland, scientists have determined the general range of the atmospheric carbon dioxide ($CO_2$) concentration over the last 800,000 years (Figure 5). Measured in parts per million by volume (PPM), the variation in the concentration is shown in the figure below. During eight cycles of natural global warming and cooling, the maximum natural $CO_2$ concentration has been in the range of 242-299 PPM. For reasons that are unclear, nature has held this upper limit at least eight times. Hence, a reasonable person would likely conclude that the upper side of this range—about 300 PPM—defines the maximum safe $CO_2$ concentration that would not cause "dangerous anthropogenic interference with the climate system."

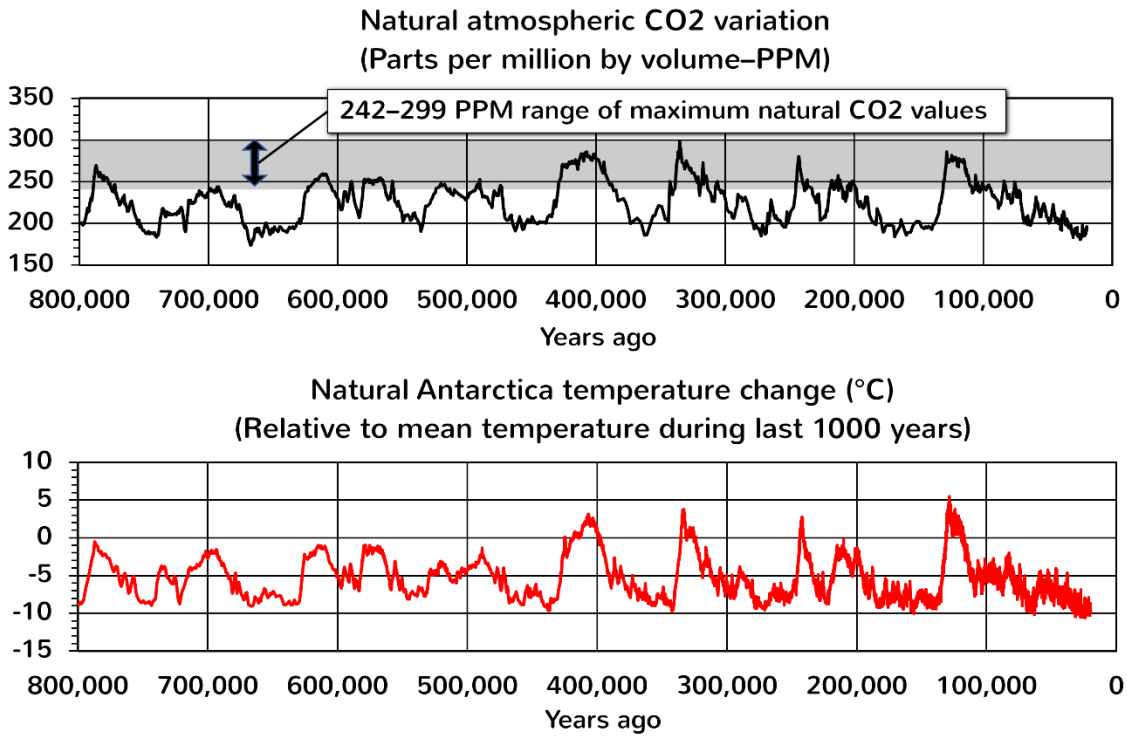


Figure 5. Atmospheric $CO_2$ concentration (PPM) and Antarctica temperature change (°C) from 800,000 to 20,000 years ago using ice core measurements (data source: World Data Center for Paleoclimatology, Bolder, and NOAA Paleoclimatology Program, retrieved 2016 and 2017).

As a matter of interest, the scientists were also able to estimate the temperature changes in central Antarctica using different measurement methods. Using the average temperature over the last 1,000 years as the baseline, the temperature changes over the last 800,000 years are also shown in the figure above. The average time between $CO_2$ data points is 420 years, while the average time between temperature data points is 138 years. Further, the temperature data do not necessarily reflect global temperature changes. While these temperature estimates show general climate warming and cooling, the lack of precision in the $CO_2$ and temperature data does not enable a cause-effect relationship to be established with scientific certainty. The lack of certainty means that our focus should be on the atmospheric $CO_2$ concentration—something that can be measured directly without ambiguity.

The abnormal rise in the $CO_2$ concentration began in the industrial age. With industrialization, the world's standard of living improved, leading to an increasing population and an increasing use of energy per capita. As seen in Figure 6, the atmospheric $CO_2$ concentration climbed as the world's population and the total fossil fuel carbon emissions increased. About a century ago, the $CO_2$ level broke through the 300 PPM natural ceiling. It has now climbed to around 405 PPM, and it is still increasing 2–3 PPM each year.

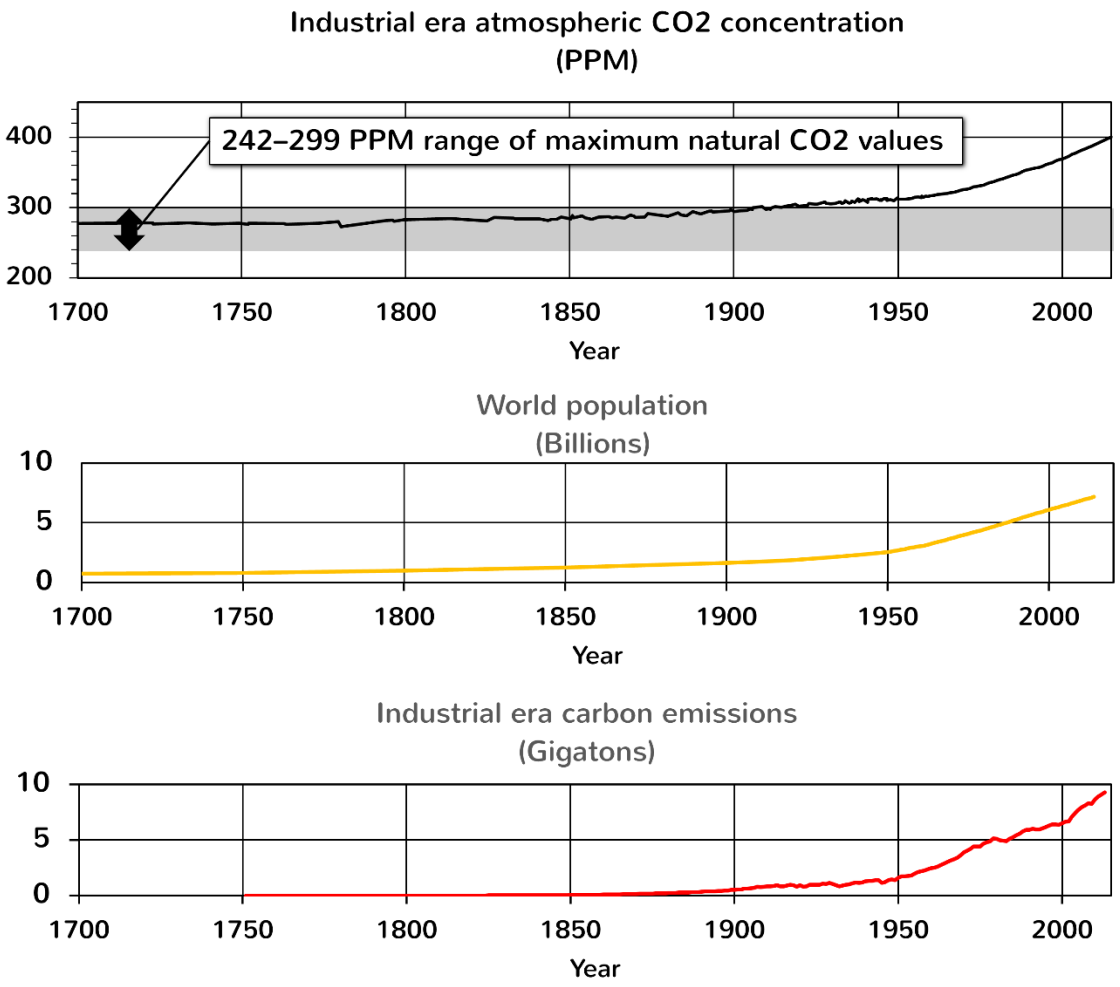


Figure 6. Industrial era atmospheric $CO_2$ concentration, 1700-2015 (climate data source: World Data Center for Paleoclimatology, Bolder, and NOAA Paleoclimatology Program, 1700–1958, retrieved 2015 and 2016; NOAA/Mauna Loa, Hawaii, 1959-2015, retrieved 2016). World population estimate (data source: US Census Bureau). Carbon emissions from fossil fuels (data source: US Department of Energy's Carbon Dioxide Information Analysis Center and BP's Statistical Review of World Energy as compiled by the Earth Policy Institute).

From the ice core data, we know that the current atmospheric $CO_2$ concentration is now abnormally high. The $CO_2$ concentration increase over the last 300 years is, most likely, due to large human and domesticated animal population increases, land use changes for agriculture and pasture, and growing fossil fuel carbon emissions due to industrialization. Measurements of changes in the ratio of the carbon isotopes making up the $CO_2$ suggest that fossil fuel carbon emissions are the primary cause for the increase.

Since the 1970s, the rising $CO_2$ concentration has raised questions about whether this is safe for the environment. While some approach this from a point of view of requiring evidence of harm, a reasonable person approaches this from the point of view of

assuming potential harm absent evidence to the contrary. Today, there is no scientific evidence that the current abnormally high $CO_2$ concentration is safe for the environment and, hence, for our civilization. Essentially, humanity is overdosing the environment with $CO_2$ without a good understanding of the impact. Clearly, now that we are aware of what is happening, it is unwise to take no action. The UNFCCC treaty established a widely accepted need for action to "prevent dangerous anthropogenic interference with the climate system." As a party to the treaty, the United States acknowledges this need for preventive action.

An examination of the Paris Agreement finds that it does not effectively address concerns with the rising atmospheric $CO_2$ concentration. For example, it does not identify what $CO_2$ concentration is safe—something that common sense indicates should be done. Further, the agreement does not even mention $CO_2$ and it gives scant attention to replacing fossil fuels with sustainable energy. What it does do is demand reductions in the use of fossil fuels in developed nations, such as the United States, while permitting continued growth in their use in developing nations. It also uses changes in the global average temperature as the key metric for determining success when there is no scientifically established cause-effect relationship that an increasing $CO_2$ concentration correlates, over a period of years to decades, with global average temperature increases. In other words, measuring temperature is not a good metric for assessing success of the Paris Agreement actions. Thus, the Paris Agreement is not an effective technological approach to address the environmental security threat created by the uncertainty due to the increasing atmospheric $CO_2$ concentration.

On June 1, 2017, President Trump acted on his campaign promise to withdraw the United States from the Paris Agreement. Formal action was initiated on August 4, 2017 through notification of the United Nations. That he did not act to withdraw the United States from the UNFCCC treaty is noteworthy. Besides keeping a legal focus in US law to prevent "dangerous anthropogenic interference with the climate system," this also provides the basis for US foreign policy, as indicated in the objective statement, "to enable economic development to proceed in a sustainable manner."

After listing the reasons for his decision, President Trump indicated a willingness to work in a bipartisan manner to revise the Paris Agreement or negotiate a new agreement. Here is a key part of his remarks:

> I will work to ensure that America remains the world's leader on environmental issues, but under a framework that is fair and where the burdens and responsibilities are equally shared among the many nations all around the world.

After announcing President Trump's America First Energy Plan later in June, the White House released the following statement that ties these two policy decisions together:

> Lastly, our need for energy must go hand in hand with responsible stewardship of the environment. Protecting clean air and clean water, conserving our natural habitats, and preserving our natural reserves and

> resources will remain a high priority. President Trump will refocus the EPA on its essential mission of protecting our air and water.
>
> A brighter future depends on energy policies that stimulate our economy, ensure our security, and protect our health. Under the Trump Administration's energy policies, that future can become a reality.[3]

Common sense indicates there is only one path forward that will provide America and the world with true energy security, while addressing the environmental security threat posed by rising $CO_2$ levels and enabling worldwide sustainable development. This is GEO space solar power. President Trump's call for American energy independence and his justified rejection of the faulty Paris Agreement have created the political opportunity to pursue GEO space solar power.

**GEO Space Solar Power Needs to Be an American Big Idea**

GEO space solar power was originated in 1968—nearly a half century ago. During this time, America has suffered through two major imported oil shortages, seen periods of extreme energy price increases bringing major recessions, fought or is still fighting several major land wars in a part of the world most Americans have little interest in, expended considerable national treasure on these wars or for securing imported Middle East energy, and suffered substantial domestic political turmoil largely because of America's oil and natural gas insecurity.

During this same period, American and worldwide environmental awareness grew. Concerns about the rising atmospheric $CO_2$ concentration were first identified in the 1970s, in part leading to the establishment of the Environmental Protection Agency. These concerns then led to the UNFCCC treaty, which a Republican president signed and the US Senate overwhelmingly concurred with in 1992. In the subsequent quarter century, no president has led an effort to resolve the potential threat of environmental harm due to the rising $CO_2$ level effectively. The most recent attempt—the Paris Agreement—failed, as did the two previous attempts, because it did not define and implement an achievable technological path for the world to transition from fossil fuels to sustainable energy while enabling continued worldwide economic development. It is especially worth noting that while the previous administration was aware of the GEO space solar power approach, it did not pursue this when negotiating the Paris Agreement despite the common sense need to identify a practical technological solution to end fossil fuel carbon emissions.

For over a half century, traditional American politicians, from across the political spectrum, have failed to recognize and champion GEO space solar power. The traditional path to American political leadership has not yielded politicians now open to big ideas of the type that built the transcontinental railroads, the Panama Canal, or the Interstate Highway System—the type of ideas that made America great.

[3] Retrieved July 11, 2017

GEO space solar power is a BIG idea that President Trump is the ideal president to champion. Championing GEO space solar power will cross the political divide and effectively engage America in addressing key world energy and environmental security concerns. Undertaking GEO space solar power will:

- make the United States energy secure with sustainable energy by 2100;
- enable the United States to end its fossil fuel carbon emissions later this century in accordance with the general goals of the Paris Agreement;
- provide for an orderly transition from fossil fuels to sustainable energy with a solution that, unlike wind, ground solar, or nuclear power, is practical to implement in the United States without unacceptable environmental consequences;
- maintain a robust domestic fossil fuel industry for, at least, several generations, because America will still need to produce, during this transition, nearly as much fossil fuels as it has produced in the last 160 years;
- expand the natural gas industry to make use of synthetic methane—produced using sustainable space power and $CO_2$ from the atmosphere—as the general sustainable fuel of choice going into the future;
- enable most of the remaining coal and America's oil shale resources to be kept as emergency energy supplies should the transition run into difficulties;
- enable the United States to initiate a spacefaring industrial revolution to establish the space mining, space manufacturing, space power, and spacefaring logistics industries needed to undertake GEO space solar power;
- provide NASA with the mission of being the human and robotic pathfinder to identify the extraterrestrial resources needed for large-scale GEO space solar power construction and, in partnership with universities and industry, undertake the key American technological development efforts and demonstrations needed to jumpstart this spacefaring industrial revolution;
- enable the United States to lead the large-scale human settlement of Earth-space, the Moon, the LaGrangian Points, and, eventually, the central solar system as part of an American commercial spacefaring industrial revolution;

- transition space transportation from outdated chemical propulsion to advanced electric propulsion using beamed power to shorten travel times dramatically and to increase the safety and comfort of commercial human travel within space;

- enable the United States to build upwards of 900 5-GW ground receiving stations—the equivalent of 2,250 Hoover Dams—across the United States to provide dispersed sustainable energy to enable America's transition from fossil fuels;

- enable the United States to build hundreds of new sustainable cities, near many of the ground receiving stations, to begin America's transition into a sustainable nation ready for the 22nd century;

- enable a broad expansion of American STEM, manufacturing, and construction career jobs all around the United States—an Apollo program on steroids, so to speak—as America begins to undertake this spacefaring industrial revolution, build the ground receiving stations, and to design and build the hundreds of new sustainable cities.

- enable the world to adopt a true technological solution to ending global fossil fuel carbon emissions through an orderly transition to sustainable energy;

- end the nation-on-nation conflict for the control of now vital fossil fuel resources that have characterized much of the warfare in the last 100 years;

- enable the world to avoid having to build nuclear fission power plants in the tens of thousands that would be necessary to replace fossil fuels;

- enable the world to avoid having to rely on the breeding of plutonium or U-233 to fuel terrestrial nuclear power plants once affordable supplies of fossil fuels become scarce;

- enable building upwards of 10,000 5-GW ground receiving stations—the equivalent of 25,000 Hoover Dams—all around the world to eradicate energy impoverishment;

- enable thousands of new sustainable cities to be built all around the world, turning the UNFCCC's objective of sustainable development into reality and enabling the world's population to enter the 22nd century with a middle-class standard of living;

- enable the use of additional sustainable space power to remove excess $CO_2$ from the atmosphere permanently, returning the carbon to

geological storage as synthetic oil and methane and providing the world with a permanent energy reserve should this be needed in the future;

- provide 50,000 GW of sustainable energy that, in combination with robotic manufacturing, construction, servicing, and recycling, will fundamentally transform human culture much as the agricultural revolution did 11,000 years ago; and,

- transform humanity into a true spacefaring civilization.

The above describes how GEO space solar power will enable humanity to undertake a true paradigm shift through plentiful sustainable energy and robotic construction, manufacturing, servicing, and resource recycling. Understanding what can now technologically be made to happen makes remaining in today's paradigm of intensive fossil fuel insecurity, energy impoverishment, and environmental $CO_2$ uncertainty simply unacceptable. What is now needed is for the president of the United States to champion this paradigm shift.

**Turning O'Neill's GEO Space Solar Power Vision into Reality**

I first became aware of the idea of space solar power in the 1970s when Princeton Professor Gerard K. O'Neill founded the space settlement movement with his transformational vision of implementing GEO space solar power. While the technical concept of space solar power originated with Dr. Peter Glaser's paper in 1968, Professor O'Neill stoked the imagination of the Apollo generation to define a spacefaring future where humans settled Earth-Moon space to build GEO space solar power systems.

In 1970, Professor O'Neill conceived of utilizing lunar resources and zero-g space manufacturing to build Glaser's GEO space solar power platforms. O'Neill wrote his first paper, "The Colonization of Space," on the topic in 1970, but it took four years—with multiple rejections by leading scientific publications, such as *Scientific American* and *Science*—before it was published in *Physics Today* in 1974.[4] The American pro-space movement's interest in space colonization and industrialization embraced his new paradigm of a spacefaring civilization. He held his first conference on space manufacturing in 1975. The L-5 Society and the Space Studies Institute were founded to promote this vision. In 1976, he published his vision in the now famous book, *The High Frontier: Human Colonies in Space*,[5] putting the idea before the general public (Figure 7). However, with no prominent American politician giving any attention to these transformational ideas, enthusiasm faded. The Space Studies Institute diminished after O'Neill's death in 1992. The L-5 Society merged with the National Space Institute to create the National Space Society, focusing on NASA's efforts with the Space Shuttle and the International Space Station. Dreamers of a true American commercial spacefaring future went into political hibernation.

[4] Gerald K. O'Neill, "The Colonization of Space," *Physics Today* 27, no. 9 (1974): 32-40.
[5] Gerald K. O'Neill, *The High Frontier: Human Colonies in Space* (New York: Morrow, 1976).

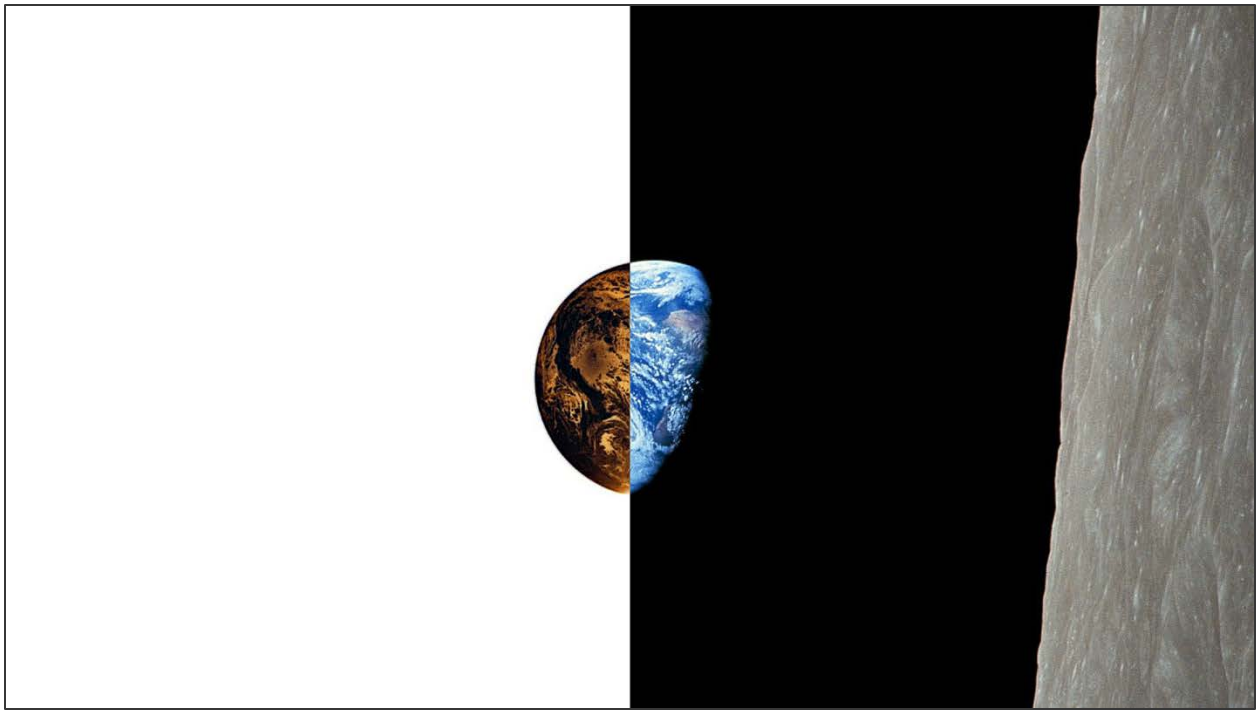

Figure 7. This is the Apollo 8 photograph of the Earth from lunar orbit. While the right side of the image depicts space as seen with the human eye, the inverted left side of the image illustrates that the Earth is surrounded by continuous solar energy, invisible to our eyes, but sufficient to power our civilization through GEO space solar power (original photograph credit: NASA).

To convince President Trump to champion GEO space solar power, O'Neill's "High Frontier" vision must be brought to the forefront of American politics as a problem-solving, opportunity-enabling idea whose time has come. A nation intensely divided politically needs unifying higher aspirational goals to overcome political divisions. Many of today's political and social divisions are directly related to areas that undertaking GEO space solar power will address—removing anthropogenic $CO_2$ fossil fuel emissions, providing real energy security, avoiding a political war with the fossil fuel industry, creating solid career jobs in STEM and construction, remaking America under the banner of sustainable development, avoiding foreign entanglements or war brought about by oil insecurity, increasing American prosperity, enabling the world to achieve individual and national prosperity through sustainable development, etc.

America's pro-spacefaring community now needs a modern version of the L-5 Society to build a social movement to promote GEO space solar power within America. New tools, such as social media and crowd sourcing, can enable this movement to have a tremendous positive influence on American politics and, of course, on President Trump by focusing America's attention on a remarkably positive future for the nation. Further, through the creation of the National Space Council under Vice President Pence, the means of bringing GEO space solar power to the attention of President Trump now exists.

The need, the means, and the opportunity to make President Trump the champion of GEO space solar power is now at hand. As Sun Tzu said long ago, “In the midst of chaos, there is also opportunity.” We dare not let this opportunity to undertake GEO space solar power slip by.

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**About the Author:** James M. (Mike) Snead has wide-ranging systems and structural engineering experience from a variety of significant projects including the X-30 National Aerospace Plane, Delta Clipper Experimental (DC-X), and USAF Transatmospheric Vehicle (TAV). He holds an MS in Aerospace Engineering from the US Air Force Institute of Technology and a BS in Aerospace Engineering from the University of Cincinnati. He is a registered professional engineer in the State of Ohio and a graduate of the Department of Defense’s Advanced Program Management program (in residence). He has chaired the AIAA Space Logistics Technical Committee and is an Associate Fellow of the AIAA.

Mike was the Project Engineer for the Air Force TAV Project Office where he led the technology readiness assessment for a fully-reusable, manned, space access system. Following establishment of the National Aerospace Plane Program (X-30), he was the Chief Flight Systems Engineer (Phase I) and Lead Structures Engineer (Phase II) in the X-30 Joint Program Office Systems Engineering Division. Later, he was a name-requested Government Technical Consultant for the DC-X Program – supporting this program through the fourth flight test – and served on the X-33 source selection. He developed systems engineering concepts for an integrated spacefaring logistics infrastructure focusing on fully reusable to-space and in-space transportation capable of achieving the equivalent of airworthiness certification for safety. His primary efforts were developing fully reusable, rocket-powered, TSTO system concepts using current technologies as well as concepts using advanced airbreathing propulsion.

Prior to his focus on space systems, Mike worked in the Air Force Aeronautical Systems Center’s Engineering Directorate doing both original engineering and contractor structural engineering oversight on a diverse range of aircraft including the F-4, F-111, C-141, and Saudi AWACS. He served on the Executive Independent Review Team assessing first flight readiness for the YF-22 and YF-23 Advanced Tactical Fighters and on the F-22 independent cost team. While working in the Air Force Research Laboratory, He served as Lead for Agile Combat Support where, in addition to focusing on future space logistics, he co-developed the Configurable Air Transport (CAT) tanker and air mobility concept. He also initiated and led a wide-ranging futures wargaming effort, reporting to the Air Force Chief Scientist, focusing on advanced military weapons system conceptualization.

In addition, he established and leads the Spacefaring Institute LLC with a special focus on space solar power and the integrated spacefaring logistics capabilities needed to make space solar power a primary sustainable energy supply capability. In this effort, Mike has

published several papers and a YouTube video on space solar power and the enabling spacefaring logistics capabilities.

**Editors' Notes:** Engineer Mike Snead has been a leading Space Solar Power engineer and advocate for decades. He frequently publishes in the *Journal of Space Philosophy,* and was a panel member in the KSI sponsored session on "*Space Abundance for Humankind's Needs"* at ISDC-2017 (see Article 17, following) where he presented the following critically important points:

> Each space solar power system will provide the equivalent of 2.5 Hoover Dams almost anywhere on the Earth.
>
> No other form of sustainable energy offers the world this opportunity for transformational sustainable development.

In this article, he aims his knowledge and expertise at the US President by elaborating on those conclusions. *Bob Krone and Gordon Arthur*.

# The Prospect of Interspecies Cybernetic Communication Between Humankind and Post-Humans Designed and Created for Space Exploration and Space Settlement

**By George S. Robinson**

**Abstract**
This paper discusses the creation of a post human "species" and its subsequent communication and physical interactions, using cybernetic principles. It notes that (1) *Homo sapiens sapiens* (i.e., modern man/woman/humankind) made, and continues to make, significant strides in developing the technology for self-metabolizing, self-replicating, and self-evolving, technological post-humans; and (2) rapidly developing artificial intelligence *in extremis* will result in a unique and alien entity functioning both independently and as a representative of human*kind* off-Earth. It discusses the underlying design and program activity of Earth-bound human*kind*, i.e., *trans*humans, and then post-humans and their self-evolving subsequent generations. It assumes that *Homo sapiens sapiens* can and will use rapidly evolving multi-fields of integrated technology to create a totally post human "species." It focuses on a non-biotic species of technology; perhaps the incipient stage of self-replicating artificial intelligence *in extremis* on its own, totally technological evolutionary bush.[1]

**Keywords:** Cybernetics, cybernetic communication, *trans*humans, technological post humans, Metalaw, artificial intelligence (AI) *in extremis*.

## Introduction: The Next Frontier in Human Evolution?

> What? We're taking ourselves off the *bush of biotic* evolution? Who really cares? Where is the fun in that? (Anonymous)
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> Longfellow: "He builds too low who builds beneath the stars."
>
> Cyril Ponnamperuma (American chemist and astrobiologist): "The division between life and non-life is perhaps an artificial one."

## I. The Role of Evolving Technology in Biotic Evolution

Over thousands of years, with the help of many changing external and internal environmental biophysical factors, such as those precipitating the formation and evolution of the opposable thumb, components of humankind have been able to survive, evolve, and develop the way they worked, thereby allowing increasing capacities to survive in changing environments. Put somewhat differently, biology and interactively evolving technology have permitted seemingly even encouraged in a directed fashion specimen and species survival and evolution. In short, evolving biology and technology

[1] The word "bush" is used since it is a given that, at this point in time of human comprehension, *Homo sapiens sapiens* is not the ultimate conclusion of biotic evolution sitting at the pinnacle of some "tree" of evolution. The applicable principle of biological and biotechnological evolution is explore, migrate, mutate, adjust, and survive or ultimately become extinct.

have connected to replace and augment human capacities for survival and what may seem almost like directed evolution on a somewhat ricocheting, hit-or-miss basis.

The absence of adequate empirical and quantifiable data that secularists rely upon to understand and explain both the past and the potential future of human evolution and survival of its changing gamete continues to leave open wide spaces and opportunities for humanist explanations of a variety of religious attempts to explain the existence of *Homo sapiens sapiens* and its ongoing changing environments; at least until additional measurable data comes to the fore and provides that empirical, quantifiable, and predictable behavior of humans not available to humanists and religious leaders prior to that time or period. As Ray Kurzweil notes, we are now at a point in the evolution of modern humans and their technology that allows the species to go far beyond its current evolutionary limitations.[2] And the necessary communicative interactions between *Homo sapiens sapiens* and the post-humans they create, and with which they must interact, will be according to Norbert Wiener's[3] definition of the science of control and communications as the discipline of "cybernetics."

A step farther into the near future brings the reader of cybernetics to Hugh Herr's[4] view that the current and evolving capacity to integrate technology directly with the human body, i.e., by merging human and machine by creating that intimacy will allow increasingly effective survival and *evolution* of the human species. For many decades, neuroscientists and others in related sub-disciplines have been "unlocking the mysteries of the human brain, from identifying the locations where key functions take place to the nature of electrical impulses between neurons that carry information like a Morse code."[5] Advancements in prosthetics have also been phenomenal, and the integration with, or substitution for, body parts very likely will lead in the next forty or fifty years to the point where artificial prosthetic devices possess the ability to "feel" whatever touches

[2] Ray Kurzweil is a highly disciplined and largely respected futurist among his peers and broader audiences worldwide. The basis of much of his studies and conclusions is premised upon his view that, in the context of exponentially evolving human technology, "We are a species that goes *beyond* our limitations" (emphasis added). In this context, and in the ensuing discussions, reference to the Latin phrase *in extremis* is used to characterize the end or death of the characteristics of currently understood limits of artificial intelligence and movement into an advanced form of intelligence or awareness yet to be perceived and fully understood.

[3] Norbert Wiener (November 26, 1894 - March 18, 1964) was an American mathematician and philosopher, who served as a professor of mathematics at MIT. A famous child prodigy, Wiener later became an early researcher in stochastic and mathematical noise processes, contributing work relevant to electronic engineering, electronic communication, and control systems. Wiener is considered the originator of cybernetics, a formalization of the notion of feedback, with implications for engineering, systems control, computer science, biology, neuroscience, philosophy, and the organization of society. For a fuller biographical sketch, see en.wikipedia.org/wiki/Norbert_Wiener.

[4] Hugh Herr is with MIT Biomechatronics in Massachusetts, and he is creating bionic limbs that emulate the function of natural limbs. In 2011, *Time* magazine coined him the "Leader of the Bionic Age" because of his revolutionary work in the emerging field of biomechatronics, a technology that closely merges human physiology with electromechanics.

[5] Quotation ascribed to John Donoghue, Brooklyn University neuroscientist and CNN Future Summit Committee member, by CNN's Michael Bay and Matt Ford in "Cybernetics: Merging Machine and Man," *Science and Space*, April 18, 2006.

them. Again, according to Rodney Brooks,[6] former MIT Robotics Lab Director, since increasing types and levels of sophistication of robotic technology will become available, determining the difference between a human and an increasingly technological entity will become messy at best, if not impossible. If the result is a post-human with the capacity for self-metabolism, self-replication, and self-evolution, etc., at what point will a new species type be determined to exist? To what extent will it embrace and embody the biotic essence of humankind?[7] Certainly Kurzweil envisages a possibility, if not a strong probability, of a not-too-distant future in which no clear distinctions exist regarding the biotic characteristics of *Homo sapiens* and a purely technological entity a post-human, e.g., taxonomically referred to as *Homo sapiens alterios*, metamorphosing into *Homo alterios spatialis*, and perhaps even something like *Technologia alterios spatialis*.

In the context of all levels and types of communication, including those involving *inter*species communication, the actual capacity to communicate is a reflection of inter-energy particle relationships in the form of directed, as well as *potentially* directed, useable information necessary for individual specimen survival purposes, and/or the survival of an affected species. In this context, responsive and meaningful directed communications do not have to be premised solely on organic chemistry from the smallest known energy particle[8] to the most interactively complex energy framework available to receive the communicated information through and by all forms of inter-

[6] Rodney Brooks is the Panasonic Professor of Robotics (emeritus) at MIT. He is a robotics entrepreneur and Founder, Chairman, and CTO of Rethink Robotics (formerly Heartland Robotics), and he is a Founder, former Board Member (1990-2011) and former CTO (1990-2008) of iRobot Corp (Nasdaq: IRBT). Dr. Brooks is the former Director (1997-2007) of the MIT Artificial Intelligence Laboratory, and then the MIT Computer Science and Artificial Intelligence Laboratory.

[7] One of the latest efforts, if not accomplishments, lending itself to a separate and distinct technological "species" is the work of a start-up company in Montreal, the product of which is in development and named "Lyrebird." The product relates to advanced speech synthesis technology, i.e., the use of an artificial intelligence algorithm. While many humans are very good at "imitating" the voices of others, Lyrebird picks up the variety of idiosyncrasies that make a voice unique. Clearly, unless properly, adequately, and legally protected, this capacity is replete with downsides with the potential of significantly abusive misuses and lack of protective measures at present. Canada is launching a web service that it claims will allow anyone to replicate all voices individually with just a minute of recorded data. The service, named for the bird, replicates nature in its ability to parse voices to allow others to imitate subject targets. At present, the service is in the proof-of-concept stage, but it represents an important leap forward in technology — specifically, in artificial intelligence. Lyrebird will even be able to "learn" voices when the recorded sample contains background noise. There is a potential for mass voice copying, which may eventually be used to thwart anything reliant on voice authentication. See, generally, search.aol.com/aol/search?s_it=webmail-searchbox&q=Lyrebird%20-%20Montreal.

[8] The definition of what constitutes the smallest energy particle may not be based upon mass as a comparison scale. Considering photons (quanta) as particles, a light quantum with a mass of zero is the smallest particle. Nevertheless, if the comparison is based upon the individual identity of the particle as a particle, the neutrino is the smallest particle in the universe (comment by Prof. Ali Atia Abdulla: www.quora.com/What-is-the-smallest-particle-in-the-universe, April 15, 2016). But note the ongoing arguments among scientists regarding the possibility of paranormal phenomena versus strict reliance on atheism resting on evolving knowledge of empirical data to explain existence on the basis of energy particle interrelatedness. See in this context the views expressed by Dr. Deepak Chopra (University of California, San Diego, School of Medicine), in Notes to the Editor, and the response by Michael Shermer (founding publisher of *Skeptic* magazine, columnist for *Scientific American*, and Adjunct Professor of Economics at Claremont Graduate University) in *Scientific American* (January 2017): 4-6. In this context, see also generally by M. Shermer, *The Moral Arc* (New York: Henry Holt, 2014).

energy communication. And this is what the ensuing discussions are premised upon, and which lead to the potentially directed and positive, as well as undirected and unexpected vagaries, of communications between and among humankind and post-human "astronauts," who or which are engineered by *Homo sapiens sapiens* modern humans as purely technological entities embracing or embodying artificial intelligence truly *in extremis*.

In addition to exploring potentially applicable principles of space jurisprudence or legal philosophy with its roots in Natural Law Theory[9] and resultant legal regimes and implementing laws, one of the main issues that must be embraced and addressed is just how purely technologically post-humans should be design-engineered and programmed initially to ensure the most inclusive and productive entity for an interspecies communications capability, particularly between humankind and its "essence-related"[10] representative space travelers, explorers, and settlers. Factors to be considered include the elements of Natural Law Theory, or *jus natural*, which initially was "intended to denote a system of rules and principles for the guidance of human conduct" and understanding the empirical, i.e., quantifiable and predictable, foundation of constantly evolving Natural Law Theory, and its impact on shaping the forthcoming generation of space jurisprudence, or space law philosophy, and implementing positive laws. The subsequent "Stoic doctrine" embellished on the concept by asserting that all life was "according to nature," which, in turn, "rested upon the purely supposititious existence of a state of

[9] At the root of evolving cybernetic communications between humankind and post-humans is Natural Law Theory, or *jus naturale*. It was, and remains in varying degrees, a philosophical speculation of the Roman jurists of the Antonine age. For the most part, it was considered a system of "rules and principles for the guidance of human conduct which, independently of enacted law or of the systems peculiar to any one people, might be discovered by the rational intelligence of man, and would be found to grow out of and conform to his nature, meaning by that word, his whole mental, moral, and physical constitution." *Infra*, note 11. See also legal-dictionary.thefreedictionary.com/Natural+Law+Theory, in which it is noted that natural law is "[t]he unwritten body of universal moral principles that underlie the ethical and legal norms by which human conduct is sometimes evaluated and governed. Natural law is often contrasted with positive law, which consists of the written rules and regulations enacted by governments," or what has been referred to in the above text as positive laws implementing the underlying jurisprudence or legal philosophy that is firmly rooted in the "parental" concept of Natural Law Theory. Adherents of the theory are often referred to as "naturalists," and although there are several approaches to defining and understanding Natural Law Theory, including "divine natural law" and "historical natural law," secular natural law is relied upon in the approach taken in the discussion herein relating to when post-humans might well become totally independent entities in a fashion that embraces many behavioral characteristics of a biological species, but with no biochemical and biophysical components. For additional interpretations and explanations of what constitutes natural law, see P. A. Harris, *The Distinction Between Law and Ethics in Natural Law Theory* (Lewiston, NY: Edwin Mellen Press, 2002). See also "Natural Law: The Classical Tradition," in *The Oxford Handbook of Jurisprudence and Philosophy of Law*, ed. J. Coleman and S. Shapiro (Oxford: Oxford University Press, 2002), 1-60.

[10] For the purposes of the present discussion, "essence" is considered the most significant element, quality, or aspect of a person; indeed, in varying levels of sophistication, "essence" is a constantly evolving component of *all* biota that appear or have appeared on the bush of biotic evolution. It embraces the core component of biological existence, survival, and evolution, reflecting probing attempts at increasingly quantifiable data and predictable information leading towards an empirically premised understanding of the who, what, and why of Creation.

nature."[11] The so-called Naturalists believe that natural law principles are an inherent part of nature and exist regardless of whether governments recognize and enforce them. Naturalists further believe that governments must incorporate natural law principles into their legal systems before "justice" (regardless of the amorphous interpretation of that word under a specific, empirically defined fact situation) can be achieved.

There are currently three schools of Natural Law Theory: divine natural law, secular natural law, and historical natural law. Divine natural law represents the system of principles believed to have been revealed or inspired by God or some other supreme and supernatural being. These divine principles are typically reflected by authoritative religious writings, such as Scripture. Secular natural law represents the system of principles derived from the physical, biological, and behavioral laws of nature as perceived by the human intellect and elaborated through reason. Historical natural law represents the system of principles that has evolved over time through the slow accretion of custom, tradition, and experience. Each school of natural law influenced the Founding Fathers of the United States, for example, during the nascent years of US law in the eighteenth century. It continues to influence the decision-making process of state and federal courts to the present. Unfortunately, in the preceding context and historical and quite indecisive explanations in many pivotal instances, there is a frequent reliance on descriptive characterizations of an ephemeral nature; not quite so accurate an understanding, particularly in given contexts of post-human creation possessing biotic and abiotic properties of human*kind*, and a totally absent understanding of the very nature and essence of abiotic post-humans.

**A. Ultimate Specimen/Species Survival = Migration + Cybernetic Communication**

Before shifting to the transitional history of Natural Law Theory, it might be helpful to address in an introductory fashion what likely will be, or perhaps must be, the primary objective of human*kind* space migration. First, use of the word human*kind*, with the emphasis on *kind*, is intended to highlight the hominid and protohominid evolutionary shoulders upon which *Homo sapiens sapiens,* i.e., modern humans, stand. It also is intended to emphasize the "*trans*human" and, indeed, post-human entities incorporating biotechnological integration to the point where human descendants ultimately may be considered totally separate and independent, self-replicating and metabolizing, sentient entities with whom or which current moderns humans must interact in the context of Metalaw.[12] Put more simply, and in the context of the ensuing discussions, the reference is strictly to technological and independently "thinking" (based upon the

[11] For a brief description of the generally understood Natural Law Theory and the Stoic doctrine, see *Black's Law Dictionary*, 4th ed. (St. Paul, MN: West, 1957), 1177.

[12] Very simplistically for present purposes, Metalaw may be defined as a proposed set of rules regulating relationships between different races or recognizable life forms in the universe. Although many definitional variations exist describing the characteristics and intentions of Metalaw, the basic premise is that all life forms in the universe must be respected for whom and what they are, i.e., do unto others as they would have you do unto them. For a discussion of the concept and history of Metalaw, see G. Robinson "METALAW: From Speculation to Human*kind* Legal Posturing with Extraterrestrial Life," *Journal of Space Philosophy* 2, no. 2 (Fall 2013): 49-56.

neurophysiological definition of that word) post-humans created by *Homo sapiens sapiens* and subsequent generations produced by post-humans themselves.

As noted in the discussion, above, in addition to cybernetics and post-humanism, the most critical operative word is communication. So, back to relatively undisputed and yet some highly questionable basics of existence and meaningful communication of useable information/data; an evolving basis regarding the human understanding of existence in the form of organized and usable information. These are basic considerations for determining the disparity and breadth of information capability that can be instilled or be desired for instilling in technological post-human entities for the very objectives of that meaningful communication. At the outset, the primary participant in the human-post-human communication is the human designer/programmer(s) of that purely technological entity. So, what is the history, and what is relatively known about the biochemical and biophysical basis of communication that is necessary or desirable for the two-way communication between such disparate entities particularly when one participant, the post-human, is operating in a somewhat unfamiliar, non-Earth environment, and given that the communications data needs are pretty much the same?

The study of communication characteristics and dictates between and among humans and to some degree between humans and non-human mammals might be said to have started approximately 300 years ago, when the Irish philosopher and empiricist George Berkley[13] asserted that the only thing biotic life forms can perceive is perception, itself. Varying degrees of understanding existence depend upon individual perceptions allowed by the neurophysiology primarily in the cerebrum or central locale of an individual biotic entity's coordination of its neurophysiology either individually or in the form of a symbiotically collective coordination. Over the centuries (but perhaps even just decades), physicists have relied upon metaphors, visualizations, and the quantifiable aspects of language of communication characteristics. But Dr. Robert Lanza[14] asserts that another form of interpretation of these characteristics makes them understandable, makes them sensible, i.e., reality predates life and creates it. He and certain of his colleagues propose that life, and in particular the varying forms or levels of consciousness manifest by biotic life forms, creates the universe, and the universe could not exist without us. In other words, can and does a tree in the forest really fall if there is no one there or in the future to hear or see it fall? Werner Heisenberg's uncertainty principle[15] exists only

[13] George Berkley (1685-1753) was an Anglo-Irish Anglican bishop, philosopher, and scientist, best known for his empiricist and idealist philosophy, which holds that reality consists only of minds and their ideas; everything save the spiritual exists only insofar as it is perceived by the senses.

[14] Dr. Robert Lanza is an American medical doctor and scientist. He currently is Head of Astellas Global Regenerative Medicine, and Chief Scientific Officer of the Astellas Institute for Regenerative Medicine. Dr. Lanza also serves as Adjunct Professor at Wake Forest University School of Medicine.

[15] Werner Heisenberg was a German physicist who published a 1927 paper titled "On the Perceptual Content of Quantum Theoretical Kinematics and Mechanics." The more familiar form of the equation became available a few years later after he had refined his thoughts in various subsequent lectures and papers. The uncertainty principle is perhaps one of the most misunderstood, yet most famous, concepts generated in the study of physics. The principle emphasizes that Nature embraces a certain fuzziness, i.e., a basic limit to what humans can understand about quantum particles, resulting in a failure to grasp and comprehend the smallest entities or scales of nature. In other words, the most humans can hope for is their calculation of probabilities regarding where energy particles in various forms of complexity exist and how

in the eyes of an observer as a rather blurry and unpredictable phenomenon with "no well-defined location or motion until the moment it is observed" individually and/or collectively. In other words, it is what physicists call a mathematical function or an expression that allows what directs the quality of communication, particularly between humans and post-humans; and to what extent can post-humans be invented and programmed to communicate energy particle orientations with anticipatory, independent, and meaningful data to the energy levels where it is receivable and useable or not by the recipient(s) of that communication.

Dr. Lanza has presented interesting views of the universe and the genesis of its existence particularly in the context of communication by and between the simplest forms of energy to the most complex organisms and perhaps inorganic entities as well that are known to date.[16] In the context of communication and what constitutes its basic characteristics, Lanza notes that

> In 1997 University of Geneva physicist Nicolas Gisin sent two entangled photons zooming along optical fibers until they were seven miles apart. One photon then hit a two-way mirror where it had a choice: either bounce off or go through. Detectors recorded what it randomly did. But whatever action it took, its entangled twin always performed the complementary action. The communication between the two happened at least 10,000 times faster than the speed of light. It seems that quantum news travels instantaneously, limited by no external constraints – not even the speed of light. Since then, other researchers have duplicated and refined Gisin's work. Today no one questions the immediate nature of this connectedness between bits of light or matter, or even entire clusters of atoms.[17]

Prior to this series of underlying experiments, most physicists viewed the universe as independent and objective, i.e., independent of any life form's perception of the universe and the progressive empirical and theoretical awareness of its components and manifestations of the known laws of physics.

Nicolas Gisin's concepts may well be a necessary part of the increasingly known properties of communication and very applicable to effective use of cybernetic communications between and among humans, human*kind* transhumans, and post-humans serving as increasingly independent astronauts, regardless of their physical

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they behave. Sir Isaac Newton, on the other hand, projected the universe as consisting of physical components responding to clear-cut laws regarding movement, etc. Prediction of these movements, according to Newton, becomes easy when you know with certainty the dictating physical characteristics and laws. If you do not know these laws, but still trust them, the prospect of introducing Heisenberg's view of Nature's fuzziness comes to the fore. For a further elaboration of Heisenberg's uncertainty principle and the ongoing evolution of attempts to explain the theory or principle, see www.theguardian.com/science/2013/nov/10/what-is-heisenbergs-uncertainty-principle.

[16] In this context, see, generally, by Lanza and co-author Bob Berman, *Biocentrism: How Life and Consciousness are the Keys to Understanding the Universe* (Dallas: BenBella Books, 2009).

[17] See, therefor, R. Lanza, "The Biocentric Universe Theory: Life Creates Time, Space, and the Cosmos Itself," *Discover Magazine*, May 1, 2009, discovermagazine.com/2009/may/01-the-biocentric-universe-life-creates-time-space-cosmos.

locations.[18] As Lanza noted, if the universe exists only for the perception by various levels of organic life-forms, what an "incredible coincidence." A second view would be the sanctuary of all religions, i.e., "God did it." Clearly, this discussion explores the genesis both of biotic and non-biotic, purely technological "life forms," and poses the questions whether post-humans, purely self-metabolizing, self-replicating, and self-evolving (including levels of artificial intelligence *in extremis*), reflect or embrace the empirical, measurable, and predictable properties necessary for interspecies communications?

Certain forms and variations of biotic communications that may be desirable, even necessary or critical, to incorporate technologically into post-humans for desired and effective interactions with humans (particularly when being design engineered as "astronautical emissaries" of humankind), might well include appropriate modifications. In attempting to define the requirements for effective and highly sophisticated communication between humankind and fully technological post-humans, it is helpful to note that, in a broad sense, there are several types of communication between and among people and between and among humans and other animal life forms, all of which can be design engineered technologically into a post-human. While keeping in mind that all forms of biotic communication are reflections of biochemical and biophysical interactions in comparatively organized ways, the first type is referred to as "haptic communication," i.e., communication by touch that relies primarily upon surface textures as the initial point of communication. In other words, it is non-verbal and non-visual. Touch is a vital form of intimacy for humans and other life forms and not necessarily strictly animal life. The question in this context, however, is whether comparatively large areas of touch (and not just energy particle interactions of relatively simple types) are necessary parts of effective biotic-to-non-biotic communication, i.e., between humankind and post-human technology, the latter of which is functioning in an off-Earth space environment (interstitial or planetary/celestial body) as an *initially* human fabricated and programmed, completely technological, and self-generating entity with artificial intelligence *in extremis*.

But is human touch, with its design engineered and programmed post-humans, and the latter's reciprocations, essential for independently perceiving, self-energizing, self-metabolizing, self-egesting,[19] and self-evolving post-humans off Earth, truly necessary? Is it necessary for the next step in the evolution of *Homo sapiens sapiens* and its

[18] Nicolas Gisin's observations regarding the strange, yet interesting, properties of photon communications existing 18 kilometers apart, are reported in Daniel Salart, Augustin Baas, Cyril Branciard, Nicolas Gisin, and Hugo Zbinden, "Testing the Speed of 'Spooky Action at a Distance,'" *Nature* 454 (2008): 861-64. Apparently, theoretical calculations have shown that performing tests over a full spin of the globe would challenge all possible reference frames. The research team did just that, and they came up with the same result in all tests. The bottom line, according to Gisin, is that "there is just no time for these two photons to communicate." The experiment succeeded in "teleporting the quantum state of a photon as a significant step in understanding the physics" involved in the concept of energy communication. According to Terence Rudolph, one of the experimenters and a theorist at Imperial College, London, the experiment shows that, "in quantum mechanics at least, some things transcend space-time." He also argues that it shows that humans have attached undue importance to the three dimensions of space and the one of time that we live in. For an expanded discussion of the experiment and purported observations and conclusions, see phys.org/news/2014-09-quantum-teleportation.html#jCp.

[19] i.e., the elimination of waste and/or non-convertible waste energy in a form not currently useable by ISS inhabitants

"essence"? Other forms of haptic communication also exist. For example, striking, pushing, pulling, pinching, kicking, and strangling, or other forms of physical abuse, are forms of communication (i.e., forms of communication through reliance on physical abuse). But can reactionary pain be programmed into a post-human? Is it necessary? Can a reactionary and/or desired response to such pain be communicated in a meaningful fashion, other than biotically (i.e., through a multifaceted and biologically premised nervous system)? Again, one can be neurophysiologically touched as a form of communication, e.g., being touched by music or a birthday card, or a letter of condolence, etc., all in the form of organized energy. Depending on the objective of the post-human programmer, these stimuli and reactions can be manifest in the reactionary behavior of post-humans. They are intra- and extra- species and interspecies forms of communication, a kind of interactive touching by organized energy at more basic levels.

Another form of communication is referred to as olfaction, i.e., the sense of smell. It is a component of biotic systems that detects fluid-phase chemicals for which olfactory receptors serve as specialized mediators "in the nasal cavit[ies] of vertebrates that are analogous to sensory cells in the antennae of invertebrates." Olfaction and taste comprise what is referred to as chemoreception. While the sense of smell is comprised of extraordinarily interactive chemical complexities, its ultimate purpose can be achieved in a helpful and productive fashion for purely technological entities represented by evolving post-humans.

The non-verbal form of communication through body motions, such as facial expressions and body movements and gestures, is referred to as kinesics, or, as more simply referred to by R. Birdwhistell as "body language."[20] These characteristics are more frequently viewed in a limited fashion as rather sophisticated aspects of current and anticipated robotic capabilities applicable to production in manufacturing and assemblage businesses/facilities.

In the context of exploring cybernetic communication characteristics between and among *Homo sapiens* and strictly technological post-humans possessing artificial intelligence *in extremis*, it is important to recognize that "'communication' also can be defined for these purposes as the interactive relationship of all energy particles, from the smallest to those that universally are the most interactively complex." Put somewhat differently in the context of human-post-human communication, including existing and unfolding applicable philosophical or jurisprudential roots and implementing positive laws, the controlling factor is that all existence represents a "process by which information is exchanged between [and among] individuals through a common system of symbols, signs, or behavior."[21]

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[20] See, generally, in this context, R. Birdwhistell, *Kenesics and Context* (Philadelphia: University of Pennsylvania Press, 1970), and in the context of the discipline of kinesics, or body and body-part movements as a primary form of communication between and among humans and between and among humans and other animal life-forms, see S. Jolly, "Understanding Body Language: Birdwhistell's Theory of Kinesics," *Corporate Communications: An International Journal* 5, no. 3 (2000): 133-39.

[21] See, therefor, "communication" as defined in Merriam-Webster's Collegiate Dictionary, 11th ed. (Springfield, MA: Merriam-Webster, 2009), 251. For a more comprehensive discussion of the level of recognized interspecies communication, see "Interspecies Communication – Theory of Universal Language" at www.ancestryofman.com/interspecies-communication/.

Somewhat differently, it may be defined as quantifiable and organized interactive relationships of energy as an expression of communication or transfer of informational data between and among all forms of energy from the smallest to the most complex at seemingly endless levels in the known universe. All levels of communications are reflections of inter-energy particle relationships in the form of directed, as well as potentially directed, useable information ultimately for survival purposes. But responsive and meaningful (i.e., directed) communication does not have to be premised on organic chemistry. With this basic understanding of the role of all currently known forms of energy involved in interactive communications, the ensuing discussions are premised in large part on issues directly relating to the use of cybernetics[22] in communications between and among humans/humankind, transhumans, and post-humans in furtherance of space-related activities.

## II. An Emerging Complexity and Confusion Deriving from Communications-Based Upon Cybernetics

Many definitions of cybernetics currently exist, and many are used in seemingly unrelated contexts, disciplines, and sub-disciplines. Numerous individuals relying on cybernetic definitions, and representing many disciplines and related sub-disciplines, use their own defining versions of the word with respect to the discipline being addressed, and what that discipline or sub-discipline represents. Nevertheless, for this discussion, cybernetics refers generally to the design or discovery and application of principles of communication and their regulation.

Cybernetics does not reflect or physically embrace animate objects or systems at present. Rather, currently, it addresses non-biotic behavioral characteristics. In other words, it does not ask "what is this thing?" But rather "what does it do, and what can it do?" Those who work in this discipline and its sub-disciplines are working with the concept of a *meta*disciplinary language hopefully allowing for a better understanding of existence and how it may modify human existence constructively particularly in a favorable, survival-oriented context. But this also may be a much too limited definition, particularly when addressing communications between *Homo sapiens* and post-human technology created initially by the biochemically based human species itself. There seems to be an endless number of variations of the definition of cybernetics in a variety of contexts. Essentially, they incorporate some form of the informational relationships created between humans and non-human technology. As a somewhat dated and confusing, but still helpful, compilation of cybernetic definitions referenced by Larry Richards in 1999 from a list put together as a 1987 American Society for Cybernetics (ASC) compilation of cybernetic definitions, the views, as quoted in large part and set forth below, lay the groundwork for developing forms of communication between human*kind* and purely technological post-humans.[23] Note that where it exists, the

[22] For the current segment of the discussion, cybernetics can be defined as the science of communications and automatic control systems in, between, and among machines and biological specimens. A multitude of provocative definitions of the word exist in different usage contexts.

[23] Larry Richards stated that his intent in preparing the list of definitions, consistently modified and added to in the ensuing yearly meetings of the ASC, was twofold, i.e., cybernetics could have a variety of

italicized and bracketed information following each definition is a description of the author of the quote.

- Use the word "cybernetics," Norbert, because nobody knows what it means. This will always put you at an advantage in arguments. [*Widely quoted and attributed to Claude Shannon in a letter to Norbert Wiener in the 1940s*.]

- Cybernetics seeks to develop general theories of communication within complex systems. The abstract and often formal mathematical nature of its aim makes cybernetics applicable to any empirical domain in which the processes of communication and their numerous correlates occur. Applications of cybernetics are widespread, notably in the computer and information sciences, in the natural and social sciences, in politics, education and management. [*American Society for Cybernetics Constitution*.]

- Cybernetics treats, not things, but ways of behaving. It does not ask "what is this thing?"; materiality is irrelevant, and so is the holding, or not, the ordinary law of physics. [*W. Ross Ashby, an English psychiatrist and early pioneer in the late 1900s of the growing discipline of cybernetics and complex systems*.]

- a branch of mathematics dealing with problems of control, recursiveness, and information. [*Gregory Bateson, an English anthropologist in the early 1900s, and who also was considered a social scientist, linguist, visual anthropologist, semiotician, and a cyberneticist whose work intersected many other fields of inquiry*.]

- So, a great variety of systems in technology and in living nature follow the feedback scheme, and it is well known that a new discipline, called cybernetics, was introduced by Norbert Wiener[24] to deal with these phenomena. *The theory tries to show that mechanisms of feedback nature are the base of teleological or purposeful behavior in man-made machines as well as in living organisms, and in social systems* [emphasis added]. [*This observation was made by Ludwig von Bertalanffy (1901-1972) who has been considered one of the more acute*

definitions that did not necessarily contradict one another, and at the same time it should stimulate dialogue regarding what the motivations might be of those proposing varying or differing definitions.

[24] *Supra* note 3. Note, further, that Norbert Wiener was an expert in mathematical communication theory, ultimately relating his work with guided missile systems and information handling in electronic devices to the mental processes in animals. His publications *Cybernetics, or Control and Communication in the Animal and the Machine* (Cambridge, MA: MIT Press, 1948), and *The Human Use of Human Beings: Cybernetics and Society* (New York: Da Capo Press, 1988), helped to popularize cybernetics as a science and particularly as a scientific term regarding processes in animals. His publications *Cybernetics, or Control and Communication in the Animal and the Machine* (Cambridge, MA: MIT Press, 1948; 2nd ed., 1961), and *Human Use of Human Beings* helped to popularize cybernetics as a science, and particularly as a scientific term.

*minds of the 20th century, particularly as expressed in his General Systems Theory. The first part of that text focuses on the function of the theory of systems and on the main features of closed and open systems. The second part presents a conception of the human being, not as a robot aiming at reducing tensions by satisfying biological needs, but as an active personality system creating his/her own universe*.]

- For cybernetics is an interdisciplinary science, owing as much to biology as to physics, as much to the study of the brain as to the study of computers, and owing also a great deal to the formal languages of science for providing tools with which the behavior of all these systems can be objectively described. Wiener found just the word he wanted in the operation of the long ships of ancient Greece. At sea, the long ships battled with rain, wind, and tides – matters in no way predictable at the time. However, if the man operating the rudder kept his eye on a distant lighthouse, he could manipulate the tiller, adjusting continuously in real-time towards the light. This is the function of steersmanship. As far back as Homer, the Greek word for steersman was *kunbernetes*, which transliterates into English as *cybernetes*. [*Stafford Beer was a highly acclaimed professor of management, and a description of his professional life and publications is at* www.cybsoc.org/contacts.people-Beer.htm.]

- Cybernetics is the science of effective organization, of control and communication in animals and machines. It is the art of steersmanship, of regulation and stability. [*Chris Lucas, former president of the American Society of Cybernetics*.]

- And finally, by Dr. Margaret Mead: The set of cross-disciplinary ideas which we first called "feedback" and then called "teleological mechanisms" and then called "cybernetics" – a form of cross-disciplinary thought which made it possible for members of many disciplines to communicate with each other easily in a language which all could understand. *[Dr. Mead, born in 1901 in Philadelphia, pursued her graduate work at Barnard College. There, she met Franz Boas, with whom she went on to do her anthropology PhD at Columbia University. She became a curator of ethnology at the American Museum of Natural History, where she published the bestseller,* Coming of Age in Samoa.]

The present definitions applied to the concept embodied in the term cybernetic approximate a somewhat more refined understanding in current uses, particularly when examining underlying philosophical differences between artificial intelligence, both in simplistic configurations and *in extremis*, and cybernetics. They show how each is construed in increasingly more complex terms. In this context, "representation" may be considered significantly different depending upon the perspective being pursued, i.e., as noted by Larry Richards,

> our nervous systems discover the world-as-it-is, but the relations are non-hierarchical. They are circular to reflect a "constructivist perspective," where the world is invented (in contrast to being discovered) by an intelligence acting in a social tradition and creating shared meaning via hermeneutic (circular, self-defining) processes.[25]

Clearly, even among the so-called experts, the term cybernetics has been widely misunderstood and misapplied, perhaps for two broad reasons: First, "its identity and boundary are difficult to grasp." Further, the complexity of the concept(s) of cybernetics and the breadth of its/their applications, particularly in light of the multitude of the working definitions of the word, make it very difficult for people who are not routine practitioners of one or more of the concepts embraced by the term and their respective applications, to grasp working or effectively useable definitions. In many respects, this caveat or concern confronts many professionals attempting to use the concept, since cybernetics is not a universally accepted professional discipline for the most part in its own right yet! Secondly, except for a comparatively few professionals, the rather carefree use of "cyb" and/or "cyber" as a prefix to a multitude of disciplines, and particularly sub-disciplines, has led to significant confusion between and among those people relying on the terms to describe their particular areas of interest and inquiry, e.g., "cyborg" relating to various levels of robotic capabilities, and "cyberspace" relating to the Internet.

Despite the relative confusion and the misunderstandings regarding the proper usage of the concept embodied in cybernetics, the concepts and origins of the word have become progressively of increasing and greater interest, especially since around 2000. Lack of success by artificial intelligence in creating intelligent machines has increased curiosity about alternative views of what a brain does, and alternative views of the biology of cognition. There is a growing recognition of the value of a science of subjectivity that encompasses both objective and subjective interactions, including conversational communication. Designers are rediscovering the influence of cybernetics on the tradition of 20th-century design methods, and the need for rigorous models of goals, interaction, and system limitations for the successful development of complex products and services (including interspecies communication), such as those delivered via today's software networks. And, as in any social cycle, students of history reach back with minds more open than was possible at the inception of cybernetics to reinterpret the meaning and contribution of a previous era. Nevertheless, this discussion represents only a comparatively short summary of the word cybernetic and its broad variety of meanings and applications in an equally broad variety of contexts.

In various presentations and publications, and particularly at the outset of his assessments regarding extraterrestrial life, Philosopher Frank J. Tipler[26] asserted a

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[25] "The implications of these differences are very great and touch on recent efforts to reproduce the brain which maintain roots in the paradigm of 'brain as computer.' These approaches hold the same limitations of digital symbolic computing and are neither likely to explain, nor to reproduce, the functioning of the nervous system." See *supra* note 22; Larry Richards at www.asccybernetics.or/foundations/ definitions.htm.

[26] Frank Jennings Tipler is a mathematical physicist and cosmologist, and holds a joint appointment in the Department of Mathematics and the Department of Physics at Tulane University. Tipler has written books and papers on the Omega Point based on Pierre Teilhard de Chardin's religious ideas, which he claims are

negative view on the likelihood of such life and even a hint particularly of extraterrestrial *intelligence* (including post-humans as the definition herein is used). In his initial conclusion that extraterrestrial life does not exist, and certainly not without the evolution of technology, Tipler did assume the initial position that, despite Enrico Fermi's paradoxical view to the contrary,[27] extraterrestrial life does in fact exist and is a natural outcome of cosmic evolution. If so, he continues, "then cultural evolution may have resulted in a post-biological universe in which machines are the predominant intelligence" *not the only intelligence*, but the predominant form of intelligence; however, the latter is defined in specific contexts. And this leads to the principal issue being examined herein, i.e., the useable definition of intelligence necessary to establish working principles and methodologies for interspecies communication based upon constantly evolving and ultra-sophisticated technology. This would characterize a *quasi*-post-biological relationship between human*kind* representing terrestrial intelligence, and non-Earth indigenous forms of extraterrestrial intelligence, i.e., strictly post-biological intelligence in the universe. According to space historian Steven J. Dick, and based in part on discussions with this author, three underlying scientific premises exist in support of arguments tending to favor post-biological intelligence:

1) the maximum age of extraterrestrial intelligence is several billion years;

2) the lifetime of a technological civilization is [more than] 100 years and probably much longer; and

3) in the long-term, cultural evolution supersedes biological evolution, and would have produced something far beyond biological intelligence.[28]

## III. From the Immediate Past of World War II Reconstruction to the 21st Century: Conflicting Views about Science and its Relation to the Core Concepts of Many Religions

This stumbling transition from humanism, or religious doctrine, toward secularism based upon the availability and securing of evolving empirical data, is reflected in an inching toward the basics of all passive as well as active awareness of empirically obtained data/information. For example, in many if not most respects, the founding father of current space transportation and the development of near and deep space as the catalyst for the evolution and need for increasing compatibility between and among nations after WW II, is considered to be Wernher von Braun, the so-called father of modern spaceflight. For present purposes, using von Braun as the pivotal fall guy in this discussion regarding

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a mechanism for the resurrection of the dead. There have been some strong differences of opinion, with some implying that this view is pseudoscience.

[27] In this context, see Paul Patton, "Beyond 'Fermi's Paradox' I: A Lunchtime Conversation – Enrico Fermi and Extraterrestrial Intelligence" *Universe Today*, December 23, 2015, www.universetoday.com/119727/beyond-fermis-paradox-i-a-lunchtime-conversation-enrico-fermi-and-extraterrestrial-intelligence/.

[28] See, generally, Steven J. Dick, "The Post Biological Universe and our Future in Space," *Futures* 41 (2009): 578-80; and "Cultural Evolution, the Post Biological Universe, and SETI," *International Journal of Astrobiology* 2 (2003): 65-74.

secularism versus humanism, in the January 1, 1961 issue of *This Week Magazine*, von Braun wrote of his inflexible belief in the lessons of the Christian Bible, and noted that he could not

> help feeling at the same time that this space effort of ours is bigger even than a rivalry between the United States and Russia. The heavens beyond us are enormous beyond comprehension, and the further we penetrate them, the greater will be our human understanding of the great universal purpose, the Divine Will itself.

Further, von Braun emphasized his view of the relationship between humanism and secularism in a letter he wrote to the California State Board of Education on September 14, 1972:

> Dear Mr. Gross
>
> In response to your inquiry about my personal views concerning the "Case for Design" as a viable scientific theory for the origin of the universe, life and man, I am pleased to make the following observations. For me, the idea of a creation is not conceivable without evoking the necessity of design. One cannot be exposed to the law and order of the universe without concluding that there must be design and purpose behind it all. In the world around us, we can behold the obvious manifestations of an ordered, structured plan or design. We can see the will of the species to live and propagate. The better we understand the intricacies of the universe and all harbors, the more reason we have found to marvel at the inherent design upon which it is based.

Von Braun then went on to state, somewhat *sub rosa,* the issue upon which secularism versus humanism, as opposed to the objective of Secular Humanism as an integrated objective for seeking to understand "existence" and its Creator, is premised, i.e.,

> To be forced to believe only one conclusion—that everything in the universe happened by chance—would violate the very objectivity of science itself. Some people say that science has been unable to prove the existence of a Designer [and that] the day will soon arrive when we will be able to understand even the creation of the fundamental laws of nature without a Divine intent.

Further, "the 'Case for Design' as a viable scientific alternative to the current 'Case for Chance' lies in the inconceivability, in some scientists' minds, of a Designer." What is missed here, of course, is that the Creator of the Universe, and life as we currently know it, may well have determined that the next step in biotic evolution is up to a cognizant, sentient, and perhaps even sapient group of specimens or entire species (individually or collectively) to evolve at will or not to evolve at all. In other words, the quietly implied position of this heavenly booming voice is that the Creator has brought *Homo sapiens sapiens* this far on the bush of biotic evolution; now it is up to the species to determine if,

how, and when the next step in evolutionary survivability will take place migrate, mutate, adjust, and survive or not and become extinct. This leads to the next step in human*kind*'s evolution: transhumanism and post-humanism; i.e., transitioning from a completely biotic species to a biotechnologically integrated human, and on to a completely technological post-human. Nevertheless, this approach as a strictly scientific understanding of a chancy next step in humankind's evolution to post-humanism, is inconceivable in the minds of many of the strictly secular scientists.

Von Braun then concluded his letter to the California Board of Education with the assertion that

> It is in the same sense of scientific honesty that I endorse the presentation of alternative theories for the origin of the universe, life and man in the science classroom. It would be an error to overlook the possibility that the universe was planned rather than happened by chance.

Earlier, in 1963, von Braun had asserted that

> The two most powerful forces shaping our civilization today are science and religion. Through science man strives to learn more of the mysteries of creation. Through religion he seeks to know the Creator. Neither operates independently. It is as difficult for me to understand a scientist who does not acknowledge the presence of a superior rationality behind the existence of the universe as it is to comprehend a theologian who would deny the advances of science.[29]

Perhaps succinctly, von Braun, serving in this discussion solely as an example, was asserting the endless interdependence between humanism or religious faiths and secularism, the increasing predictability of empirically premised reality (i.e., scientifically based data) at the expense of faith in the unarguable control of a creating deity. The former leads to a more quantifiable understanding of the who, what, and why of Creation. All biological/biotechnological/technological evolution embraces the endless evolutionary journey, itself, of the evolving individual and collective essences seeking that understanding in an increasingly secularly, empirical fashion. Under present global circumstances reflected in tense international relations, it might be safe to say that the conflicts are still between cultures, societies, and civilizations competing for biological, biotechnological, and ultimately post-human technology dominance and 'twas ever thus.

## Conclusion

The primary underlying given of the preceding discussion is not if, but when post-humans will become totally independent, self-replicating, self-metabolizing, and self-evolving entities possessing some form of independent and perhaps unique intelligence characteristics biotically recognizable and interactive as such. Further, it is a given that

[29] W. von Braun, "My Faith: A Space-Age Scientist Tells Why He Must Believe in God," *American Weekly*, February 10, 1963.

this will lead to an effective communication between and among humankind and post-humans, relying on a carefully defined use of cybernetic principles. Rather, given the ongoing explosive evolution of human technology, the question is really when? This would not be a distant step in the evolution of so-called smart machines, already displacing large numbers of humans in manufacturing facilities, as well as providing routine chores in private homes.[30] Further, as noted in that portion of the discussion regarding the sophistication, complexity, and rapidity of advancing research in disciplines of technology, its mind-boggling sophistication for most people, and its applications to, or expressions in, seemingly independent entities possessing manifestations of artificial intelligence *in extremis*, it is safe to assume that domestic and international laws relating to cybercrimes and breaches of applicable civil-cyber laws relating to post-humans in space and elsewhere are barely in the gestation phases.

Renaissance eras are never easy on the human populations experiencing them. They have a strong tendency to create hectic and contradictory behavior, as well as disparate chaotic events. New values become inherent in those people directing and/or contributing to those events. While pursuing vastly different goals, the reality emphasized is the uncharacteristic, evolving dissimilarities between humans/humankind and post-humans, the creation of which they have initiated. But, given the global network between and among humans, the objective of space migration of the human genome and its naturally and technologically directed evolving gamete is becoming more widely and commonly shared. This, despite the ongoing fight for control between and among biological representatives of differing cultures, societies, and civilizations competing for dominance on Earth and despite frequently relying on shared and/or non-shared migratory activities and resources in near-earth orbit. And humans, transhumans, and post-humans must participate in the migratory process for the preservation of the evolving essence or purpose of all Earth-indigent biota that have found their temporary places as fibrillating leaves on the bush of evolution.

Finally, the process of post-humanism and evolving technology to an independent and totally technological species results in the application of the principle of Metalaw based upon Andrew Haley's concept of doing unto others as they would have you do unto them, i.e., between and among separate and independent entities/species with which/whom communication has been established and premised upon the basic principles of cybernetics communication between and among humans and non-biotic life with artificial intelligence *in extremis* that establishes a variety of physical relationships, most of which are yet to be conceived.

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[30] For an interesting, provocative, and readable view of one nation's survival reliance approach to the importance of rapidly evolving technologies (i.e., South Korea), see G. Shteyngart, "Thinking Outside the Bots," *Smithsonian Magazine* (June 2017): 66-80.

**About the Author:** Dr. George S. Robinson, III is a space law pioneer and international space expert. His book, book chapter and professional article publications – over 100 – are found throughout the aerospace and Space literature and continue to date. He served as International Relations Specialist for NASA, legal counsel to the FAA, and legal counsel at the Smithsonian Institution in Washington, DC. He serves on numerous Boards of Directors for science research. Dr. Robinson was a strong supporter of the Aerospace Technology Working Group, which was the forum from which Kepler Space Institute and University emerged.

Dr. Robinson has taught and lectured in law and business relating to space commerce at numerous universities in the United States and abroad, including George Mason University, Oxford University, McGill University, George Washington University, and Georgetown University. He serves on the board of directors for various science research facilities, foundations, and hospitals. He has also consulted for the National Research Council, the Smithsonian Institution, the Department of the Interior's Remote Sensing Data Archives, the Maritime-Aerospace Liaison Project of the Maine Maritime Academy, and NASA, where he serves on the Planetary Protection Advisory Committee.

**Editors' Notes:** Dr. George S. Robinson is a senior Space Law expert, consultant, and member of distinguished boards of directors. The Smithsonian Institute and NASA have benefitted from his legal counsel. After decades of work with public and private organizations to enhance cooperation for international Space development, in this article he falls back to his major in biology at Bowdoin College in Maine to delve into future possibilities for humans to evolve into post-humans through Space exploration and settlement. This is a complex discussion and analysis which ends with his comment:

"The primary underlying given of the preceding discussion is not if, but when post-humans will become totally independent, self-replicating, self-metabolizing, and self-evolving entities possessing some form of independent and perhaps unique intelligence characteristics biotically recognizable and interactive as such." *Bob Krone and Gordon Arthur*.

# Peace: The Final Frontier

**By Kim Peart**


Space has often been referred to as the final frontier, but to survive in space, we will need peace on Earth, which makes peace the final frontier, if we wish to go into space.

With global fanfare at a press conference in Paris on October 12, Dr Igor Ashurbeyli proposed founding a new nation, one that would be in space, called Asgardia.

Over half a million curious possible citizens were attracted to Asgardia in a couple of weeks, which by itself reveals a very high level of interest on Earth in a future beyond Earth.

For Asgardia to proceed as an independent nation, current laws would need to change, as the 1967 Outer Space Treaty does not permit nations to set up in space, and states: "outer space is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means" and "the exploration and use of outer space shall be carried out for the benefit and in the interests of all countries and shall be the province of all [hu]mankind."[1]

[1] United Nations Office for Outer Space Affairs, "The Outer Space Treaty" (New York: United Nations, 1967), www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html.

Considering the spirit of the Outer Space Treaty, rather than launching a new nation, could a city be built in space as a United Nations trust territory, which would be open to citizens of all nations?

The first celestial city could be called Celestia, in honour of the first space nation launched by James Mangan in 1948, before the Outer Space Treaty existed, which he called the Nation of Celestial Space, or Celestia.[2]

The shape of the new city would be an orbital space settlement, like the space habitat illustrated by Bryan Versteeg, which would be powered by the Sun, offer protection from solar and cosmic radiation, and provide an Earth-like gravity via rotation.[3]

To found Celestia as a UN trust territory, the support of all nations will be sought.

To turn the idea of Celestia into a city in space, citizens from all nations are invited to collaborate in building the celestial dream.

If ten million citizens on Earth supported the creation of Celestia and national governments approved of Celestia, what on Earth could stop the first celestial city from being built?

Through creating Celestia, the gates to space will be opened for all the citizens of Earth.

**Creating Celestia**

To build Celestia will require energy to do the work, and in space, there is no shortage of power radiating from the Sun, which has so much fuel in reserve that our star will burn fiercely over the next five billion years, until expanding to the orbit of the Earth as a red giant.

With the power of the Sun, resources from the Moon and asteroids can be gathered to build Celestia, along with the first factories in space, able to make any product for Earth and space markets.

Products made in space are easily transported to Earth, as no fuel is required for a space shuttle flying into the Earth's gravity well.

The power of the Sun and the factories of space would become the foundation of a stellar economy in the Solar System, where there is no limit to growth beyond Earth, and where unlimited wealth can be created.

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[2] Wikipedia, "Nation of Celestial Space," en.wikipedia.org/wiki/Nation_of_Celestial_Space.

[3] Jesus Diaz, "What a Space City Would Actually Look Like in Real Life," Sploid, November 6, 2014, sploid.gizmodo.com/what-a-space-settlement-would-actually-look-like-in-rea-1589315268; Bryan Versteeg, "Kalpana One: Interior View," www.bryanversteeg.com/portfolio_page/kalpana-one-interior-video/; Bryan Versteeg, "Kalpana One: Exterior View," www.bryanversteeg.com/portfolio_page/kalpana-one-exterior-video/.

Once a sustainable industrial presence is secured beyond Earth, there will be no further cost to Earth, with an infinite return on the investment, from across the Solar System and among the stars.

There is no shortage of raw materials available beyond Earth, from asteroids, moons, and planets, with trillions of objects flying around in the outer Solar System, where comets originate.

All the readily available resources on Earth came from space.

The early Earth was a molten orb, sizzling away any water, with heavy elements, like iron, sinking to the centre of the planet.

It was in the later bombardment by asteroids and comets that iron and water were delivered to the surface of the Earth.

All those resources are still out there, waiting to be found, gathered, and put to work.

**Benefits for Earth**

By designing and launching a stellar economy, based on the power of the Sun, it will be possible, for the first time in human history, to look to a future where poverty can be sent into history.

Sending poverty into history will be a powerful contributor to peace on Earth.

By creating land in space in orbital settlements, old conflicts over territory can diminish and make way for peace.

Land can be built in orbital space settlements many times greater than the land area of Earth, using resources gathered in space.

With industry in space, it will be possible to build home planet defences against asteroids and comets, which can destroy cities and, if large enough, terminate human civilization on Earth.

Offending asteroids or comets could be nudged into new orbits, or mined into oblivion.

If a monster asteroid or comet is too large to deal with, arks can be built in space to preserve life and to provide sanctuary for all the people of Earth.

When the planet is safe again, life can return to Earth.

Once a sustainable industrial presence is secured beyond Earth, there will be no further cost to Earth for development in space, where any dream can be created, and any need met.

Having an amazing creative outlet in space will be a great boon for the youth of Earth, who are always hungry for a new adventure.

By gaining direct access to the power of the Sun in space, it will be possible to beam the energy to Earth to extract excess carbon from the air, and to process extracted carbon into a useful resource for Earth and space industries.[4]

Carbon can be extracted from the air, but a huge volume of energy is required to do this work.[5]

By being able to access the power of the Sun beyond Earth, space development can be put to work to win back a safe Earth from dangerous degrees of global warming, climate change, impacts on plant biology, and ocean acidification, which is threatening to undermine the global food chain.

With a sustainable industrial presence in space, it will be possible to build a sunshade in space to help cool the Earth and to win back a safe Earth, with no cost to Earth.

With the Sun getting hotter over time, life on Earth only has around a billion years to run, but with a sunshade in space, the tenure of life on Earth can be extended by billions of years.

With the celestial gates open for stellar exploration, new hope will bloom in the hearts of the citizens of Earth, seeing poverty sent into history, seeing peace being built on Earth and seeing the way open to win back a safe Earth, people will be inspired to solve all the problems on Earth.

Using the factories of space, robots can be made that will clean up the massive volume of trash in the oceans, even down to the micro plastic particles that now fill the sea.

**We Must Clean Up Space**

The world is on notice that there is so much space junk above Earth that a couple of satellites crashing into each other can now cause a cascade of space debris that could destroy all satellites and space stations, leaving a maelstrom of high-velocity debris that will make it impossible to send anything into space for hundreds of years.[6]

If this happens, the skies of Earth at night will be brilliant with falling stars, as space debris burns up in the air.

Incoming space debris may also pose a threat to aircraft and, if too many planes are destroyed, air travel will be deemed too dangerous.

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[4] National Space Society, "Space-Based Power," www.nss.org/settlement/ssp/; Wikipedia, "Space-Based Solar Power," en.wikipedia.org/wiki/Space-based_solar_power.

[5] James E. Miller, "Why Not Split Harmful Carbon Dioxide into Harmless Carbon and Oxygen?" *Scientific American*, July 9, 2009, www.scientificamerican.com/article.cfm?id=splitting-carbon-dioxide.

[6] Kim Peart, "What Happens when the Sky Starts to Fall?" *Tasmanian Times*, June 25, 2016, tasmaniantimes.com/index.php?/weblog/article/what-happens-when-the-sky-starts-to-fall/; The 2013 movie, Gravity, depicts events including a space junk cascade: www.youtube.com/watch?v=OiTiKOy59o4; Another haunting short film, a spin-off of this movie, but set after the event, is at www.youtube.com/watch?v=jLR1yCvu498.

A space junk cascade could happen at any time.

With civil war in Syria, conflict spluttering away in Ukraine, and tensions simmering to the boil in the South China Sea, if a global conflict broke out, some of the first targets to be hit would be military satellites, to blind the enemy.

The moment satellites are lost may also be the moment when nuclear weapons are unleashed, which, if used in number, could end all life on Earth.

The first star war could spell the end of all human dreams, if it causes a space junk maelstrom to lock us down on Earth.

We need to find ways to move swiftly on building the first celestial city as the best way to build peace on Earth.

If humankind continues to cling to the third rock, we may have no future in this universe.

**When Nations Act**
Nations who decide that Celestia is a good initiative can support its creation and help to open the way to space.

With the vision that the bounty of the Solar System will benefit all the people of Earth, there will be a direct incentive.

With unlimited wealth potential in space, securing a sustainable industrial presence beyond Earth will open the way to create any dream in space.

By ensuring space development is designed to send poverty into history, peace can be built on Earth, which will improve security in space.

All Earth's institutions will be able to enjoy space in Celestia for education and research.

With a view from space, which all Earth's citizens will in time be able to access, the needs of the Earth will be seen clearly.

From space, it may be seen that the cornerstone of education needs to be the proper management of the life-support systems of our Earth.

By understanding the life-support systems of the Earth, there will be a better appreciation of maintaining the life-support systems needed in space.

By learning to manage the life-support systems of celestial cities, the citizens of Earth will better understand what must happen to keep the home planet safe.

**When Citizens Respond**
Participation with Celestia is open to citizens of all nations.

Citizens can meet to explore the project and discuss how to help make it happen.

Interested citizens can receive regular e-mails and newsletters, connecting all to the action of building Celestia.

Earth citizens can support research and development of all aspects of the project, and those with ability can find work creating Celestia.

Anyone who can access the virtual worlds, like Second Life, can join a crew, set up displays, hold global meetings, and build models of our future in space, including Celestia, which can be used, tested, and improved via avatars.

The virtual world model of Celestia will be an excellent way to build the community that plans to live in space.

Using the virtual world, citizens can connect globally to plan local action toward building a celestial future.

**A Mini Robot Space Program**

Pressed by the need for swift progress to a sustainable industrial presence beyond Earth, located beyond the space junk zone, a mini robot space program can be pursued.

Mini robots would cost less to send into space, and once access to solar power and resources was gained, mini robots would be able to build factories in space, larger robots, and human scale structures, which could be occupied when safe for life.

Space factories can build the shuttlecraft that fly to Earth to bring citizens to Celestia.

One way of sending mini robots and raw materials from Earth into space, can be with a mass driver, an electromagnetic propulsion system powered by the Sun.[7]

Many private space companies exist now, so there are many transport options available.

How small could mini robots be that are used in orchestration and would deliver a sustainable industrial presence beyond Earth?

The answer will rattle out of research and development.

With so much to gain, and so much more to lose by not acting, there is a clear incentive for individuals and nations to be interested in Celestia.

Mini robots could be automated and managed by an AI, and accessed from Earth using remote control systems, using VR headsets like the Oculus Rift.

Human workers in space could be in a safe environment, and use remote control systems to work with robots of all sizes in space.

[7] Wikipedia, “Mass Driver,” en.wikipedia.org/wiki/Mass_driver; for the use of a mass driver on Earth to send cargo into space, see www.youtube.com/watch?v=k0cLczpAXAc.

The training for this way of working can begin now using the virtual worlds, where robots can be used and remote-control systems tested.

Managing an avatar in a virtual world can be like the remote control of a robot.

When Celestia is built, made radiation safe and with an Earth gravity, then human occupants can set up house, universities can set up labs, and artists can record the experience of life among the stars.

Living this experience can begin now, with virtual world environments.

Before Celestia is finished, work can begin on the second celestial city, as there will be no limits on development in space, with robots building robots to do the work.

**Tourists Will Be Welcome**

Celestia will be open to visitors from Earth, paying tourists who will come to enjoy the city in space.

The space factories will be producing a unique range of products, using techniques in zero gravity that are not available on Earth.

Celestia will offer the best shopping beyond Earth for visitors, and they can take plenty back with them, as no fuel is needed for a shuttle craft to glide back down to Earth.

Unique sports and recreations can be developed in space, such as zero-g tennis, or a pool in the axis of Celestia, where there is air in the centre of a cylinder of water.

Located in a zero-g environment, this would be the most amazing swimming pool in the Solar System.

**What Can Happen Now?**

Individuals can take an interest and connect with the vision for Celestia, and the action that must happen to open the way.

Two or more people can meet in any nation to discuss what can happen with Celestia, and how soon the way will be opened.

Anyone interested can participate in the virtual world activity, join in global meetings, set up displays in virtual galleries, and look at occupying an apartment in the virtual world model of Celestia.

Interested citizens can obtain a VR headset, like the Oculus Rift, and look toward working with robots, both in the virtual world and in real life, where remote control systems will open new ways to work in space.

Space centres can be set up to show what can happen in space, show what Celestia will be like, and show how we must care for the Earth.

A stepping-stone project can be to use mini robots in space, which could be in a mini space station, where citizens on Earth will be able to see through the eyes of the robot in space using a VR headset, and with remote control systems, move the robot around and see the Earth from space, along with the stars and the Moon.

In time, every interested citizen on Earth will be able to have an experience of space, without leaving Earth.

**Youth Activity**

The global momentum to create Celestia will be a golden opportunity to launch a unique activity for young space pioneers, who are keen to look to a future in space, or simply like the activity.

In addition to the full range of space-related activities, space pioneers can work with robots, pursue rocketry, and practice astronomy.

Space pioneers can also learn survival skills, as pioneers have on the frontier in earlier days, with bush skills and crafts.

Learning to survive in the natural environment on Earth will be great preparation for learning to survive in space.

Space pioneers can gain an understanding of Earth's life-support systems, and how to keep the Earth safe.

Meditation can be practiced, to calm the mind and to help travellers to remain sane in deep space.

Meditation will also help people to find peaceful ways to deal with problems on Earth.

**Celestial Values**

With a view to setting the best example for youth, celestial values will need to be identified and put to work.

As with science, honesty can be held up as a primary celestial value.

Trust is built through honesty, and in space, trust in others is critical for survival.

Compassion can also be viewed as primal for survival in space, as by showing compassion toward all citizens on Earth, peace will be built on Earth, which will translate into security in space.

Human habitats beyond Earth are fragile bubbles in a vacuum, all too easily burst from within or without by conflict and or terrorism.

The best way to deliver security in space is to build peace on Earth.

Compassion is therefore a primary celestial value.

**Seeking Peace on Earth**

To build peace on Earth and help protect Celestia in space, citizens in all nations can start the ball rolling now, by beginning to send poverty into history.

Using space techniques for growing food and providing clean water, nutritious food can be provided for all Earth's citizens.

This may be achieved through assistance and self-help projects, but the bottom line must be that no member of our human family will be allowed to go hungry.

Ways can be identified for real work with real pay to be available for all citizens, which will be the most direct and sustainable way to bring people out of poverty and homelessness.

Creating a stellar economy must include providing work and homes for all citizens, on Earth and in space, to build peace on Earth for security in space.

Understanding how the present economic system works on Earth will help us to design better ways to live on Earth and in space.

Add universal compassion to capitalism, and there will be cooperation toward allowing life-opportunities for all citizens.

Compassion is therefore the key to creating a stellar economy that benefits all citizens, and opens the way to infinite wealth in space.

By focusing on creating Celestia, there will be a global project for the citizens of all nations to help to open the way to a better future for the human family.

The old political ways have left us with a planet bristling with nuclear weapons, with starvation and homelessness, with wars and millions of refugees, and with a carbon crisis that is becoming a threat to the future health of life on Earth and is taking away happiness from people.

If global warming runs out of control, a runaway greenhouse effect will be inevitable, sending Earth toward becoming a second Venus, where there is no water and the rocks glow in the heat.

It would be far better to look toward Venus being transformed into a second Earth than to allow the Earth to become a second Venus.

**Avoiding Star Wars**

By raising the vision of creating Celestia, a city of peace in space for all the citizens of Earth, it may be possible to avoid another global conflict on this planet, which would hold all the potential of sliding swiftly into nuclear madness.

Another problem that the Asgardia space nation proposal may face is fear on Earth of weapons being sent from space.

A rock dropped from space could destroy a city, which nearly happened to the Russian city of Chelyabinsk in 2013, when a meteor exploded in the air, and if that rock had been a little closer to the ground, there would have been far more damage and many deaths.[8]

Another form of weapon that can be sent from space is a simple metal rod, which would be cheap to produce in space, and be easier to send to a target on Earth than a rock.[9]

A metal rod is a kinetic weapon, that gains its explosive power through the speed it gains when falling to Earth, which unleashes its explosive force on impact.

The prospect of an independent Mars may also be viewed with suspicion, as if there was a real war of the worlds, a rain of kinetic weapons sent from around Mars would gain speed as they accelerated toward the Sun, and then to the Earth.

By running with a vision for Celestia that builds peace on Earth, and with the participation of all nations, any potential threat from space will be replaced with goodwill.

We need to build a future where conflict is sent into history.

**Seeking Peace in Space**

By building a celestial vision for peace in space, in which the citizens of all nations can take part, we can begin the work of building peace on Earth and a bright new future for all Earth's children.

We will also be able to look toward the exploration of the Solar System, the stars of the Milky Way, and, in time, other galaxies.

Rather than living in fear of a nuclear winter on Earth, we will be creating glittering cities among the stars.

By winning peace on Earth to survive in space, if or when we encounter other intelligent life, even a Mediaeval or Roman Empire-level society on another planet, we will be able to show caution and kindness, unlike the treatment meted out by colonial invaders on Earth.

We may discover that peace in space is the standard way for advanced spacefaring alien societies, who will only speak with us if we have discovered the high frontier of peace in space.

We may have been lulled into a false sense of desperation, with movies like Star Wars to tingle our excitement.

To survive in the cosmos, we may simply have to learn how to climb the high frontier of peace.

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[8] Kim Peart, "Defending Earth from Space" (includes YouTube video), *Tasmanian Times*, April 1, 2013, tasmaniantimes.com/index.php?/article/defending-earth-from-space/.

[9] Wikipedia, "Kinetic Bombardment," en.wikipedia.org/wiki/Kinetic_bombardment.

To paraphrase John Lennon, “All I am saying is give” space a chance.

**Swift Action Needed**
If we are going to build Celestia and to secure a sustainable industrial presence beyond Earth, this needs to happen swiftly.

This is work that could have been happening in the 1970s, when it became possible following the Apollo Moon landings.

The delay has seen multiple problems building on Earth, which are steadily limiting our options.

The nations of Earth, and the citizens of Earth, need to invest in a cosmic survival insurance policy.

Just as we take out insurance on our car and house, we need to invest in cosmic survival insurance for our home planet.

This can be achieved, and this can happen swiftly, if the citizens and nations of Earth decide to act.

Gerard K. O’Neill put the matter quite simply, when he said, “Almost anything can be done in a ten-year period, when we set our minds to it.”[10]

The only question is, are we ready to set our minds to the challenge, in numbers that will deliver a celestial city?

This challenge will unite the citizens of Earth in a stellar vision, where we will solve all our problems.

We can secure a happy future on Earth, if we will reach to the stars.

**Suggested Reading**
O’Neill, Gerard K. *The High Frontier*. New York: William Morrow & Company, 1977.

O’Neill, Gerard K. “The High Frontier, 1/5.” www.youtube.com/watch?v=EfkEV5Sq0pk.

Peart, Kim. “Creating a Solar Civilization.” Space Pioneers, 2006; revised in 2012. spacepioneers.com.au/articles/casc.html.

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**About the Author:** Kim Peart is an observer of the Earth and beyond. Living in Ross in Tasmania’s Midlands, in the island state of Australia, he began a lifelong journey to find ways to live in harmony with the Earth in 1975, and added exploration of the space option

[10] O’Neill, Gerard K. “The High Frontier 5/5,” www.youtube.com/watch?v=Kyt5W812hCQ.

in 1976. For many years, Kim could not reconcile Earth issues with the space option, until he examined the problem of human survival in the context of the Solar System as a whole in his 2006 document, "Creating a Solar Civilization," which offers a plan for cosmic survival and for saving the Earth from human folly. Kim now seeks ways to inspire others to participate in building a future that includes a space future and a safe Earth. Kim is the director of Space Pioneers, and he can be contacted at SpacePioneers@iinet.net.au.

**Editors' Notes:** Kim Peart is one of the global Space community's "Downunder leaders." He is the founder and Director of Space Pioneers located in Ross, Australia and Tasmania. Kim and his wife, Jennifer, host global meetings with space advocates in Second Life, a virtual world, where people can connect globally and plan local action toward creating a celestial future, and winning back a safe Earth. In 1976 Kim wrote an essay, "Creating a Solar Civilization," exploring how we can only achieve a sustainable human presence on Earth, by building a sustainable industrial presence beyond Earth.

In this article, Kim hypothesizes Celestia, a city of peace in space for all the citizens of Earth. Its purpose would be to avoid another global conflict on Earth, which would hold the potential of sliding swiftly into nuclear madness. Two of his beliefs in the article are:

> By building a celestial vision for peace in space, which the citizens of all nations can be part of, we can begin the work of building peace on Earth, and a bright new future for all.
>
> To survive in the cosmos, we may simply have to learn how to climb the high frontier of peace.

*Bob Krone and Gordon Arthur*.

# Space Spiritual Dimension

**By Madhu Thangavelu**

**Editors' Introduction:** University of Southern California Professor, Madhu Thangavelu traces the history of spiritual people and events on Earth's societies and civilizations, then contemplates their continued impacts as humans explore and settle in Space. See our Editors' Notes at the end for how this presentation has motivated us, in Kepler Space Institute, to expand our future projects. *Bob Krone and Gordon Arthur*


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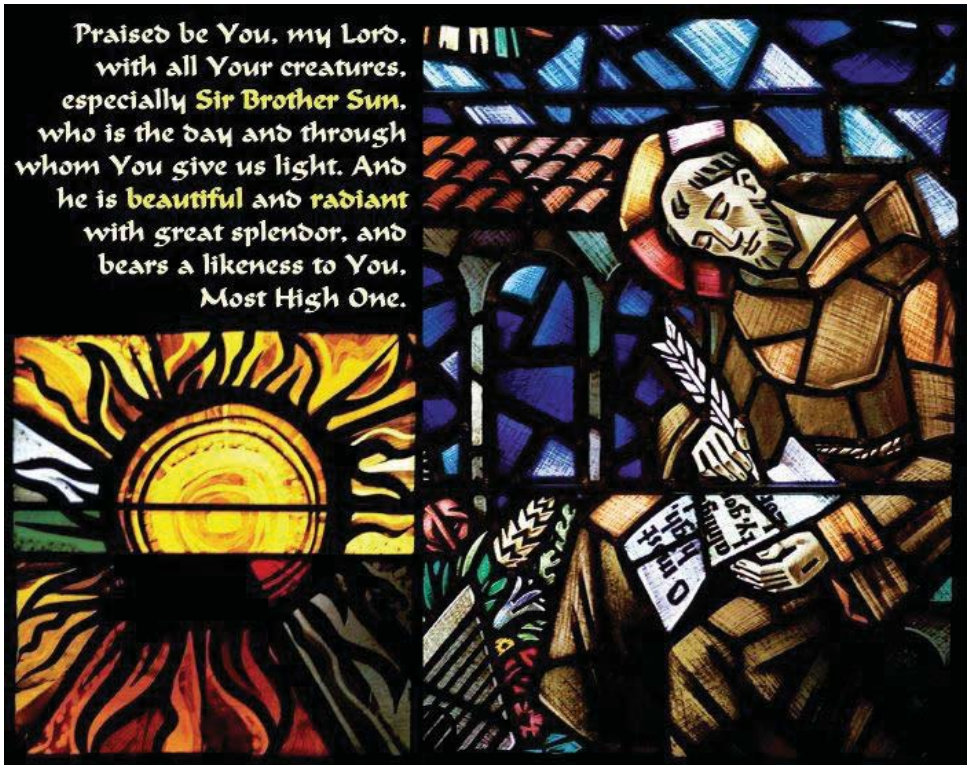
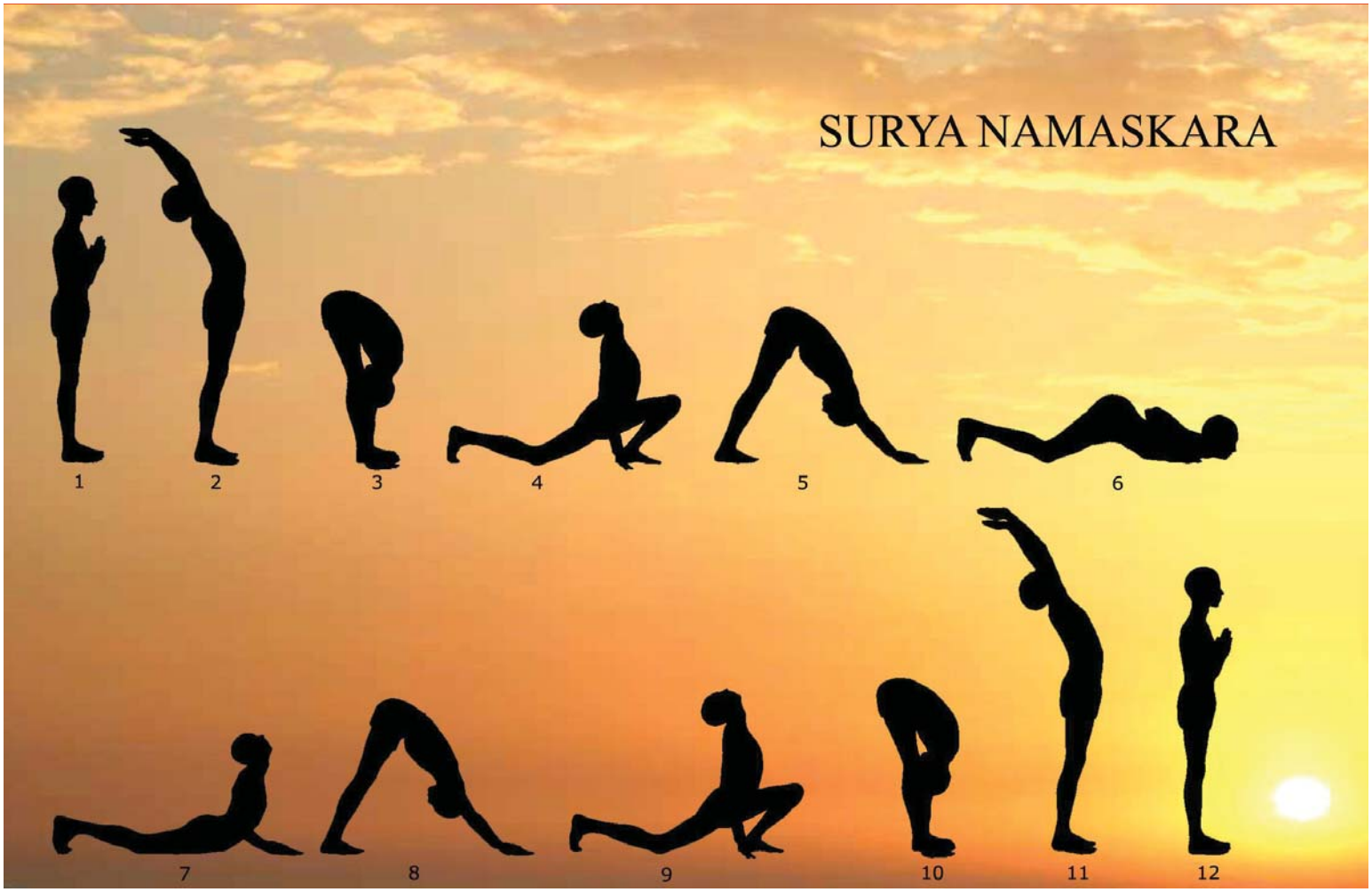
# Science and Religion

- Pope Benedict talks to ISS crew May 21, 2011
- https://www.youtube.com/watch?v=81jAmb_e1pg

# Francis of Assisi




SURYA NAMASKARA
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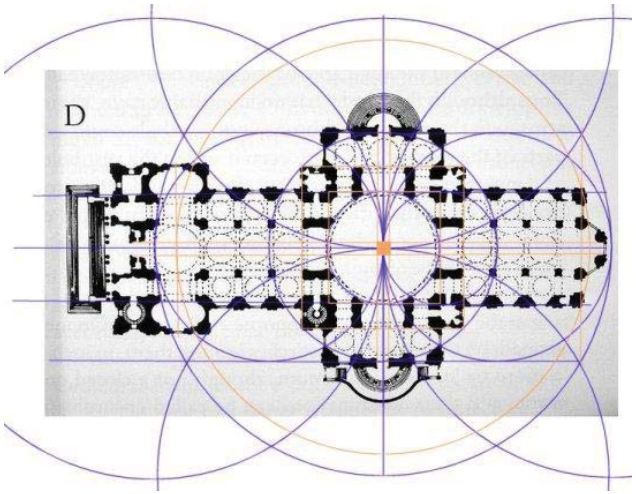
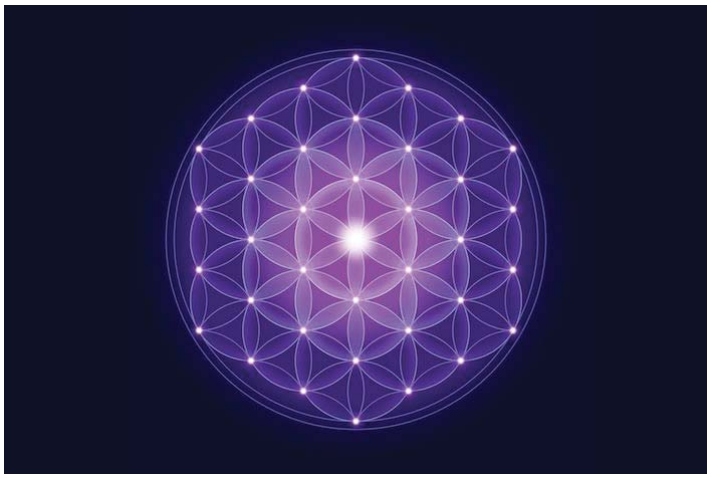
# Galileo Affair

- 1610, 1633, 1642

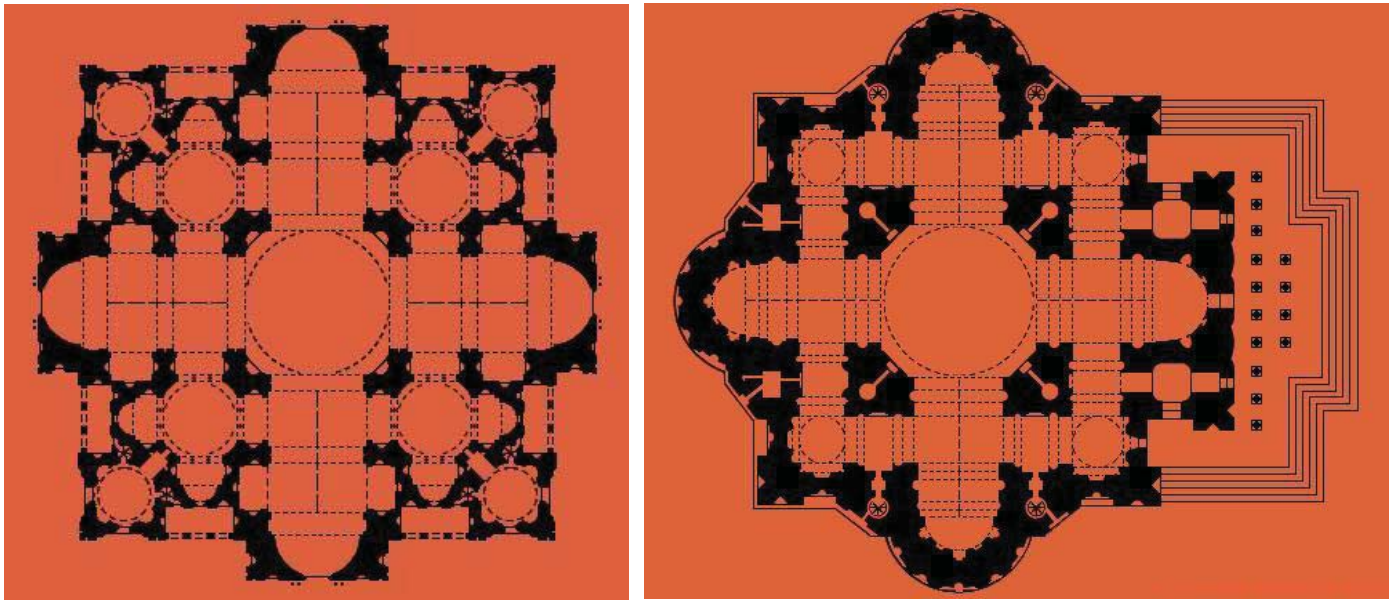
# Spiritual Mathematics
# Sacred Geometry

- Temples, Cathedrals, Altars, Rituals
- Athenian, Arabic, Egyptian, Jewish,…
- Sankhya in Eastern Philosophy



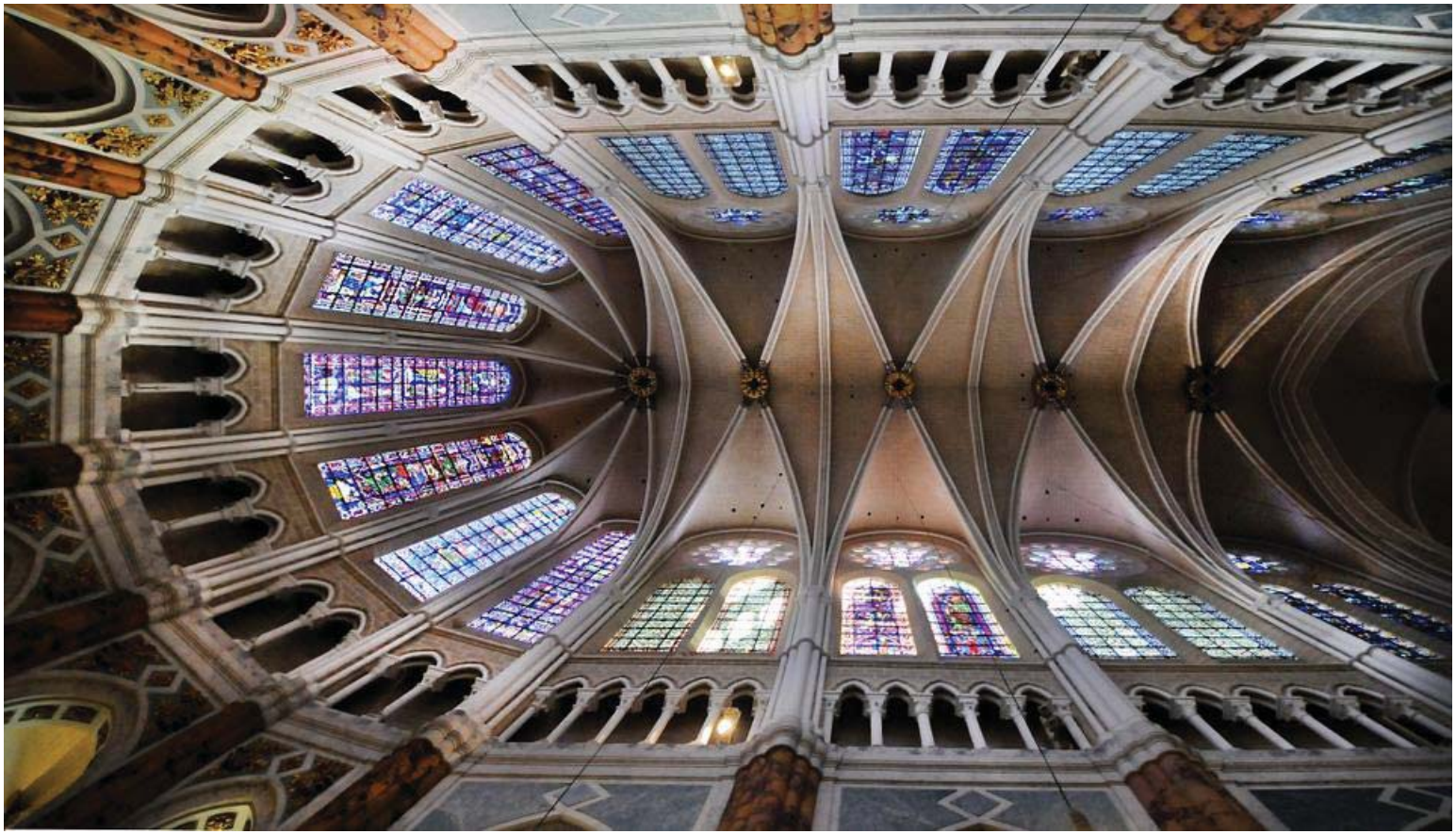



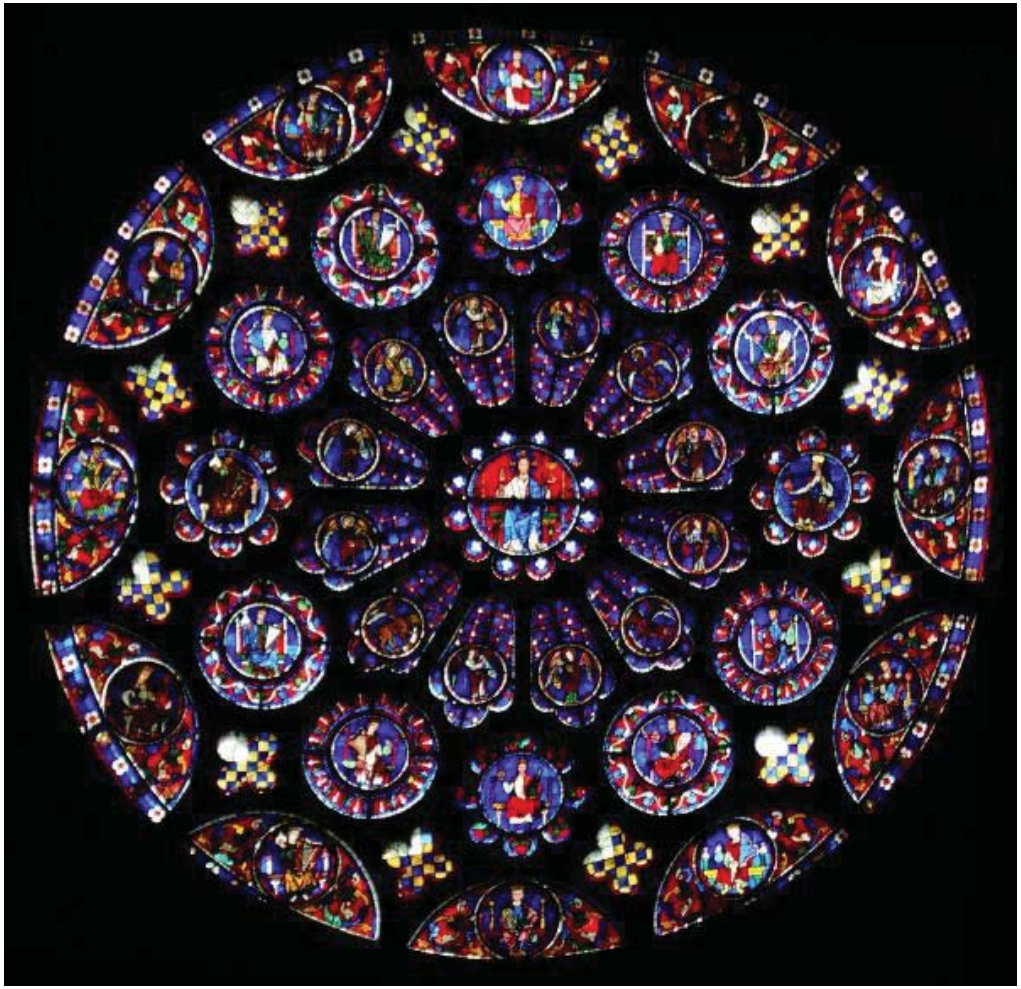
# St.Peter's Basilica
# Bramante - Michelangelo

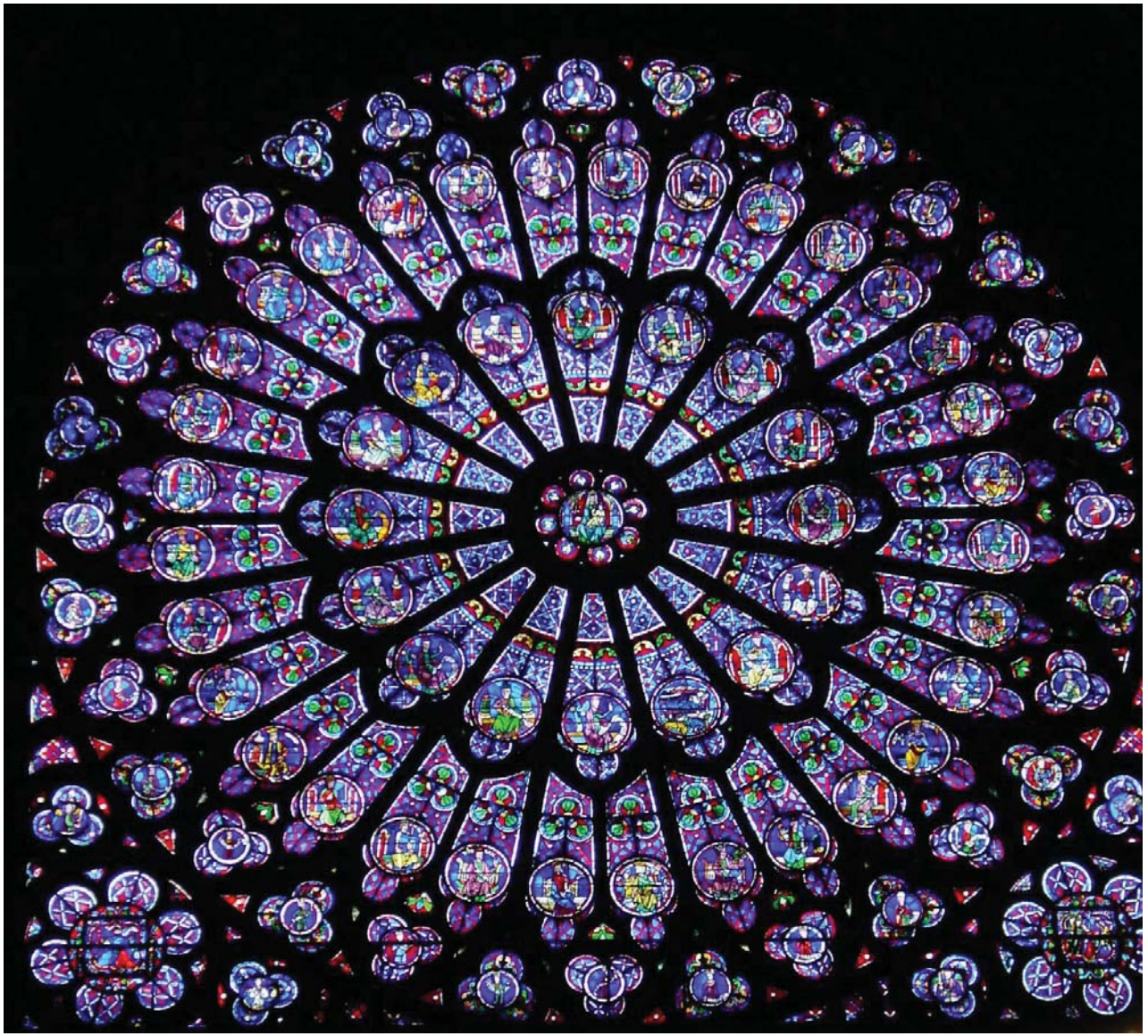


# Sun and Moon

# Chartres



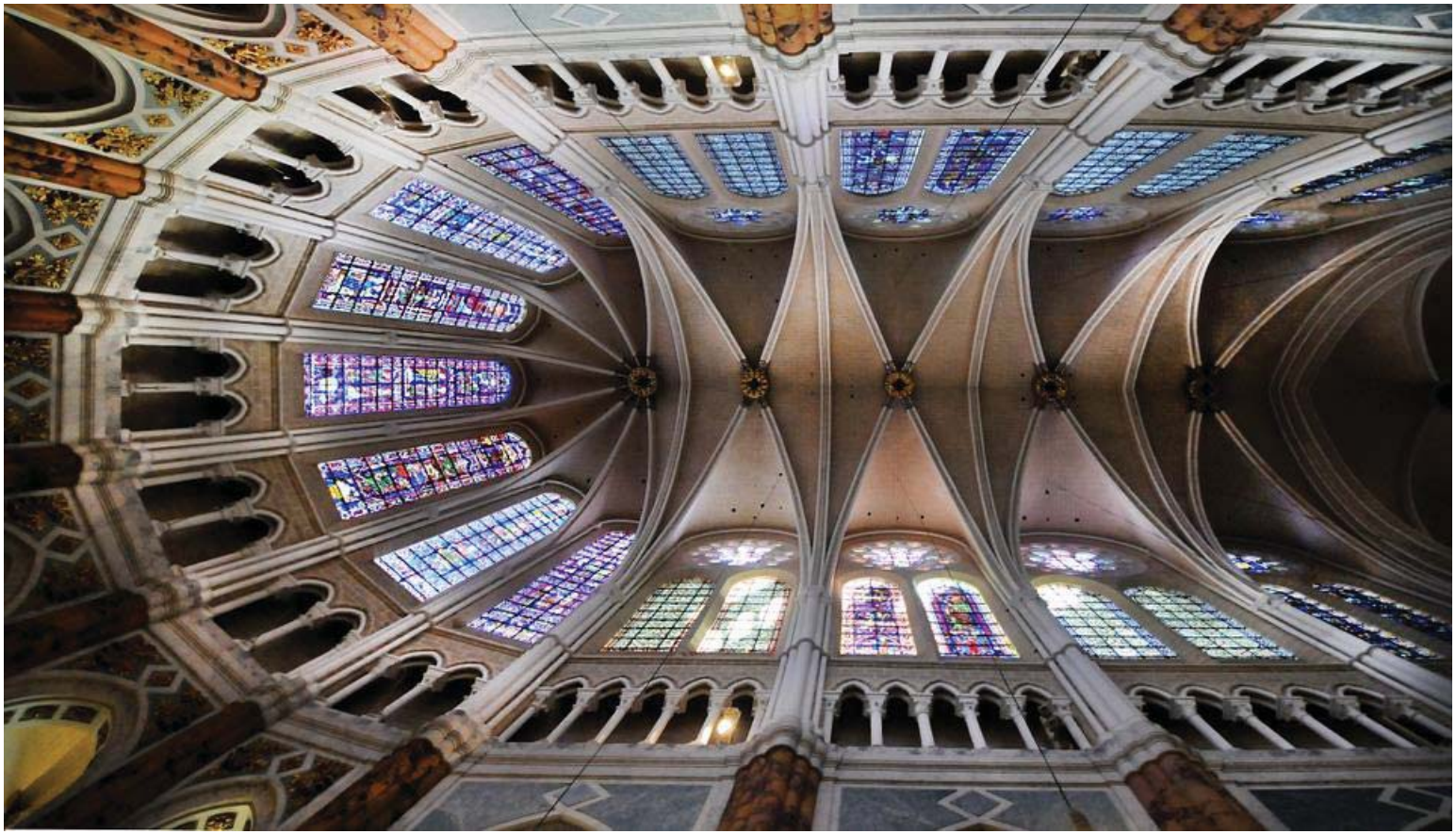




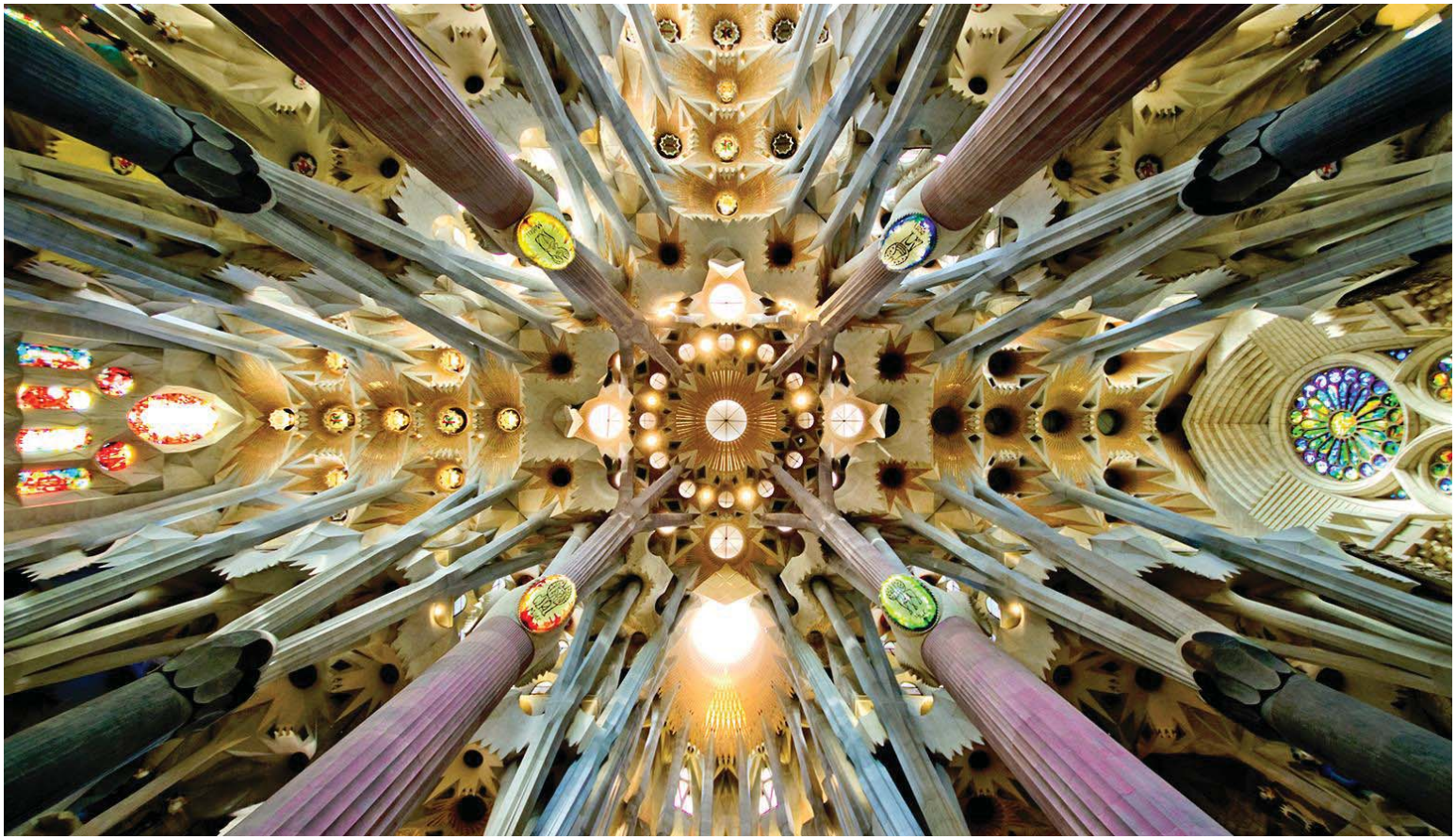
# Gerry Judah Cross @ St.Pauls

# Gerry Judah Cross

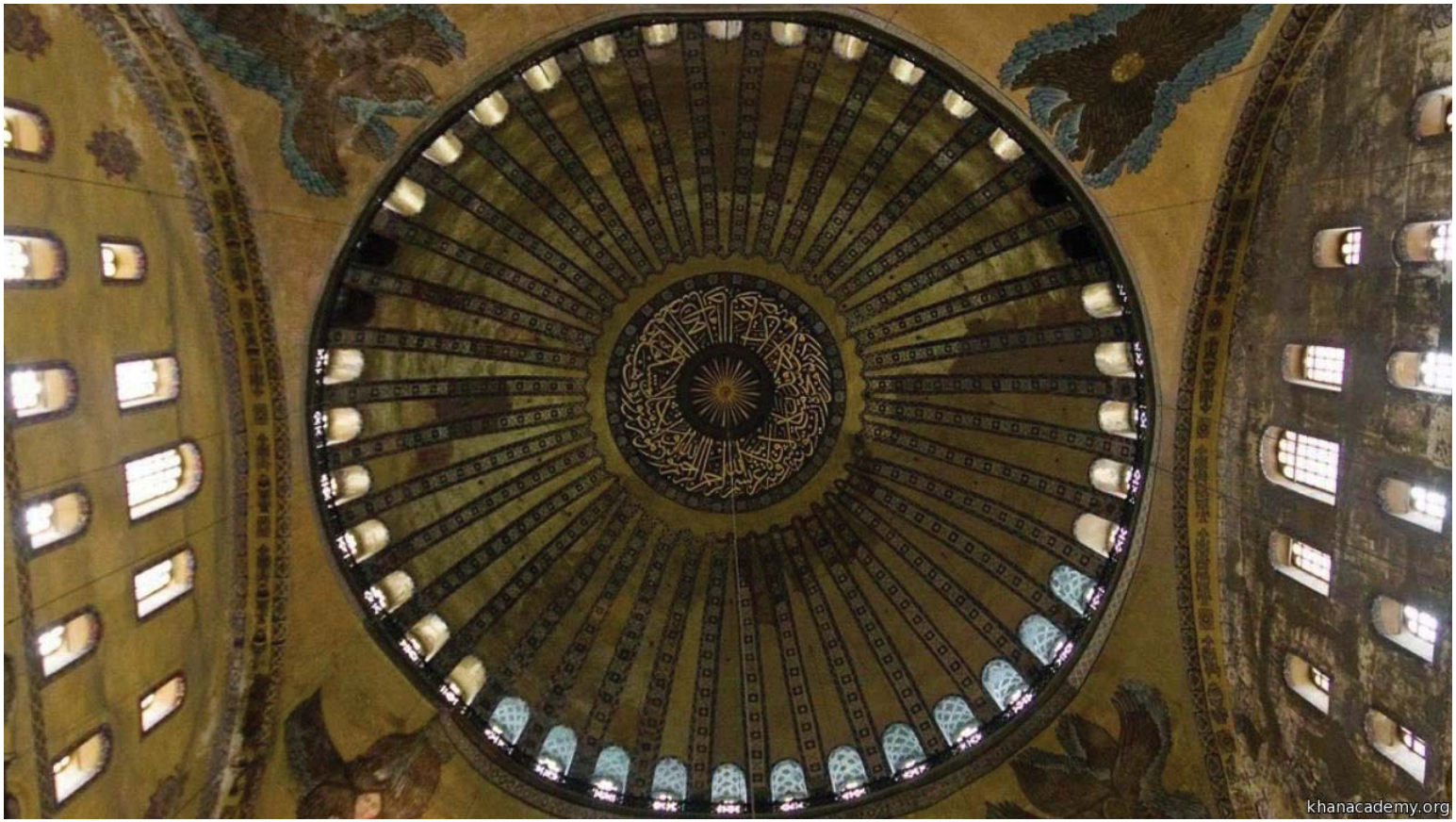
# Chartres



# Sagrada Familia



# Hagia Sophia

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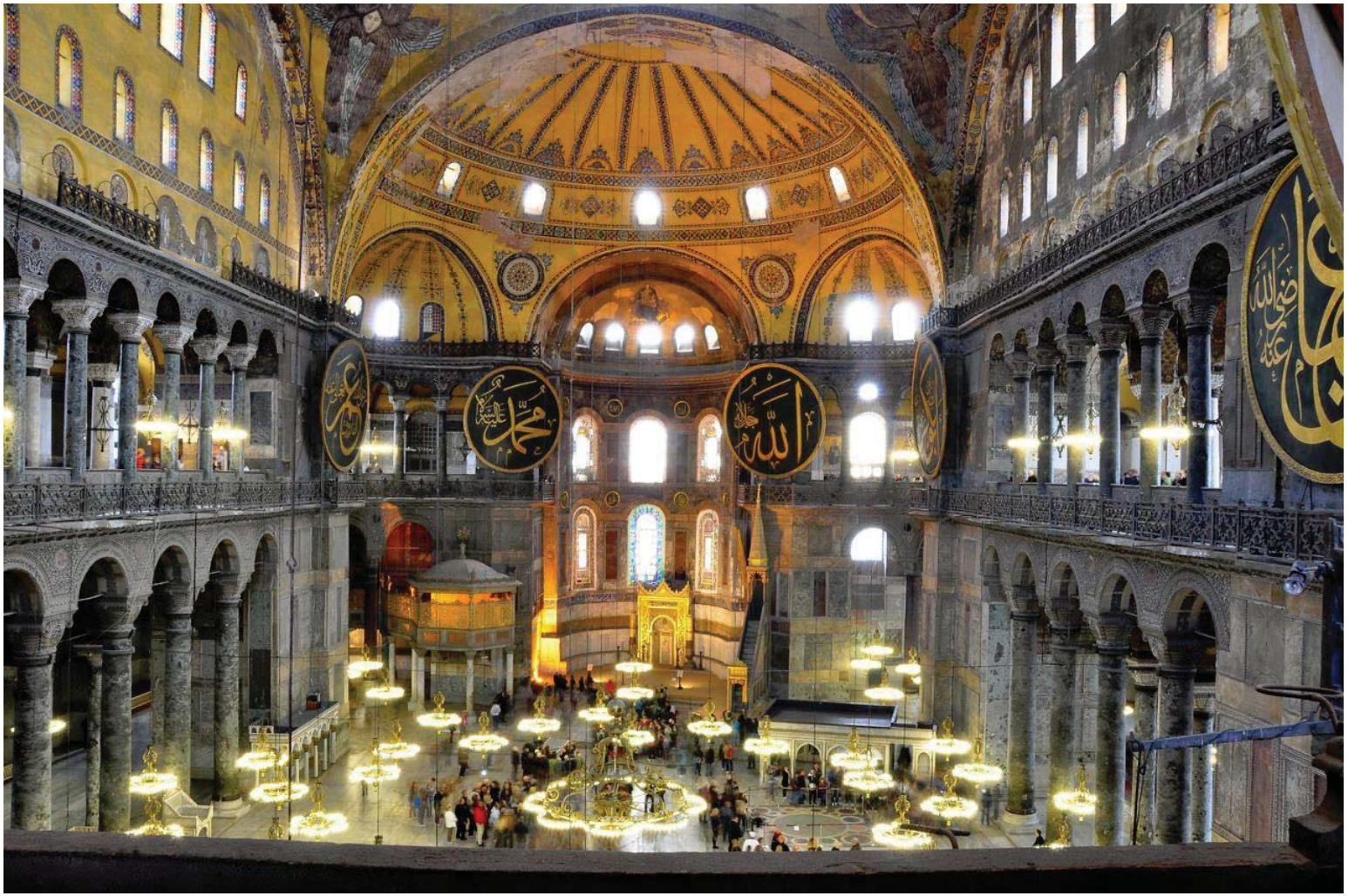


# Bahai Temple - New Delhi

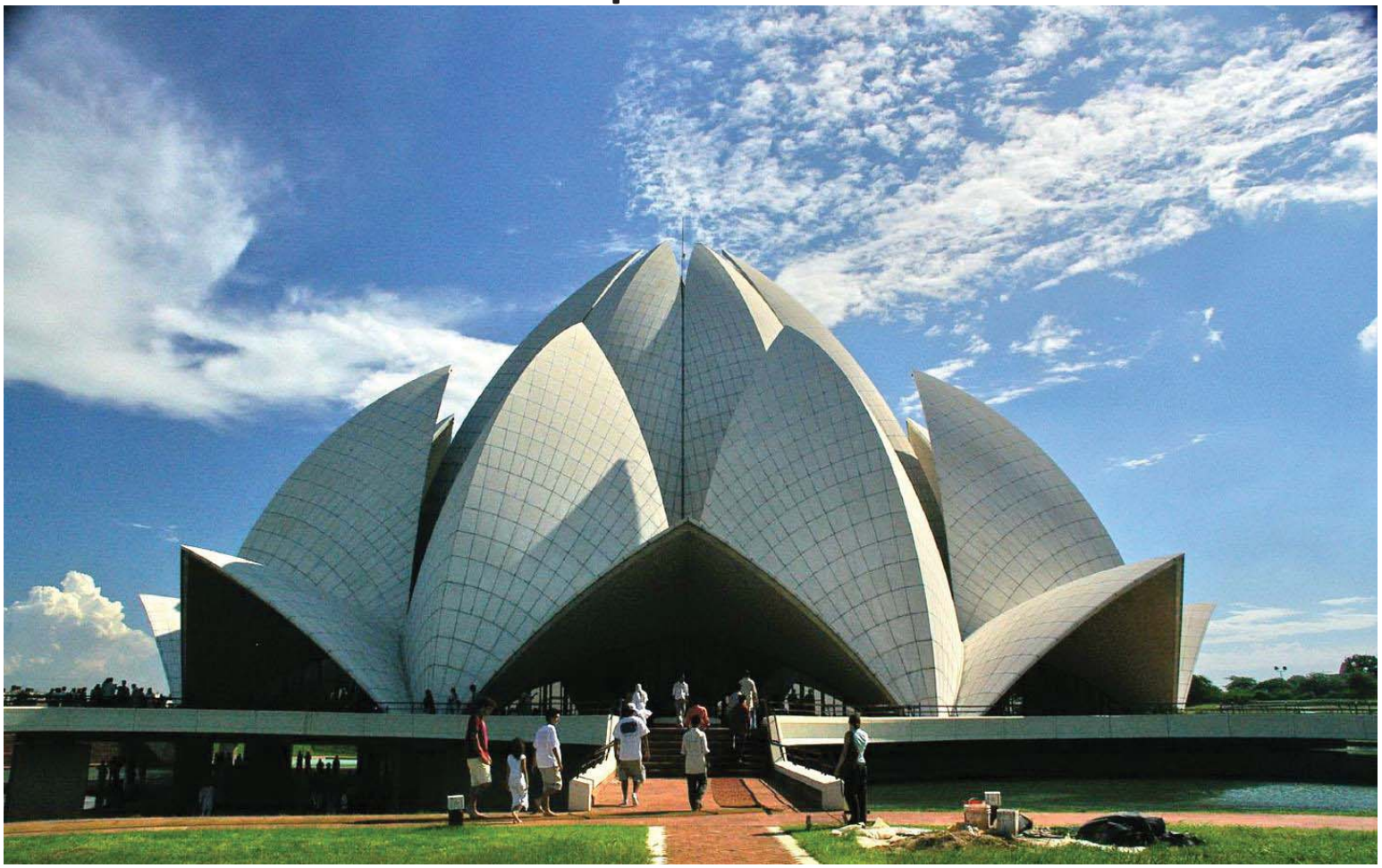
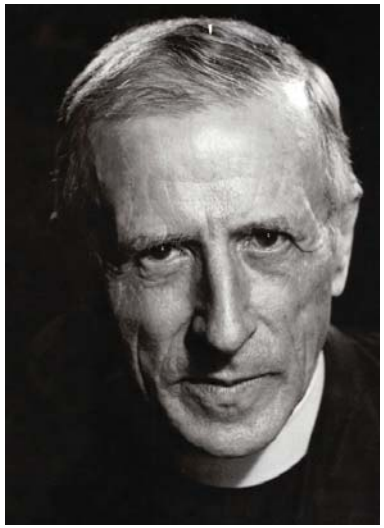
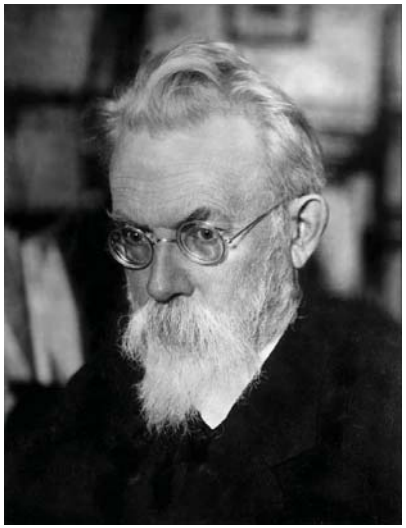



image source : www.templefolks.com

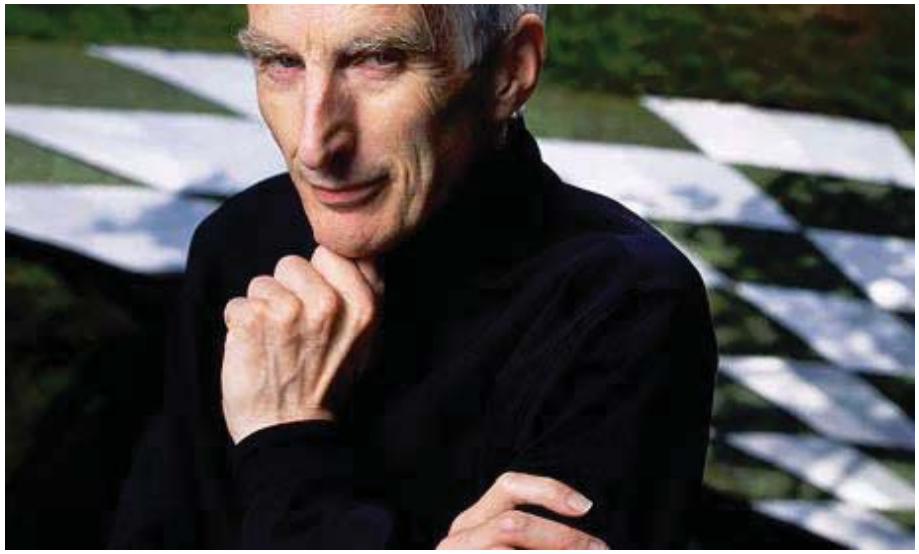

Philosophy, Visions, Policies,
Architectures, Concepts, Engineering

# H.G.Wells, de Chardin, Vernadsky

- Omega Point
- Noosphere
- World Brain

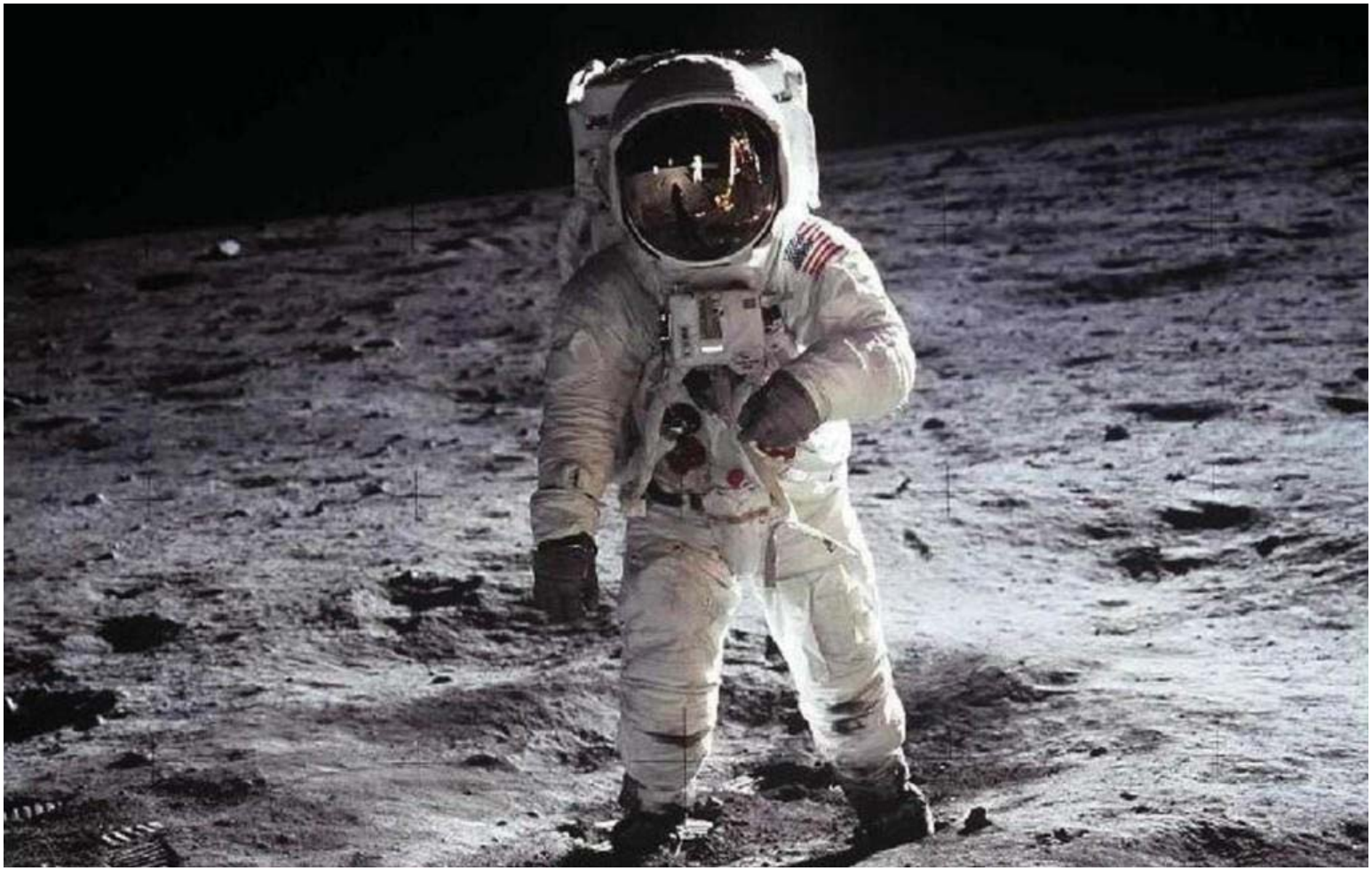

# Martin Rees – Templeton Prize Winner



Ian Sample : What do you gain from churchgoing, considering you don't subscribe to religious dogma or believe in God?

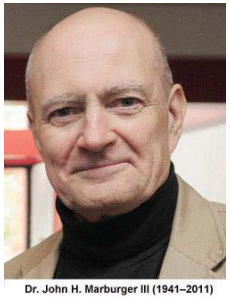
Martin Rees: Well, I think it's a common traditional ritual which one participates in as part of one's culture.
https://www.theguardian.com/science/2011/apr/06/astronomer-royal-martin-rees-interview

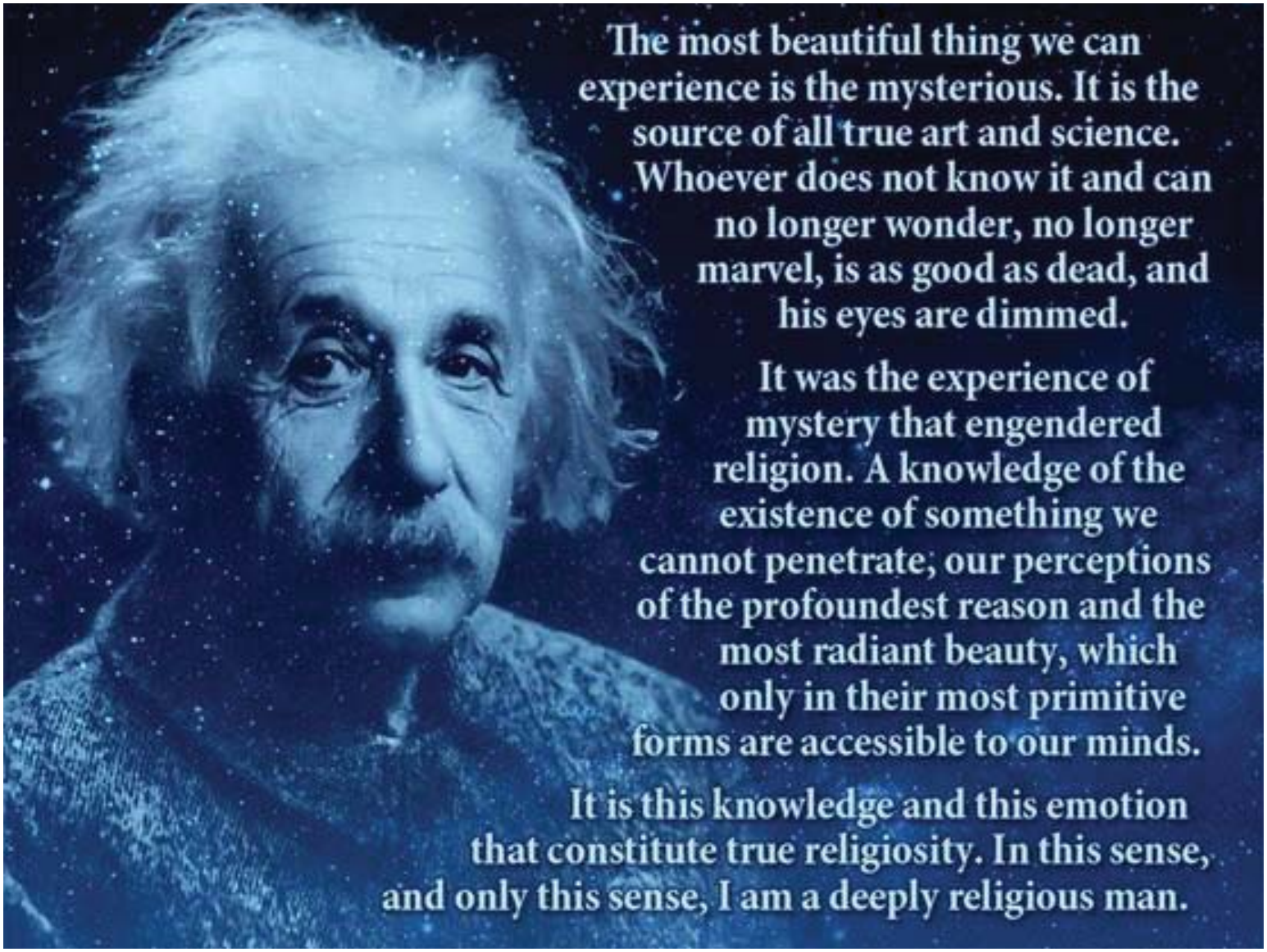
# Buzz Aldrin

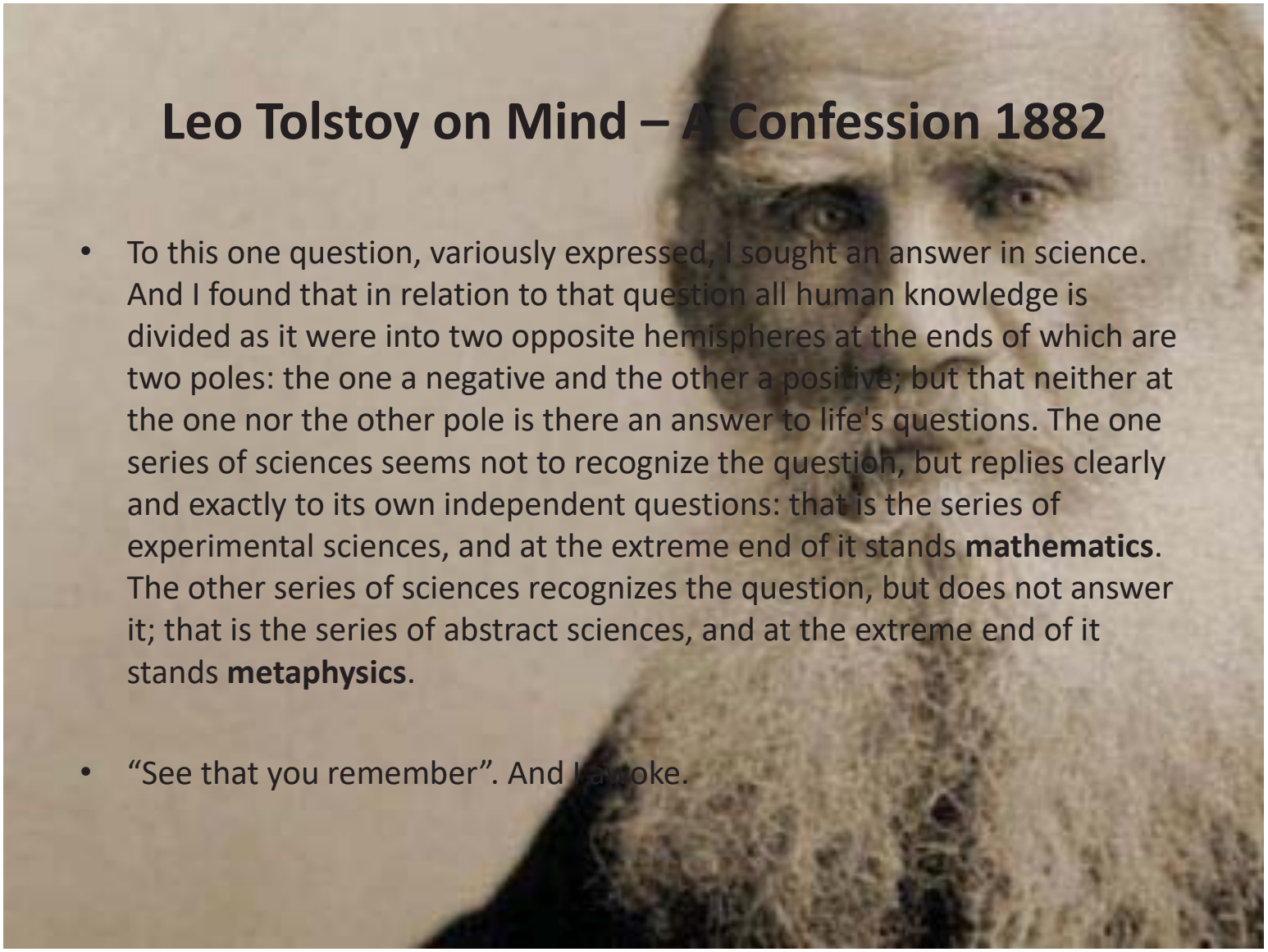


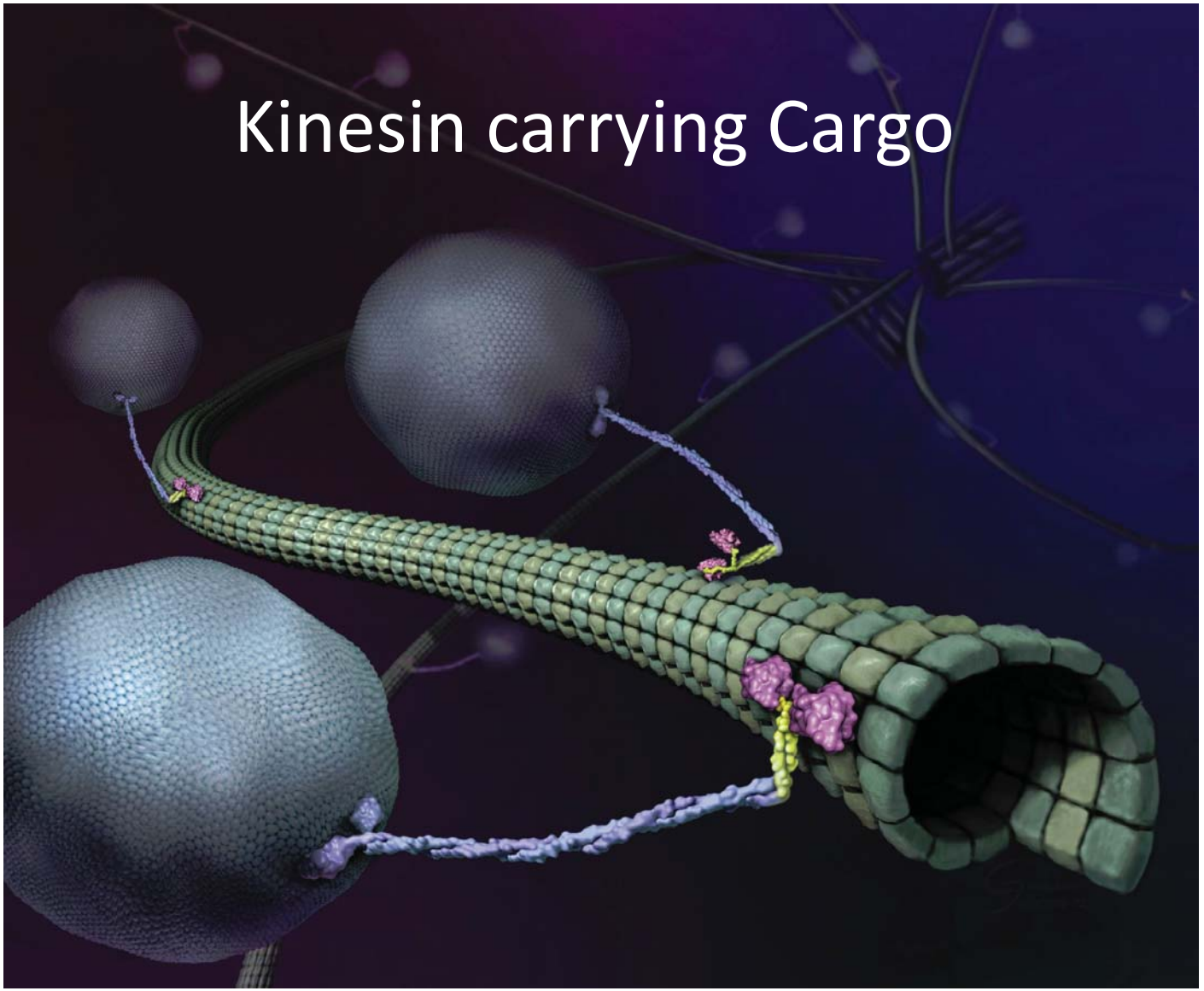
# New Space Paradigms

- Musk – Settle other planets – human survival insurance
- Bezos – Protect and make Earth beautiful
- Marburger lll – Economic sphere of influence
- Campbell – Return of the Hero
- Dyson – Beautify our Universe
- Frank White – Overview Effect

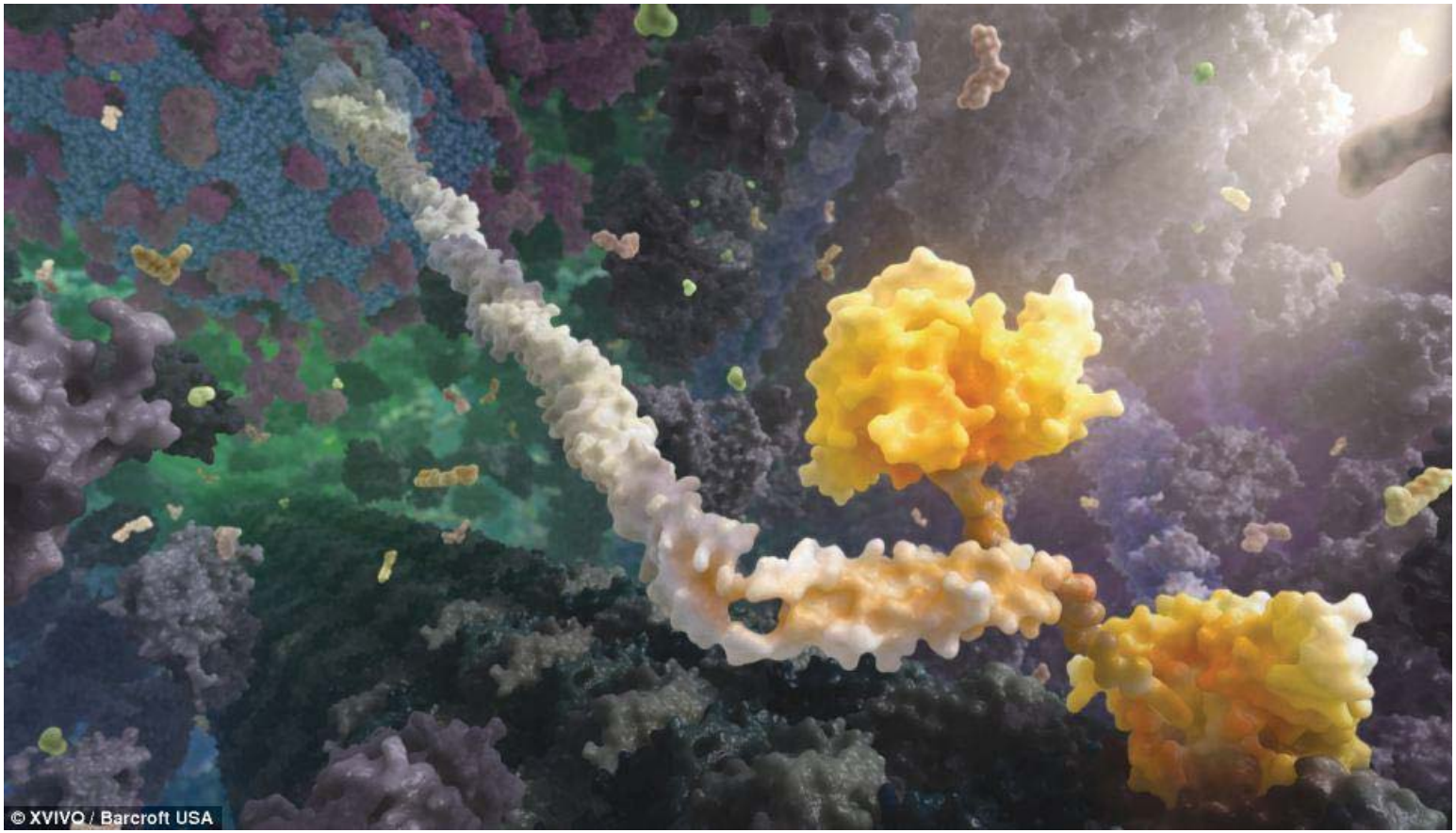

Dr. John H. Marburger III (1941–2011)


The most beautiful thing we can experience is the mysterious. It is the source of all true art and science. Whoever does not know it and can no longer wonder, no longer marvel, is as good as dead, and his eyes are dimmed.
It was the experience of mystery that engendered religion. A knowledge of the existence of something we cannot penetrate; our perceptions of the profoundest reason and the most radiant beauty, which only in their most primitive forms are accessible to our minds.
It is this knowledge and this emotion that constitute true religiosity. In this sense, and only this sense, I am a deeply religious man.


Leo Tolstoy on Mind – A Confession 1882
• To this one question, variously expressed, I sought an answer in science. And I found that in relation to that question all human knowledge is divided as it were into two opposite hemispheres at the ends of which are two poles: the one a negative and the other a positive; but that neither at the one nor the other pole is there an answer to life's questions. The one series of sciences seems not to recognize the question, but replies clearly and exactly to its own independent questions: that is the series of experimental sciences, and at the extreme end of it stands **mathematics**. The other series of sciences recognizes the question, but does not answer it; that is the series of abstract sciences, and at the extreme end of it stands **metaphysics**.
• "See that you remember". And I awoke.


Kinesin carrying Cargo

http://www.dailymail.co.uk/sciencetech/article-2335596/Photographs-reveal-alien-planet-No--breathtaking-animated-simulations-world-HUMAN-BODY.html



# Publications

- CNN (2011) – Space Travel is a Spiritual Experience

http://religion.blogs.cnn.com/2011/07/06/my-take-space-travel-is-a-spiritual-experience/

- Journal of Space Philosophy (2014) – Human Space Activity:The Spiritual Imperative

http://www.bobkrone.com/sites/default/files/Human%20Space%20Activity%20The%20Spiritual%20Imperative%20-%20Madhu%20Thangavelu.pdf

- Astrosociology Journal Newsletter - Human Space Activity: The Spiritual Imperative

http://astrosociology.org/Library/PDF/Newsletters/ARI-Newsletter_Vol-3_Iss-2_10-2014.pdf

- International Space University Magazine (2017) – Human Space Activity: The Spiritual Imperative

http://en.calameo.com/read/0047295678057f2b0ec52

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**Editors' Notes:** We, in Kepler Space Institute (KSI), have included the spiritual and faith aspects of humanity's future in Space since we were meeting in Dr. Ken Cox's Aerospace Technology Working Group (ATWG), beginning in 1989. It has frequently been a subject in the Journal of Space Philosophy and in sessions in the Living in Space Track during annual International Space Development Conferences. University of Southern California's Professor Madhu Thangavelu, prepared this presentation for the ISDC 2017 Conference in St. Louis and for this issue of the *Journal of Space Philosophy.* He has motivated us to add a formal "Space Spiritual Dimension" component to the academic curricula that KSI is now planning. *Bob Krone and Gordon Arthur*.

# Getting Started with Doing Doctoral Research

**By Barry Elsey and Amina Omarova**

## Preface

Without exception, doing a research-based doctorate, particularly a PhD, means embarking on a long-haul learning journey. It should not be undertaken lightly, which means that time and effort should be spent conceiving and planning for the journey from the outset. The details of plans will invariably change as you go deeper into the learning process of doing practical doctoral research, but there is no denying the importance of starting out with a clear road-map giving direction and milestones.

These notes are designed to help you think about your choice of research topic and to organise the process in a systematic way. As the authors of these notes, we offer the benefits of long experience of higher degree research supervision (from 1980), combined with the experiential learning of a PhD recently completed, achieved with flying colours and a medal for scholarship (2017).

There is much that may be written about doing a doctorate, notably the emotional roller-coaster ride it can become, as well as the demands on stamina like a long-distance marathon, not to mention the constant worry about producing new knowledge that others critically appraise and recognise. We have set all that aside and concentrated instead on a building-block approach, that is, the idea that many kinds of doctoral research comprise five main chapters: Introduction, Literature Review, Methodology, Data-Set Description, and Analysis, Discussion, and Conclusion. It is a basic approach, comprising "framing" chapters (1-3), followed by an analysis of and an argument about the new knowledge produced by the research. Your thesis may have more chapters or indeed it may comprise published research-based papers. The five-chapter model is only a guide to how the research can be organised and presented.

Ultimately, the doctoral research is independently examined by academics in the knowledge discipline field and they agree that it makes a valuable contribution. It is not enough to produce new information or even to have sharp insights. As it is a doctorate in philosophy it is important to extend the boundaries of received knowledge by contributing to theory-building.

We believe that our five-chapter model provides a solid foundation for starting off on the learning journey. As this paper is designed to get you started, we pay attention to the first three framing chapters.

### *Making a Research Proposal*

In a nutshell, making a research proposal is a serious business. The entire thinking that has been poured into the research proposal is exposed to critical assessment by others. If they don't like your proposal, for whatever reason, you are bound to hear about it and be asked to explain, justify, and defend what you have done. You may be required to

make revisions, anything from minor to major changes. It takes weeks of sustained hard work to produce a good research proposal, and even then, it rarely passes through critical minds without some difficulty. This is the nature of the academic research process, and you must submit to its discipline in good faith, as well as with determination.


The starting point for making a research proposal is to be clear in your own mind what you want to know. This is easier said than done, for it often takes a long time before you know want you want to know. Most research ideas usually start off as vague thoughts and it takes a good deal of solid thinking to whittle them into shape. Think of the process as sculpture, as you let your mind guide you into shaping your idea into a recognizable form.

That is why it pays to attend to what goes into the first three framing chapters: first the introduction explaining what you want to know and why (like a road map), second, the review of extant literature on your topic (the discourse with what is already known and how your research makes a new knowledge contribution), and third, the methods you use to collect valid data (research methodology).

***Getting Defensive While Producing New Knowledge***

Before getting into the structure of each of the five chapters it is useful to become acquainted with three important shorthand expressions. Think of them like pointed sticks prodding into your mind as you proceed with your research.

1. A PhD is geared towards producing the three Is, that is new information, new insights and new interpretation, with the third I focused on theory-building and philosophising about your knowledge contribution.

2. A PhD is a defensive piece of research in which you painstakingly explain, justify, and defend (EJD) what you think, know, and do throughout the thesis.

3. Signpost your way through the thesis chapters. A thesis is usually a very boring document to read and examine. It is easy to get lost in the words and to give in to the temptation to doze! Make it easier for the reader (examiner) to keep on track by inserting short paragraphs explaining what is going on (where you are now, where you have been, and where to next). Furthermore, it is helpful to provide short introductions and summaries for each chapter. Keep them short and concise.

## 1. Introduction

Chapter 1 (Introduction) of a PhD thesis is a general overview of the research. It explains why you initiated the research, what you aimed to study, how you collected data and what findings you discovered. Chapter 1 is a roadmap of your research, and it indicates its structure. In many cases, the final draft of Chapter 1 is completed when the whole PhD thesis is finished, as it represents a very condensed summary of the whole work. Below we explain the main parts of Chapter 1.

1. *Choosing a PhD topic*. You should consider two options in approaching the research topic. You can draw upon your own inside knowledge and working experience of an industry to identify a researchable topic in which you have a deep interest. Or you may trawl through the extant knowledge on a topic that interests you to find a knowledge gap, that is, an unexplored aspect that you think you can address and fill with new knowledge. Both approaches should be focused on producing new knowledge, not on reworking of what is already known. Think about this carefully, as it becomes of crucial importance when you eventually submit your thesis (or research papers as a portfolio).

2. *Problem statement or research rationale*. Explain why the research is worthwhile. In other words, explain what you want to know and convert your thinking into a problem statement or gap of knowledge investigation.

3. *Contextual background*. An important part of the introduction should be an explanation of the contextual background. This might be more than nice to know, as readers of your published research need to understand where you are coming from with some relevant factual and descriptive background that sets your research into the macro/meso/micro environment. A clear explanation of what is going on (WIGO) in the area of your interest should support and justify your own research focus. In other words, please explain more about the contextual background to your topic.

4. *The main research questions that arise or flow from the problem statement or gap of knowledge definition*. Explain each question as either being drawn from previous research or your own thinking. Both are okay.

5. *Overview of the literature*. It is useful briefly to indicate the concepts, models, and theories (refer to the description in Chapter 2 for more details) you have called upon to give a big picture of your research topic and an indication of what is already known about the topic from the literature. You need to be clear what added value you can contribute to received understanding on your topic. If the main research questions are drawn from previous studies, especially those using concepts, models, and theories to create a big picture general interpretation, you need to identify and briefly to explain the connections with your research. You can go into greater detail in Chapter 2 (Literature Review). It is unlikely that your research questions have emerged solely from your own thinking, so be prepared to explain where your ideas come from.


6. *Research methodology*. Also in the introduction, it is useful briefly to underline the highlights of the research methodology. There are two main paradigms: qualitative research, which often means the case study method, and interviews with key people, and the large survey and the rules associated with positivist research. So, briefly describe the research methodology you use, but avoid going into detail. That is for Chapter 3.

7. *Research outcomes*. You might like to follow up the main research questions with what you regard as the objectives and ideal outcomes from your knowledge contribution. This gives you a chance to explain your own vision for improvement and change management and the knowledge contribution your research makes.

8. *Research paper structure*. Outline the rest of the thesis structure and content in the five-chapter model and finally remind the reader about the point and purpose of the research. Remember to signpost your way through your writing as much as you can, as it also helps you to keep on track.

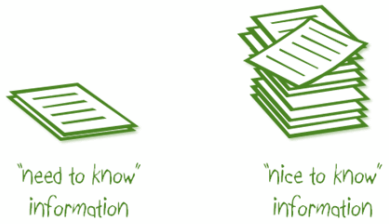
## 2. Literature Review

### *Writing the review of the literature*

This is an important chapter, as it is expected that you can relate your research topic to other studies like yours and generally locate it with what is often called the contextual background and conceptual literature.

*Conceptual literature or need-to-know*. As a rough guide, research-based studies like your own offer the possibility of comparing and contrasting with what is already known from published sources. This is the need to know literature, and you must search hard to make sure you have not missed important studies.

Ideally, your research adds new knowledge. You don't want to find that it is already known. Typically, the review of literature and how you devise a discourse between what you want to know and the already known is closely examined. You must convince examiners you are capable of producing new knowledge and advancing comprehension of the research topic.




*Contextual background or nice-to-know*. The second kind of literature is often called nice to know, as its purpose is usually to colour in the background. In writing the literature review, you should start with these nice to know studies. This should include descriptive contextual background. In writing the story of your topic, you simply make use of what is already written and acknowledge the sources upon which you have drawn. You can mention broad concepts (including models and theories) that provide a big picture explanation of WIGO and how ideas should be interpreted and understood. By doing this, you are not challenging current understanding, but simply using these ideas to throw more light on your own research focus.

What should be clear is that the review of literature serves more than one purpose, but above all it is an extended and imaginary conversation between you and all the others who have done work in and around your research topic. In a way, it is like thanking them for helping you construct your own research and in particular sharing your findings and interpretations with the select few who have actually done research comparable to yours.

### *Some main definitions*

- *Concepts*. Start with simple English language meanings. For instance, concept refers to a general idea connected to a frequently used term, such as *downstream product development* and related ideas like *continuous quality improvement*, *organisational effectiveness*, and many other expressions used in business and government. These

terms help to describe WIGO and to generalise your understanding. These terms can either have very specific meanings (particular product development) or can be very open and flexible with multiple meanings, such as *love*.

- *Models*. Going further, a model is understood as a set of relationships that have a common connection and represent an abstract idea that is also grounded in reality. A prime example would be our understanding of a bureaucracy that describes organisational behaviour as a regular pattern. Models are often ideal types reflecting reality, but in a stylised form. They help us to see something as a whole instead of unconnected parts.

- *A theory* is an extension of a model and it provides a big picture explanation of WIGO. In an empirical investigation, a theory should be a set of hypotheses or propositions that seek to explain reality through systematic investigation. We prefer the term theory-building, as it is difficult to claim that an explanation is complete and beyond further analysis.

## 3. Research Methodology

### *Choosing a research methodology*

There should be three sections to this chapter:

1. *Data*. The first part simply describes how data was collected, that is, the ways and means you used to gather evidence in support of your research purpose and focus. Please feel free to provide your own explanation of how you did this. Make use of your ability to produce clear, visual guides to illustrate this part of the research methodology.

What is important is to reveal what data you have been able to collect in answer to your research questions. It is possible to work with quite small data collections, of course, making sure the limitations to generalisation are clear.

*Thinking about your data*

This is where the truth, the whole truth, and nothing but the truth comes into play. Answer these questions as accurately as you can:

- How much data were you able to collect? In your own view, is it enough or does it fall short of what you feel you need to provide sufficient evidence in answer to your research questions (RQs)? Give a rough estimate in percentage terms, with 100 being the complete answers to the RQs.

- What do you consider missing from the answers to your RQs? How will this affect what you can write about? Is it necessary to reduce or rephrase the RQs? What do you propose to do? In hindsight, what other or different questions should have been asked?

- Thinking about your RQs and the key literature sources you found most relevant, how far does your data go in making a new knowledge contribution? Apart from offering new information based on the regional significance of your findings, do your findings add anything new to the existing conceptual models and theories you called upon to draw a big picture of your research? Please explain if you think it does.

- If you had a second chance to repeat the research, what would you do differently?

2. *Explain, justify, and defend (EJD) your research methodology*.

   - *Positivist research*. The second part is more demanding. For those making a scientific inquiry, this entails explaining the ground rules and philosophy of the positivist-empiricist tradition, usually without much need to justify and defend the methodology.

   - *Qualitative-interpretive approach*. For those engaging with the subjective perceptions, lived experiences, felt needs, and personal interpretations of what they understand by WIGO, called the interpretive-constructivist tradition, it is often necessary to undertake more EJD work. It is just how it is.

   You should imagine that you have to EJD your research methodology to a science-trained mind familiar with the rules of positivism-empiricism and rather sceptical about other methods, which are regarded as soft and too subjective to be treated as serious knowledge. Your task is to persuade this imagined sceptic that the data you have collected is worthwhile. What should you do? First, you need to EJD the case-study method. There are plenty of books on the subject. Second, you must work hard on getting to grips with the thinking behind what is often termed the qualitative-interpretive approach.

3. *Describe the limitations of your research methods*. By doing this, you should demonstrate that you are aware that no research methods are ideal and that they provide only a limited capacity to collect data.

   Below are some tasks to help you if you are dealing with qualitative-interpretive research:

   A. Think of at least four main ways in which qualitative research differs from the quantitative method. This might mean that you distinguish between two versions of what is called reality. What is meant by claiming that reality is objective and singular or that it is subjective and multiple? Please explain. Another talking point is about the role of the researcher; one position being that researchers should be independent while the other argues that it is alright to interact with those being researched. How will you explain the second position? What about the data? One position is that only numbers count as evidence, whereas the opposite view is that words have real meaning and express WIGO through the subjective experiences and interpretations of those closely involved in the subject-matter of your research. What

would you say to the sceptic who argues that such knowing data is too soft to count as anything called knowledge?

B. Some would be content to label their research as belonging to phenomenology, simply described as a way of understanding the conscious action of subjectively interpreting individual experiences. It takes these grounded interpretations as the foundations of knowing and how they eventually become received knowledge. The subject-matter of such inquiries is referred to as things, meaning anything ranging from the tangible through to abstract concepts. How would you explain phenomenological research to the ardent positivist?

C. Another way to label research is to acknowledge that you are exploring, mostly through interviews, WIGO as understood by the respondents to your questions. As the subject-matter is close to the hearts of some respondents, you might find them being emotional, especially if you delve into authentic insights and feelings associated with success and failure (performance). So here is the last task for you to address: should your research be called social constructivist or should it use another name? Does it matter?

## 4. Reporting Research Findings

We have deliberately left this blank, as it depends on the research methodology how data should be reported and analysed. For instance, there is a big difference between reporting empirical quantitative data and data derived by an interpretive/qualitative methodology.

## 5. Conclusion

### *Concluding PhD Research*

It is expected that you will provide more than a simple summary of your main research findings. If you do it well, then you have reason to celebrate the conclusion, not only of your research, but also the long march you had on the way. Here is a digest:

1. After providing a summary of your key findings (only the highlights, not everything), you should give your own view of what they mean.

2. After your overview of the main findings you should consider their implications in this order:

   - a practical implication;

   - a strategic implication (if applicable);

   - a policy-making implication (if applicable);

   - a theory-building implication, that is, your academic knowledge contribution to the literature on the subject matter.

3. Admit the limitations of your own research design and propose remedies.

4. Stand back from your thesis and think as an independent researcher. What has the research taught you about WIGO? Should you be satisfied with what you have discovered or should you seek more and better data? Be constructively critical without overdoing it.

5. You should also provide some ideas for further research on the topic.

A PhD thesis should amount to about 80K words. There is skill involved in ensuring that the research does not go far beyond these word limits.

### *Other parts of a PhD thesis*

- References. This should include all the sources you have consulted in doing the research.

- Appendices. This might include additional material that provides useful explanation, if required.

Please note, the above is only a general guide to the structure and content of a PhD thesis. More detail should follow through discussions with your supervisors.

## 6. Defence

### *General guidance for a PhD presentation*

You should plan on a 30-40-minute presentation, which we estimate to be about 15-20 slides, no more. The ones named below are essentials. The others are your choice.

- Title of your topic. Add your name.
- Overview of what you want to know – research focus and objectives.
- Background context and anything else you consider nice to know.
- Briefly explain the problem or gap in the knowledge your research addresses.
- Identify some key need to know literature sources you used to design the research, especially any concepts, models and theories you found helpful to generalize and big picture your findings.
- Research questions.
- Briefly describe the particular methods you used to collect data.
- Research findings and how they were analysed.
- The most important findings arising from the research and their implications for practice, strategy, and policy making. Were you able to add to big picture theory-building and how did you do this?
- Further research directions and what you would improve on your own design.
- Standing back ask yourself, “what did I learn about my subject and its capacity for the kinds of improvements and innovations my research explored?”

Please feel free to add more slides up to the maximum number (20), but only if they add value to your presentation.

## 7. Writing a Paper for Journal Publication

What follows are summary notes on writing a paper for publication after the PhD thesis has been examined and passed with minor amendments. It provides a useful example of a mid-range journal that takes an interest in a broad range of topics. It is a Thai university-based publication with a long history and an established reputation for academic quality. Every paper is peer-reviewed.

It is on "Integrated Pest Management as Sustainable Agricultural Practice: The Process of Innovation-Adoption by Durian Growers in Thailand and the Role of Agricultural Extension Workers as Change Management Agents". It was published by Assumption University in Thailand, *ABAC Journal* 22, no. 1 (2002): 40-57.

I was the main author and my PhD student, Dr. Kittipong Sirichoti, was the second contributor. Nothing would have been published as a journal article (altogether four papers were published) if he had not produced the raw materials in his thesis from extensive research on the topic. My long experience of academic publication, English language, and writing skills were superior to his, so it was decided I would mainly write the paper. It was a sensible division of labour.

These notes focus on the structure of the paper, which I suggest you follow in converting your research project or mini-dissertation into a paper for journal publication. I suggest that you write no more than 3-5K depending on the richness of your dataset. How was it put together? Follow these steps.

1. *Abstract*. IPM is briefly explained, then the context of the research (durian growers in Eastern Thailand) followed by the focus on innovation-adoption theory leading to the adoption of IPM by the farmers, with their learning facilitated by Agricultural Extension Workers (AEWs). After explaining the key factors involved in IPM adoption, the paper explores the study as an illustration of change management theory and practice. In short, the Abstract explains the focus and content of the evidence produced by the research-based investigation.

2. *Introduction: the focus of the paper*. Four paragraphs introduce the topic, mentioning the core concept of IPM, the problem of pest control for durian growers, the location of the research fieldwork, the role of AEWs and finally the theory of innovation-adoption.

3. *Explaining IPM to durian growers*. One long paragraph explains how IPM as a philosophy and practice was communicated to durian growers through a participatory workplace learning program organised by AEWs. They were identified as key change management agents communicating with semi-literate durian growers living in a subsistence economy in rural locations. This section combines the contextual background with leading concepts and how things happened in practice (WIGO).

4. *Conceptual background: the innovation-adoption model and active principles of environmental management (EM)*. Seven paragraphs cover the content of this subsection. IPM is introduced as an important innovation in the eyes of AEWS and the Thai government generally, striving to reform agricultural practices in farming communities and to make the economy better geared to international markets. The key economic and socio-psychological benefits of innovation-adoption are noted as well as the importance of communication and learning in knowledge diffusion. Attention is drawn to the theory of innovation-adoption advanced by E. M. Rogers (1995). The key factors involved in the process of decision-making in adopting an innovation are identified and briefly explained, based on Rogers. The links between IPM and EM are noted as well as how together they reflect modern thinking about sustainable agricultural practices.

5. *Research design and methods*. A brief description of the population sample of durian growers and location is followed by an outline of the descriptive survey design, probability sampling, and other tricks of the trade in six paragraphs. Stick to being descriptive about how you gathered data. Note the research limitations.

6. *Highlights of the IPM research findings*. The reporting of the dataset comprised the core of the paper and comprised six subheadings dealing with the key factors associated with innovation-adoption of IPM by the durian growers over a period of time (embracing *early adopters* through to *laggards*).

7. *Relating change management theory to the IPM project (discussion)*. These eleven paragraphs cover important ground, such as linking IPM as an ideal illustration of leading ideas from change management theory and practice. This actually takes five paragraphs. The rest deals more with the application of these leading ideas to what happened in the durian orchards and the growers gathered around the AEWs. The theoretical reflections extend into the realm of sustainability as a long-term strategy for agricultural development.

8. *Conclusion*. The focus of the paper is repeated along with the main ideas that were regarded as applicable to the central argument, notably about the importance of a grass-roots approach to workplace learning as an empowering approach to managing change in farming practices. Special mention was made of the key role of AEWs in informing and persuading the durian growers to adopt IPM and to give it a proper trial over a period of time. Nature rarely produces results in a short time-span.

9. References. This is a select list of those works actually consulted in writing the paper, including the PhD thesis that provided the source material.

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**Editors' Notes:** Doctoral-level research is already underway within Kepler Space Institute (KSI) and will increase in the future. Doctoral-level educational standards will be integrated into all of KSI's programs. Dr. Barry Elsey has successfully supervised seventy PhD and DBA candidates to earning their degree. He and I shared the doctoral supervisory role throughout Asia between 1997 and 2007. Amina Amarova is one of Dr. Elsey's PhD successes in Australia. She also has aerospace credentials from Russia. This article will be permanently available to KSI people through the Space Library of Rob Godwin. We also look forward to having both Dr. Elsey and Dr. Amarova working with us. *Bob Krone.*

# Logic for the Description of a Viable Path to a Cis-Lunar Transport System and Lunar Mining Base

**By John Strickland**

**Abstract**
This article covers the need for an integrated, clean sheet set of space vehicles for the cis-lunar transport system and lunar mining base, and the problem that we will probably not get such a system. A system created from a mish-mash of existing designs and elements will take much longer to integrate and become economical. It also presents a list of some of the required critical components for cis-lunar bases and lunar mining bases.

**Keywords:** clean sheet, cis-lunar transport, reusable boosters, reusable in-space vehicles, reusable lunar ferry, propellant depots, cargo transfer capability, heavy excavator, cargo unloader, power sources, fuel production system.

Given the current lack of direction by the national space program in the United States, but at the same time noting that individual companies are starting to choose their own directions, which may or may not be compatible with common goals, how can any responsible group that has any influence in the space community best suggest a way forward to create the currently desired goal of a cis-lunar transport system and lunar mining base that is fiscally supportable and practical? The dilemma faced by any such effort is the choice between supporting the slower but more probable direction of a piecemeal approach led by the individual companies, or the possibly much faster and more efficient clean sheet system approach, which requires coordination between companies. Is any compromise or hybrid of these two paths possible? To solve this problem would be like successfully herding jaguars.

There have been many proposals for lunar transport systems, but these have mostly been descriptions of *individual components* of a transport system, (one composed of already existing designs), or a *clean sheet* and integrated system, which is less likely to be built, since a significant number of new components would all need to be designed in concert, built, and then operated as a unit. No one company currently has the industrial muscle to do this. NASA is not currently in a political or fiscal position where it can do this. If a system is designed component by component, each by a different company, it is likely to take decades to make the pieces work together. As an example, when semi-trailer trucks first appeared, they competed with railroads for long-distance shipping. Later, it was found advantageous for certain types of cargo to be carried both on rail cars and on semis, which led to the concept of simply placing the trailers on rail cars for the longest part of the trip and using trucks for local delivery. But such solutions do not always happen. Australia still has three different railroad gauges nearly 200 years after the first railroads.

If a group wants to create a realistic scenario that could lead to an efficient cis-lunar transport system, it needs to deal with the piecemeal vs. clean sheet system divide. Individual companies' decisions are made by their own executives, but they do not live in an information vacuum. News about advances in space transport come in almost every day, and they could affect the viability of any design. The diameter and lifting capacity of

launchers also limit what can be built, so that it may be launched in the near term. The nearer the required launch date, the more restrictive the launcher choice is.

The logic to create such a transport system may thus be divided into two phases:

(1) One using existing or very near-term boosters and mostly existing designs to create a temporary lunar transport system, which may be able to bootstrap a more efficient later system.

(2) A full-size transport system, with components made by different companies, but designed to work with the components made by the other companies for mutual profit.

How can NASA or any other agency or group expedite the efficient creation of either type of system? Proof of profitability seems to be the largest issue. This means (a) the ability to produce a product such as lunar-derived water or rocket propellant in sufficient volume, and (b) the existence of one or more markets for that product (cis-lunar commercial travel and/or Mars expeditions mounted by government or private agencies). Of course, the cost of providing the service or product must be sufficiently less than what can be charged for it.

Some examples of near-term systems include the ACES depot concept and the XEUS lunar lander concepts being promoted by ULA and Masten. SpaceX is favoring an infrastructureless design for its Mars transport system, using tankers instead of depots for fuel transfer, but as of July 2017, it was in the process of updating its overall launch vehicle and Mars vehicle designs. Blue Origin has not yet defined any of its in-space transport and infrastructure concepts in concrete terms. Other companies such as Moon Express are working on lunar landers with significant cargo capacity, but no crew-sized lunar vehicles are under serious development yet. It is not clear whether any of these smaller vehicles will be reusable or not.

If any of these companies or NASA goes ahead with a near-term design that can be launched on a near-term booster, how long will it then take before any of the companies decide they need a blank sheet design for efficiency. Will the companies eventually work together? Will they work with NASA for long enough to get real results such as actual lunar rocket fuel production and its transfer to L1 or an equivalent location?

If companies and the government could decide on a cooperative, integrated approach, there would still be one more major decision to make. Would each company build a complete, separate vehicle, or would some companies agree to build common components such as rocket engines and habitation modules, and then have companies designated to assemble the vehicles and modules from the components? Which method would cost less in the long run if NASA were the primary customer?

There are not enough detailed current system component designs to fill out a complete lunar transport and mining base system. Perhaps the best thing to do is to create a description and possibly a video of a blank sheet coordinated system to show the disparate companies what the benefits of such a system could be. Such a video could

show near-term refueling of lunar payloads in LEO to allow larger ones to be landed on the moon, prospecting for the lunar volatiles and initial validation of quantities and qualities. Then the entire transport and base system could be shown in full operating mode, supplying thousands of tons of propellant to Mars expeditions. Emphasis should be on the operating elements like propellant depots and cargo-handling equipment that are still missing from most official cis-lunar plans.

**A List of Components for a Cis-Lunar Transport System and Lunar Polar Mining Base**

This list is just an *example* of one approach with multiple components. Any transport system must consist of both mobile vehicles and stationary nodes such as bases or stations. The transport system is needed first to create the bases, first at L1 or equivalent, and then at a lunar pole, which can then help support the cis-lunar transport system and propellant production for Mars expeditions. Reusable in-space vehicles must carry enough propellant for a return to the departure point. These represent the building blocks needed to create the bases and supporting transport systems, which are integral to the design. This is an ideal, clean slate system based mostly on new, purpose-built elements. This path may not happen.

1. Rockets
    a. Reusable first-stage rockets: **Falcon 9, Falcon Heavy** (existing), **New Glenn** (proposed).
    b. Reusable second-stage rockets: possible Falcon 9 upper stage, ITS upper stage (both proposed).
2. LEO logistics base with *propellant depot* and cargo transfer capacity with crew habitat(s) (part of the required cargo transfer capability already exists on the International Space Station).
3. Cis-Lunar logistics base with *propellant depots* and cargo transfer capacity with shielded crew habitat(s). Initially, this will need several hundred tons of propellant storage. Roughly 2,000 tons of storage is needed to support realistic Mars expeditions with reusable vehicles.
4. Reusable LEO to L1 ferries (capable of single-pass aero-capture for return to LEO), versions to carry crew, cargo, and propellants (here, L1 represents a range of possible cis-lunar locations).
5. Lunar ferries
    a. Reusable L1 to Lunar surface ferry – propulsion module (when alone – acts as a flatbed cargo ferry).
    b. Reusable Lunar Ferry – crew version (with crew cabin) (used with a propulsion module).
    c. Reusable Lunar Ferry – tanker version (with propellant tanks) (used with a propulsion module).
6. Lunar polar mining base
    a. Infrastructure

Power sources (reactors/turbines, solar panels, cables, power management, battery or fuel-cell backup).

Heavy excavator and narrow trencher.

Cargo unloading and transport system including cranes, flatbed trucks, and tanker trucks.

Assembly robots.

b Crew and Science equipment

Two or more buried habitat modules with redundant life-support and power equipment.

Pressurized crew rover.

Local ATV crew transport.

Tools and science equipment.

Food and water reserve.

c Mining and extraction equipment

Specialized excavation and separator system for volatile deposits.

LOX-LH2 fuel production system from lunar water.

Lunar propellant depot (initially several hundred tons of storage needed; can be located in sunless area if near base).

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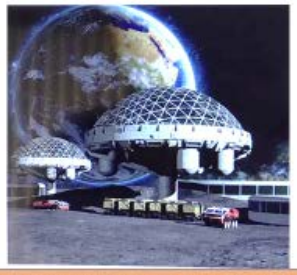
**About the Author:** John Strickland has a BA degree in Anthropology and another in Computer Science. He retired as a senior Analyst for the State of Texas in Austin in June 2009 after 20 years. He is a member of the Board of Directors of the National Space Society and of the Protect Lake Travis Association in Austin, TX. He serves as the NSS Assistant Treasurer, is the chair of the NSS Awards Committee and Roadmap Committee, is an Advocate with the Space Frontier Foundation, and is an active member of other pro-space organizations. His specific interests include access to space, reusable spacecraft, space policy, space solar power, and planetary and space logistics base infrastructure. He contributed chapters to the 1998 edition of Dr. Peter Glaser's book: *Solar Power Satellites: An Energy System for Earth*, and to the 2005 book *Return to the Moon*, edited by Rick Tumlinson. Since 1976, he has produced articles and papers for *The Humanist*, *L5 News*, *Solar Power*, *Ad Astra*, *Space News*, *NASAWatch*, *The Space Review*, the *Journal for Space Communication*, and for other local and regional publications and sites. He is currently finishing work on his major book *Developing Space*. He lives near Austin, Texas.

**Editors' Notes:** John Strickland has been positively influencing the Space Community for over fifty years. He founded the Austin Space Frontier Society (Texas) and been its Chairman since 1981. He was a member of the National Space Institute and the L-5 Society, from which flowed the National Space Society (NSS), the distinguished leading global space organization. He has a career of research, publications in the Space Review and presentations for Space conferences and symposia while serving on the Board of Directors of the National Space Society. This article is his first in the *Journal of Space Philosophy.* Returning to the Moon for both capturing resources for Earth and facilitating exploration to Mars has revived over the past ten years as a feasible goal. John Strickland here describes what will be needed, and how companies and the government could cooperate for an integrated approach to a complete lunar transport and mining base system. *Bob Krone and Gordon Arthur.*

# Kepler Space Institute (KSI) at ISDC-2017

**By Bob Krone, President, Kepler Space Institute**

The Kepler Space Institute continued its participation for the National Space Sciences' International Space Development Annual Conferences events with several sessions at the St. Louis ISDC May 2017 Conference. They were:

Living in Space Track, ISDC 2017, 28 May

***TRACK CHAIRS: BOB KRONE & NATE SUSHEREBA***

- 10:00 AM, Howard Bloom presents Dr. Louis Kauffman,
- *"Recursive Distinctioning Theory"*
- 10:35 AM, Print the Future Award Winner-Team Bengal Tigers
- 11:00 AM Howard Bloom presents Dr. Louis Kauffman,
- *"Recursive Distinctioning Applications & Ramifications"*
- 2:OO PM Ayse Oren, *"Future Space -Architecture"*
- 3:00 PM Print the Future Award Winner-Team H2's H2 Capsule
- 3:15 PM Print the Future Award Winner-Team ProtoFluidics
- 3:30 – 5:00 PM Panel: *"Space Abundance for Humankind's Needs"*

This article documents the presentations of Space professionals in the Living in Space Track at the St. Louis ISDC-2017 Conference, which occurred on May 28 from 10:30 am to 5:00 pm. Subjects are introduced with the slides used to introduce the presentations.

The following page from the Summer *AdAstra Magazine* has instructions for ordering a DVD of any presentation made in the ISDC-2017 Conference.

1. We were proud to include three award-winning presentations from the **Enterprise in Space (EIS)** 3D Printing Competition. The mission of EIS is to motivate students everywhere to reach for the stars. EIS will design, engineer, build, launch, orbit, recover, tour, and exhibit a spacecraft named NSS Enterprise containing over 100 student experiments. The three award winners had designed 3D printing experiments capable of printing in the International Space Station or anywhere in Space.


2. **Dr. Joel Isaacson and Dr. Louis Kauffman**, the world's leading scientists for *Recursive Distinctioning* (aka "Nature's Cosmic Intelligence"), worked together for months prior to ISDC 2017 to create a presentation that provides the 2017 update description, theory, and future ramifications of the 1964 discovery by Joel Isaacson and its paradigm shift implications for science and humanity. Dr. Kauffman was on a world lecture tour in May 2017 and Dr. Isaacson was not able to present personally in St. Louis. Howard Bloom stepped up to make the presentation, which readers can find at:

   67256.dl.dropboxusercontent.com/u/11067256/RecursiveDistinctioningMay2017.pdf

   Howard Bloom has unique qualifications, as readers can see from the quotes in the following slides used to introduce him.

## Howard Bloom - Some Quotes

* Joseph Chilton Pearce, author of *Evolution's End* and *The Crack in the Cosmic Egg:*

*"I doubt there is a stronger intellect on the planet"*

* Britain's Channel 4 TV:

*"Bloom is the Darwin, Einstein, Newton and Freud of the 21st Century"*

• Howard Bloom:

*"We need a new horizon, a new sense of purpose, a new set of goals, a new frontier to move once again with might and majesty, with a sense of zest that makes life worth living, through the world in which we live. One of the most challenging frontiers left to us hangs above our heads."*

* Joel D. Isaacson, PhD and Louis H Kauffman, PhD:

*"Howard Bloom will bring Recursive Distinctioning to the public in his own unique creative style. We thank him for being our spokesman at the International Space Development Conference in St. Louis on May 28, 2017"*

## • Some Louis Kauffman notes

**1. From:** Louis H Kauffman <loukau@gmail.com>
**Date:** May 7, 2017 at 11:22:41 AM CDT
**To:** Joel Isaacson <isaacsonj@hotmail.com>
**Subject: Re: Patterns in the expansion of a unitary square**
Dear Joel,
We could call this a New Kind of Science: Using RD to put a microscope on primordial distinctions.
The VERY EARLY UNIVERSE - JUST THIS SIDE OF THE VOID.

**2. Dear Bob and Joel**, We are doing a trial run in this slide show with the notion that our subject really is about the emergence of distinctions and recursions and recursive distinctions "from nothing". That is, we are looking for the simplest possible processes that are clearly non-trivial. The 1DRD is a prize example for the concurrence of distinction and recursion. It is not the only example. The natural numbers are another, as is the binary system and one can go on and on. The real point is that if you go to nothing or almost nothing and come back, it is not a chaos of rules or some other unfortunate circumstance. There is simplicity and elegance in primordial beginnings.

**Lou Kauffman, email, 8 Apr 2017**

***Louis H. Kauffman, PhD, Professor of Mathematics ,University of Illinois, 26 April 2017, E-mail To Dr. Joel Isaacson***

On Apr 16, 2017, at 10:19 AM, Louis H Kauffman <loukau@gmail.com> wrote:

Dear Folks,
I do not position RD at the bottom of some hierarchy.
I position the concept of distinction as most basic and systems that use it in a fundamental way such as RD, LOF, Boolean Algebra,Dirac Brackets, Mathematics, Cellular automata and so on as EXAMPLES of the concept. Some examples are whole fields of investigation. RD is such a field and a new one.
Best,
Lou

Howard Bloom had his personal contributions, which have been documented in the Conference DVD discs.

3. **Ms. Ayse Oren** is a brilliant, successful entrepreneur in Turkey. This was her first participation in a National Space Society Annual Conference. Her presentation traced the history of the influence of architecture and the environment on human progress as a model for future Space architecture.

National Space Society
Interational Space Development Conference
*Find Your Spirit of Exploration & Discovery*
Union Station Hotel, St. Louis, MO | May 25-29, 2017

Living in Space Track, ISDC 2017, 28 May

- **2:00 PM, Ayse Oren,**
  *"Spacecraft Architecture in long Duration Space Travels"*

***"If we are going on a different direction in the course of the Homo sapiens evolution, we can do this with designs addressing not only our needs, but also our senses. Well-being of human can be achieved by creating environments supporting the cognitive and social stages in the evolution process."***

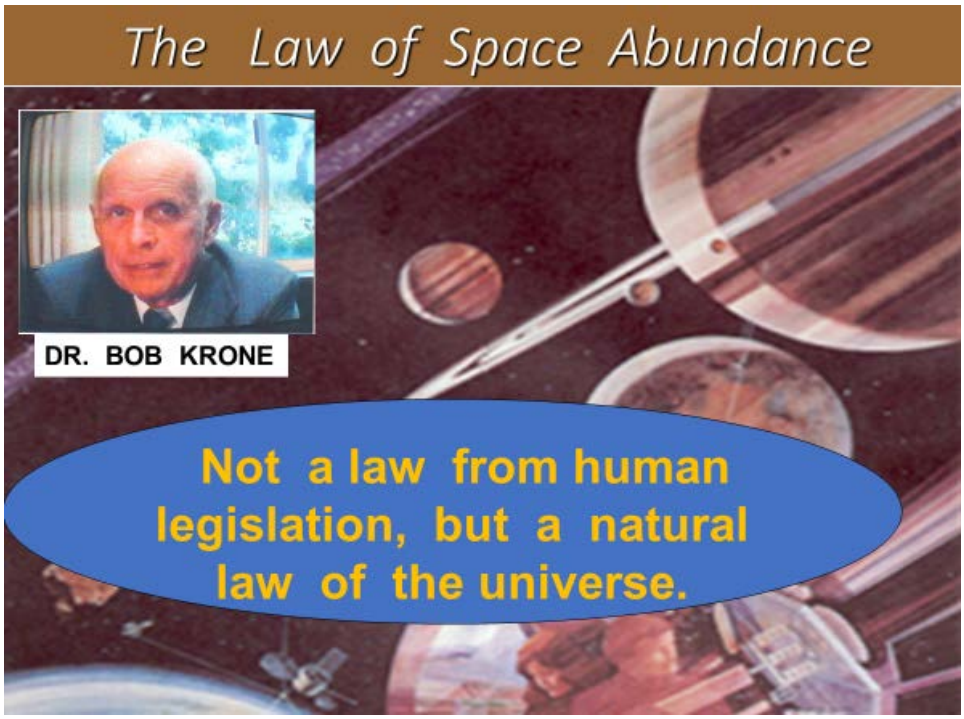

An important Space future quote of Ayse Oren at ISDC 2017 was:

> Architecture is multitask science that takes abstract human needs into consideration as well. If we are going on a different direction in the course of the *Homo sapiens* evolution, we can do this with designs addressing not only our needs, but also our senses. The well-being of humanity can be achieved by creating environments supporting the cognitive and social stages in the evolution process.

4. The Team ProtoFluidics Print the Future Award Winner project will be an experiment in the ISS during the Fall of 2017.


5. The H2 Capsule Print the Future Team created a product designed for Mars Explorers which will find expanding uses throughout society for permanently documenting events and thinking.

6. Distinguished Space leaders, teachers, and researchers were panel members for the two-hour Sunday afternoon panel titled *Space Abundance for Humankind's Needs.* The Bob Krone introduction for the panel was as follows:


7. **Dr. Howard Bloom**. See the remarkable quotes describing Howard Bloom, above, in this article.

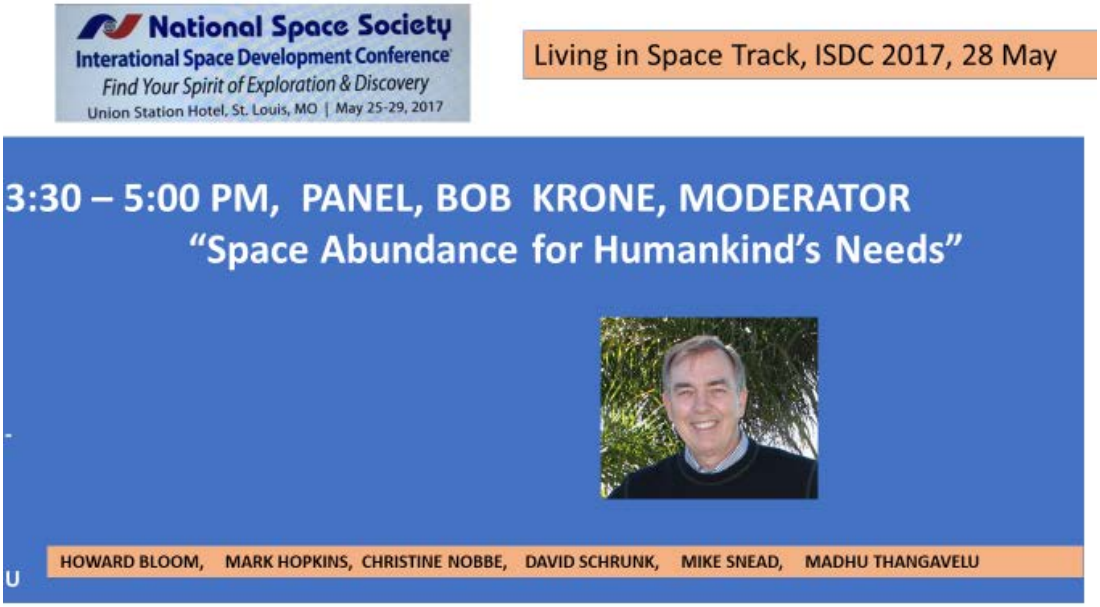
8. **Mark Hopkins.** Mark Hopkins currently serves as Chairman of the Executive Committee (the Chief Executive Officer) of the National Space Society. He has served as an officer in one position or other for 35 of the last 41 years. He has received numerous degrees in economics from Cal Tech and Harvard. He has written numerous space economics articles.

   Hopkins initiated the merger negotiations and conducted most of the L-5 side of the discussions that led to the creation of the National Space Society from the L-5 Society and the NSI in 1987.


Hopkins was participating in his thirty-sixth Annual ISDC Conference as an original founder of the National Space Society and its Chief Executive Officer. Attendees always seek his views. During this panel, he was asked to give his thoughts about the progress of Space exploration, development, and human settlement. His answer was:

> I wish it were going faster, but we are indeed winning, and along with those of us in the Space advocacy community, all of humanity.

9. **David Schrunk, MD.** David Schrunk is an aerospace engineer and medical doctor with board certifications in the medical specialties of nuclear medicine and diagnostic radiology. Dr. Schrunk retired from the practice of medicine in 1994, and now dedicates his time to his two passions: the future exploration and human development of the Moon and the science of laws. He has given presentations and presented scientific papers on lunar development tools and on the science of laws, and he is a co-author of the book *The Moon: Resources, Future Development, and Colonization*, published by Wiley-Praxis in 1999. The second edition of "The Moonbook" was released by Springer-Praxis in 2007. Dr. Schrunk founded the Science of Laws Institute in 1995, and he authored the book, *The End of Chaos: Quality Laws and the Ascendancy of Democracy*, published in 2005 by the Quality of Laws Press. Dr. Schrunk lives in Poway, California.




David Schrunk's presentation titled*: Silicon and Sunlight: Key Resources for the Beginning of the Spacefaring Age* included:

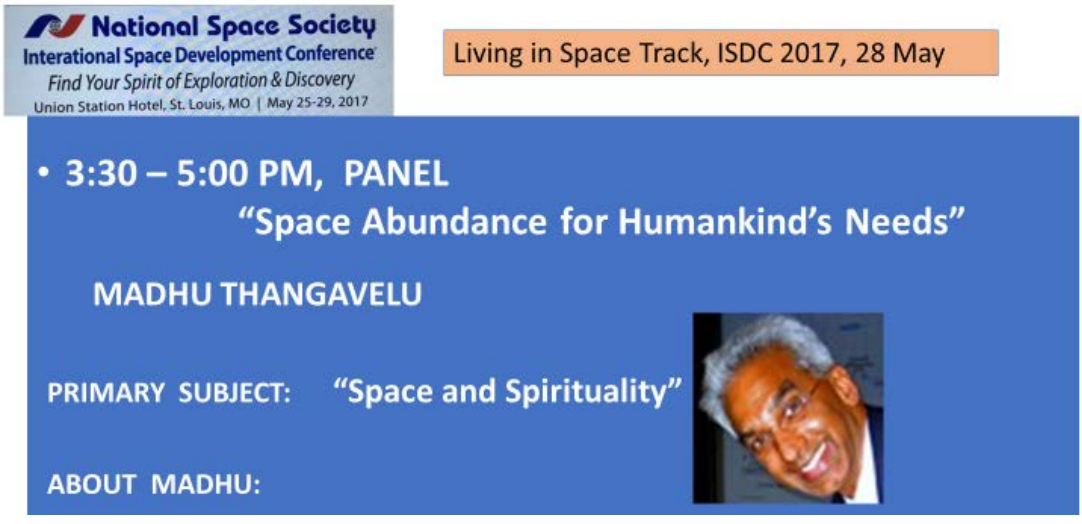
> A milestone in space development will occur on the Moon sometime in the coming decade. A robotic processing and fabrication device will be landed on the Moon and directed to create the first functioning solar cell from lunar regolith material (e.g., silicon). This milestone demonstration of the use of space materials to generate electricity from sunlight will inaugurate the Spacefaring Age, in which human technological expertise is linked to the unlimited resources of space. Human activities in space will grow exponentially from that point forward; we will explore the solar system on a grand scale, create permanent homes in space, and open endless frontiers.

10. **Mike Snead.** Mike Snead presented a sophisticated video concept for how America can become a commercial spacefaring nation. It included a LEO 100-person habitat which can be assembled with eight SLS cargo missions, and pressurized Space hangars for in-orbit maintenance and servicing for Earth or the Moon.

- **3:30 – 5:00 PM, PANEL, MIKE SNEAD**

**Mike Snead is a professional engineer and president of the Spacefaring Institute. He is an associate fellow of the American Institute of Aeronautics and Astronautics. He will speak on building the spacefaring logistics infrastructure needed to open the central solar system to commercial spacefaring operations with focus on space solar power.**

11. **Madhu Thangavelu**




All great civilizations have a spiritual background, upon which science and technology were nurtured and thrived. To present science and scientific process as the pinnacle of human thought may be hollow without due appreciation of history. One way to dodge the question is seen in Templeton award winner Martin Rees's response to the pointed question from Ian Sample: "What do you gain from churchgoing, considering you don't

subscribe to religious dogma or believe in God?" Rees's response was, "Well, I think it's a common traditional ritual which one participates in as part of one's culture."

Best, Madhu

**Concluding Comments by Bob Krone**

Kepler Space Institute (KSI) leadership and members are proud to have sponsored the above professional contributions to the 2017 International Space Development Conference at St. Louis. We thank our Vice President for Public Relations, Naté Sushereba, for all the planning and coordination she did in preparation, followed by her working from dawn to end-of-dinner every day during the Conference. Things progressed smoothly in the normal chaotic environment of conferences due to her attention to every detail. And we thank all the professionals shown above for their time and creative contributions. The primary reasons that the National Space Society ISDC conferences have attracted people for the past thirty-six years are the networking, updating, and learning that always occur. And all of those contributing to these KSI sessions volunteered their time and knowledge. Thanks and congratulations to you all.

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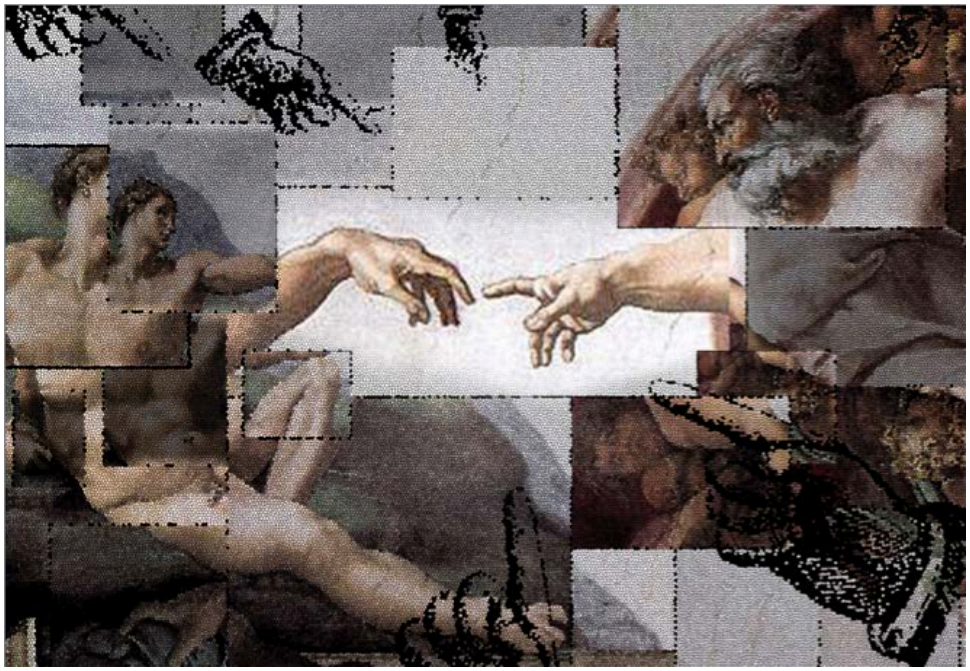
**About the Author:** Dr. Bob Krone is President of Kepler Space Institute (www.keplerspaceinstitute.com). He is an Emeritus Professor of Systems Management at the University of Southern California; has been the principal sponsor for PhD, DBA, and Master's Degree Program candidates for forty years; and is a USAF Colonel (Ret).

**Editor's Notes:** Kepler Space Institute continues to make significant contributions to ISDC, and will no doubt continue to do so. This illustrates both the breadth and the depth of the expertise we can offer. *Gordon Arthur.*

# Future Space Architecture

**By Ayse Oren**



**What is Architectural Imagination?**
Imagination is the most individual and intense activity of design. It connects the space between the perception and understanding. It is different from other mental processes, because imagination does not need any reference. It creates its own image.

When we are talking about architectural imagination, we pay a lot of attention to form and how it is going to look, independent of materials, investment, and function. This is architectural imagination at work. This brings us to knowledge.

**How is Architecture Science?**
In the history of Architecture, there are two important moments: first, the invention of perspective by the Renaissance architect, Brunelleschi, in which all orthogonal lines converge to a point at infinity. That later influenced Immanuel Kant to conclude that the stars in the sky might be other galaxies.

The second invention is sensor technology and neuroscience, which have rationalized our senses and revealed the new paradigm of Neuro-Architecture. The information we gain has a greater potential to reveal the needs and preferences of individuals, which can make the difference in how we analyze consciousness or the subliminal responses of our brains and bodies to the environment, and how they affect our well-being and health.

Neuro-Architecture allows us to create places that align with our instincts and our human nature, and this knowledge will create an architectural revolution. We create places because we need to lean on them physically and emotionally.

Even though the standards of aviation are very strict – particularly in long-duration space travel – individualization is going to be a must. If scientists and architects are to unite to construct spaceships that can be integrated with living functions, they must learn to think, to deal with the needs of individuals, and to make the necessary changes to adapt to people's emotional states.

That makes people feel they belong more to the environment, which brings in transhumanism. It is important, since the environment should be like clothes that are comfortable and that provide for people's needs without making their presence felt. By all means, allow for integration with the crew and craft. The success of an extended mission on a space station depends on the crew being an integral part of the interior design.

Spaceships are half machine half architecture; infrastructure and construction need to occur together: the electrical system, ventilation, installation, lighting. Architects and engineers also need to work together. To date, we have developed the typology of space architecture by learning from earlier space stations.

Typology is the essence of the building, defining a system that has nothing to do with the five senses. Skylab, MIR, and the ISS are forming a certain kind of developing typology. The key point is to systematize and to operate the typology so that we can create infinite variety. That keeps us on the road to serial production, which creates economy, and economy creates variety and competition as well.

So, what is this typology that is creating space architecture?

**Flexibility – Modularity – Changeability**

After the industrial era, architects adopted the use of metal with its technical advantages. Joseph Paxton, who was a gardener and an entrepreneur, built the Lily House (a greenhouse) in the reign of Queen Victoria. He developed this building by drawing inspiration from the pattern of a lily. The pattern of a leaf is a fractal design. Accordingly, it can solve modularity problems, because by understanding the design principle of the system, one can solve the entire system.

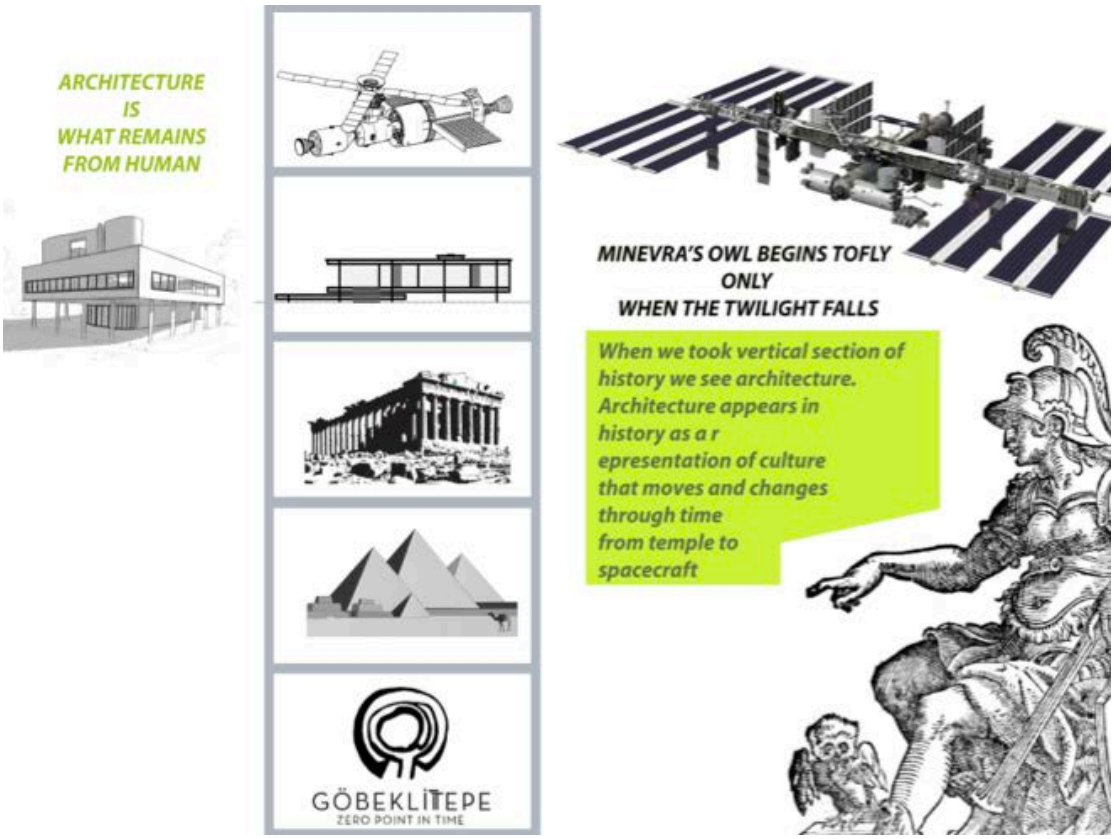
Being flexible and changeable means thinking about the process of recycling mechanical parts from the early stages of design. Development of production processes is a similar approach, in that each product will turn into another product after use.

Open plan is also an option where reshaping can be useful. Combining different metals can add structural flexibility and enable modularity. By contemporary means, nodes and connection details can act as ornaments in architecture. If we think more thoroughly about change in space, the module that lands on the surface of a planet can shift to another function after landing.

**Slayt-Göbeklitepe to the ISS**

If we are to understand space stations, we need to appreciate how they developed. When we take a vertical section of history we see architecture, because architecture is what remains from human occupation.

Look at these images:



You will probably start to compare them: one is stone, another is painted white, and the third is metal.

Let us start with the first one – Göbeklitepe. See how it meets the ground. It almost seems to be emerging from the earth like a mountain.

The second one is Mies van der Rohe's Farnsworth House. It is lifted off the Earth. It kind of perches on the Earth, but it is still in contact with the landscape.

When we came to the architecture of space stations, they are free from the Earth's surface, elevated from the ground, and conceptualized.

**Slayt: Skylab-Mir-ISS**

***Space Stations***

Due to the technical aspects of space travel, the architecture of space stations is still very primitive. But it will develop despite the restrictions. The important thing is to understand what you can do and what you cannot do in space, and to be creative in this restricted zone.

When we compare Skylab, Mir, and ISS, it is clear that they are going through their own evolution process: The earlier stations provided references for the subsequent ones. For example, the Mir space station had crew quarters designed using information from Skylab. They included visual barriers to provide a little privacy. Skylab had no openings at all, while MIR had a 20 cm window. The ISS has a better window size that enables astronauts to observe the planet Earth and space.

The interior architecture of space stations is messed up with cables, poor acoustics, and ventilation problems, and they all have poor lighting. The ISS can accommodate six people for 90 days at a time. For the first time, human well-being, human psychology, and maximizing efficiency became subjects for a space station. We experience change and see apparently fixed objects in continuous free-fall.

These initiatives are developing a space industry and an infrastructure that allows for larger and more complex structures.

***Triz***

A method called Triz came out when architects were looking for a way to expand interior spaces. Triz is a technique of producing systematic ideas for engineers. I decided to use it for evaluation and development of systems and interiors so that we can optimize ideas. I have a team at Istanbul Technical University, and we have begun to hold workshops on designing more effective spaces.

Triz was used in building the Cassini-Huygens Probe (which is a cooperative project of NASA, ESA, and the Italian Space Agency). Nowadays Cassini is very famous due to its the successful analysis of Saturn's atmosphere.

The radiation in space is harmful to some of the digital and electronic devices in the spacecraft, so the design team divided the equipment and elements into two separate

layers: an inner and an outer layer. The pieces that were less affected by radiation went on the outside of the structure, and thus served as armor for the components that the radiation was likely to affect.

Delta Airlines used another method to improve the seating areas for passengers and to increase the volume of cabin at the same time. An asymmetric seat arrangement solved the problem, by increasing the interior volume and the seat volume at the same time. The same problem exists in space stations. That is why I want to create systematic solutions that will enlarge the interior space, so I created a team that can produce ideas for the enlargement and efficiency of the interiors of modules or stations.

### *Sensory Inputs*

Color, light level, sound, and odor are not just surface effects and they are not intangible. They are very real, very strong, powerful tools, and they have a real, physical presence. For example, even if you design the most beautiful place in the universe, if it smells bad, people will not go there.

### A View Through Space – Windows and the Use of Glass (Apollo-Soyuz-Piramitler)

Windows have a very important function and effect in architecture. Architects have learned how to design windows only comparatively recently. This is true of building spaceships as well. Engineers first deemed windows unnecessary, yet the results were worth it.

The small module with windows in the ISS was named the cupola. Windows have a very positive impact. The size and the shape of windows is another important consideration. In their free time, what astronauts enjoy most is to gaze at the planet Earth. A window is more than just a form; it can enable escapism. It allows humans to form connections with the outside world.

### The Capability of Obtaining and Sharing Information on Our Surroundings and Nature

We are awed by life in our lives, even watching the sunset, the phases of the moon, or the tide. Our interactions and bonds with nature are very important for us to make sense of life. The philosophy of *anima mundi* suggests that the universe has a soul as well, which makes us one with nature and its events. However, for safety reasons, we must be able to take shelter against external impacts.

### *Light – Integrating Light*

The light that enables us to see has a significant impact on our mental state, cognitive function, behavior, and physical health. Light has effects on melatonin, endocrine, and cortisol levels, which prepare the body for activity and satisfaction.

In fact, the amount of light in nature constantly changes, minute by minute. Light and humidity may vary at any location (color, shadows, brightness contrast, sun angle; thermal/haptic sensations associated with direct sun, wind, and humidity). The light design project and the organization of light, especially on long-duration missions, is of critical importance.

### *Color*

Light creates colors that allow visual experience. We use light to make the world meaningful. Architecturally, in the 1970s, there was a jump to another level in the use of color (for example, the Pompidou Center in Paris). Color has many uses for technical purposes beyond taste and culture. It may be highly useful, especially on long-term space missions.

1 In a place where there is no direction, color can create perceptions and give information about the building. Color schema can be used for way finding, defining up and down, etc.

2 It can be useful for communication and automation purposes: giving distinct colors to building systems – the electrical system, heating, ventilating, air conditioning, and cooling (HVAC), and plumbing.

### *Memory in Reality – Augmented Reality and Virtual Reality.*

Virtual reality and augmented reality can provide a significant advantage in coping with special moments, having visual experiences and dealing with homesickness. As we move away from the world, the relationship between people and reality is unclear. We still do not know how people will react to this situation. These two kinds of realities can create ambiance without adding extra load to the structure.

Ambiance is the theme about which architects really care. We can create cozy atmospheres in social and private places. The sounds of nature, and even its smells, can be provided in any room. However, one criticism of virtual reality tools is that they do not capture the full multisensory experience of humans in the built environment, but they are still better than lacking everything to which people are used.

### *Sound Design – Ventilation, Acoustics, Noise*

We are getting smarter, but we are still far away from the wisdom of nature; we need to understand what nature means. Nature does not leave waste behind. It does not create pollution, so it is essential to observe nature. One must be aware of hidden knowledge and pull out of it. Nature is noiseless (nature is not soundless, but it is noiseless: we take noise as the mechanical sounds that human-made machines create), and what makes spacecraft unbearable is the noise and buzzing inside.

Today's spacecraft, tools, computers, and machines make a lot of noise. However, nature has solved this problem. For example, spiral seashells provide both ventilation and cooling efficiently and with little noise.

Yes, we have developed, but we still have a long way to go.

Solutions like this need to be investigated. If this information proves useful, it may be possible to solve energy efficiency and acoustic problems.

### *Simple Solutions*

Even though space travel is very expensive, sometimes it leads to inexpensive solutions to terrestrial problems. For example, Velcro was designed to help astronauts to walk in

zero gravity, but it has had endless applications on Earth. Simple ideas like this can provide unexpected solutions.

**The Importance of Play in Architecture**


We finish with the importance of play in architecture.

LEGO-like solutions may also work well, as we are not only *homo sapiens*, but also *homo ludens*, meaning play-loving. The element of play and the satisfaction of playfulness can be achieved by attaching materials to a grid and the changing them around to satisfy playfulness. Games are often underestimated. We should not forget that we all have a child within. This is most important.

My focus is on simple and lean thinking. We may design starships with artificial intelligence, we may laugh at absurd things, we may be interested in meaningless things, but that will always be the case. In space, it does not matter how old we are; in essence, we are all little children.

This child needs games and stories. Building a spaceship is a serious and technical topic; we are going to develop a system that also meets the need for entertainment of the child within.

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**About the Author:** **Ms. Ayse Oren** is a brilliant, successful entrepreneur, architect, sculptor and design artist in Turkey. She is a nationally and internationally awarded designer developing projects focusing on electronics and design, positioning human and life in the center. As an artist, honored by Republic of French as "Future Leader," she was also the first designer to be accepted into a Technopark (Boğaziçi University) by the ministry of Science Technology and Industry in 2010.

She is an active member of Kepler Space Institute. At the International Space Development Conference 2017, in St. Louis, she presented on the history of the influence of architecture and the environment on human progress as a model for future Space architecture. She will represent KSI at the International Moonbase Summit in Hawaii in October 2017. See her web site at: www.ayseoren.com

**Editors' Notes:** We were pleased to have Ayse presenting in the *Living in Space* Track at the International Space Development Conference 2017 in St. Louis and to write this article for the Journal of Space Philosophy. Her reasons for working in the Space Architecture field are well summarized in her following quote:

> If we are going on a different direction in the course of the *homo sapiens* evolution, we can do this with designs addressing not only our needs, but also our senses. The well-being of humanity can be achieved by creating environments supporting the cognitive and social stages in the evolution process.

Ms. Oren is destined to be a creative and productive member of Kepler Space Institute. *Bob Krone and Gordon Arthur*.

# Space Abundance for Humankind's Needs

**By Robert M. Krone, PhD, Salena Gregory-Krone, GM-13 (Ret), and Kat Krone, MBA**

**Abstract:** This article is an introduction to a major research and education project in the planning stage by Kepler Space Institute (KSI), www.keplerspaceinstitute.com.

All the resources humans will ever need are waiting in Space. The Law of Space Abundance, which states that *Space Has Abundant Resources to Meet Human Needs*, has been proven valid. We have used the systems approach to cover the huge spectrum of subjects to be investigated, documented, discovered, and researched – then applied – if humankind is to overcome the problems, mistakes, and pathologies of its history on Earth, and to progress successfully into an age in which there is reverence for life within ethical civilizations.

Science and technology continue to give us the tools, and the hope, for that successful journey. Our Earth cradle has brought us to the verge of maturity. We are not yet there. Space has the solutions. But science and technology have also given humanity the tools for its own extermination. And the human factors for selecting the good, and rejecting the bad, remain a challenge. It is the belief of those who created the Kepler Space Institute, that Jonas Salk, American Medical Scientist and Virologist, was right in his 1973 book, *Survival of the Wisest.* Dr. Salk described humanity as being in a transition from Epic "A" (Survival of the Fittest) to Epic "B" (Survival of the Wisest). In 1973, he was in doubt about the outcome. In 2017, we are still in doubt. In 1956, President Eisenhower presented Dr. Salk with the United States Gold Medal, declaring his development of the Polio Vaccine was a "victory for the whole nation." It became a victory for global humanity.

The following is the set of subjects that have received attention and will continue to be addressed for capturing the resources in Space to meet humanity's needs on Earth.

1. Space Vision, Philosophy, and Theory
2. Leadership for the Space Epoch
3. Space Science, Technology, and Engineering
4. Space Exploration
5. Human Factors: Living and Working in Space
6. Governance and Management of Space Systems and Settlements
7. Cosmic Intelligence and Information
8. Space Infrastructure and Commerce
9. Space Faith
10. Space Culture, Music, and The Arts
11. Quality Education and Research for the Space Epoch
12. Humankind's Future: Space and Earth

All the other articles in this Fall 2017 issue of the *Journal of Space Philosophy* address some aspect of this huge project.

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## About the Authors, The Krones

**Dr. Robert M. "Bob" Krone, PhD,** is President of Kepler Space Institute (KSI); an Emeritus Professor of Systems Management at the University of Southern California; has been the principal sponsor for PhD, DBA, and Master's Degree program candidates for forty years; has authored, co-authored, or edited eleven books; is a Fellow Member of the American Society for Quality; and is a US Air Force Colonel (Ret). His complete Curriculum Vitae is at www.keplerspaceinstitute.com and e-mail is BobKrone@aol.com.

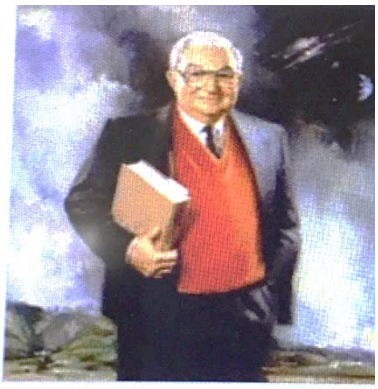
**Salena Gregory-Krone, GM-13 (Ret),** Bob Krone's wife and professional partner, had a United States Civil Service career that is recognized in the US Congressional Record. She was the Director of Equal Employment Opportunity at Norton AFB, where she personally created the first EEO plans adopted by the Department of Defense and US Air Force in the 1970s; Salena is a Research Associate for Kepler Space Institute and has published in the *Journal of Space Philosophy*.

**Kat Krone, MBA,** Director of Library Services, Kepler Space Institute, is a magna cum laude graduate of Brandeis University with Honors in Theater Arts and an MBA in Arts Administration and Labor Relations from the UCLA Anderson Graduate School of Management. Kat worked for the Screen Actors Guild (SAG) national from 1980-1986 and served as the Dallas-Fort Worth Executive Director of the American Federation of Television and Radio Actors (AFTRA)-SAG Local until 1995. Kat is currently the Vice President of Labor Relations for the TEAM Companies, where she is a subject matter expert in all SAG-AFTRA agreements. She has been with TEAM since 2004, and worked at both Media Services and Cast & Crew from 1995-2004.

**Editors' Notes:** This curriculum will set the framework for a considerable amount of ongoing research, and we are grateful to the Krones for developing it. *Gordon Arthur.*

# Space Legacy of US Representative George E. Brown, Jr.

**By Hans Johnson and Bob Krone**



A portrait of George Brown Jr. standing on the surface of the Moon.

Congressman George E. Brown, Jr., born in 1920, was one of the most celebrated elected California officials, having served in Congress for more than 30 years. He represented congressional districts in Los Angeles from 1963-1971 and the Inland Empire from 1973-1999. He died in 1999 at the age of 79, while serving his 18th term.

His professional career legacy has been preserved in the Special Collections and University Archives in the Rivera Library of the University of California, Riverside campus, Riverside, California 92517-5900, Phone: 951-827-3233. The archives' reference number is MS 351; library.ucr.edu/libraries/special-collections-university-archives. Most of the collection documents Brown's 34-year tenure in the US House of Representatives. It occupies 438 linear feet (978 boxes, 10 cartons, 20 oversize boxes) and consists of Brown's legislative, committee, campaign, and constituent files, as well as photographs, personal papers, and other materials.

The collection includes materials relating to topical issues of continuing public importance, such as human rights, climate change, alternative fuels, environmental protection, water resources in California, and federal support of scientific and technological research. Brown's collection also includes materials on important historical political events such as the Vietnam War, anti-satellite and nuclear weapons development, and the passage of the North American Free Trade Agreement (NAFTA). Brown's papers also provide a depth of material on important Inland Empire California events and history, including the closure of Norton Air Force Base, the growth of the Ontario Airport, the cleanup of the Stringfellow Acid Pits, and economic development efforts throughout inland southern California. The Brown papers are an important source of primary research materials for several fields, including public policy, political science, history, and environmental science.

**It includes 91 references to Congressman Brown's active involvement in policy for the early Space activities of the United States.**

This article for the *Journal of Space Philosophy* summarizes the contribution of Congressman George E. Brown, Jr. to early US policymaking for Space exploration, development, and human settlement.

At the opening of the George Brown Collection at UC, Riverside in November 2016, Hans Johnson, director of the George Brown Legacy Project, right, recognized important leaders in the successful effort to preserve Brown's archives and ongoing work to celebrate the public service of the late Congressman. These include Brown's sister-in-law Gloria Macías Harrison, Board Member of the San Bernardino Community College District, center, and Brown's former senior congressional aide, Bobi Johnson.


**George E. Brown, Jr.'s Space Legacy**

George Brown served on the US House of Representatives Committee on Science from 1963-1971 and again from 1973-1999. He was the Committee Chairman from 1991-1994 and the ranking Democratic member from 1995-1999. He also served at various times as chairman of the Subcommittee on Science, Research, and Technology; the Subcommittee on Environment and the Atmosphere; and the Subcommittee on Transportation, Aviation, and Materials. His service included legislation; committee hearings, briefings, and testimony; research, budget, news articles, administrative records, memorandums, and committee agendas.

From the beginning of Brown's elected public service in the state Assembly of California in 1958, he was active in Space subjects, programs, conferences, policy, and legislation. The George Brown Archives at UC, Riverside document his activity, including conducting the first Congressional hearing on global climate change and its causes in 1977. The following list of subjects in those archives will give readers an understanding of the important role George E. Brown played in the beginnings of the Space Age:

1982 *United Nations Conference on the Exploration and Peaceful uses of Outer Space*, Box 98, Folder 9.

1983 *Order of Arts and Sciences Conference on Militarization of Space*, Box 98, Folder 22.

1983 *National Space Policy*, Box 16, Folder 32.

1983 *American Bar Association Symposium on Space*, Box 98, Folder 24.

1984 *Roosevelt Center for American Policy Studies Debate on Space-Based Strategic Defense Systems*, Box 99, Folder 3.

1984 *L-5 Society Space Developments Conference*, Box 99, Folder 4.

1985 *H.J. Res. 252*, *Space Weapons Treaty Act*, Box 20, Folder 14.

1985 *H.J. Res. 318*, *Designation of Space Exploration Day,* Box 20, Folder 23.

1986 *H.R. 5366*, *Long Range Plan to Implement Report Submitted by National Commission on Space*, Box 25, Folder 7.

1986 *H.R. 4860*, *Replacement Orbiter for the Space Transportation System*, Box 25, Folder 4.

1986 *H.R. 4397*, *National Space Grant College Act*, Box 24, Folder 32.

1987 *Classified Military Space Symposium*, Box 101.

1987 *H.R. 3765*, *Commercial Space Launch Act Amendments*, Box 33, Folder 29.

1987 *H.R. 1733*, *Space Station Being Planned by NASA to Be Used for Civilian Purposes Only*, Box 30, Folder 13.

1987 *H.R. 1633*, *National Space Grant College and Fellowship Act*, Box 30, Folder 5.

1988 *Conference on Space Values*, Box 104, Folder 3.

1988 *H.R. 4218*, *Space Settlement Act*, Box 33, Folder 57.

1988 *H.R. 4399*, *Commercial Space Launch Act Amendments*, Bob 35, Folder 5.

1989 *H.J. Res. 213*, *Space Exploration Day*, Box 26, Folder 22.

1989 *H.R. 2201*, *Outer Space Protection Act*, Box 40, Folder 26.

1989 *Energy Space Board Nuclear Reactors*, Box 249, Folder 5.

1990 *H.R. 2674*, *Space Transportation Services Purchase Act*, Box 40, Folder 59.

1990 *Japan-U.S. Cooperation in Space Conference*, *Hawaii*, Box 110, Folder 8.

1990 *H. Con. Res. 74*, *Space Program*, Box 35, Folder 58.

1991 *H.R. 564*, *NASA Multi-Year Authorization*, Box 44, Folder 33.

1992 *Rockwell Space Systems Division – Space Shuttle Atlantis Return Ceremony*, Box 112, Folder 17.

1994 *Space Shuttle Columbia Return*, Box 116, Folder 12.

1997 *IEEE Aerospace Conference*, Box 120, Folder 4.

1997 *Meet with Director of the Russian Space Agency*, *Yuri Kaptivo*, Box 120, Folder 5.

1998 *H.R. 1702*, *Commercial Space Act*, Box 61, Folder 24.

1998 *International Space Station Agreements Signing Ceremony*, Box 123, Folder 4.

1998 *National Space Society (NSS) Governors Meeting*, Box 124, Folder 10.

Note: The box and folder numbers shown refer to locations in the University of Redlands Archive Catalog.

This article, expanded with the personal comments made by George E. Brown, Jr.'s family and friends who were close to him during those years, who knew of his Space work, and who later created the George Brown Legacy Project, will be presented at the Historical Society of Southern California conference in February 2018.

Marta Macias Brown, talks with former Riverside, California Mayor Ron Loveridge at a ceremony marking the completion of the project to catalog the archives of her husband, Representative George E. Brown, Jr., November 18, 2016.

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## About the Authors:

**Hans Johnson** is director of the George Brown Legacy Project, which makes the life and work of the late Congressman George Brown (1920-1999) a touchstone for education and research on the diversity, equity concerns, and environment of the Inland Region of California. This includes ensuring use of his world-renowned archives at UC, Riverside by present and future generations of scholars and leaders in science, labor, business, and public service.

**Dr. Robert M. "Bob" Krone, Ph.D.,** is President of Kepler Space Institute (KSI); is an Emeritus Professor of Systems Management at the University of Southern California; has been the principal sponsor for PhD, DBA, and Master's Degree Program candidates for forty years; has authored, co-authored, or edited eleven books; is a Fellow Member of the American Society for Quality; and is a US Air Force Colonel (Ret). His Curriculum Vitae is at (www.keplerspaceinstitute.com) and his e-mail is BobKrone@aol.com.

Bob Krone and Salena Gregory-Krone

# Journal of Space Philosophy (JSP) Board of Editors

Kepler Space Institute (KSI) is honored to have 39 of the world's Space community professionals as members of the Board of Editors for the *Journal of Space Philosophy*.

Dr. Elliott Maynard, our *Journal of Space Philosophy* Board of Editors colleague, has beautifully stated both the purpose and the style for our peer reviews:

> This is such a hi-caliber group of leading-edge thinkers and supercharged individuals, it should be natural for each of us to wish to provide a supportive and synergistic environment for the others. I have also learned always to have someone else proof read any material I write, as I have discovered that the brain tends not to "see" my own simple mistakes. Ergo, within the new Kepler context I feel editors should be there to support our writers in the most creative and positive ways possible. (e-mail to Bob Krone, March 23, 2013)

The purposes of peer reviews of article submissions to the *Journal of Space Philosophy* are: (1) to determine the relevance to the Vision and Goals of KSI; (2) to help the author(s) improve the article in substance and style or recommend references; and (3) to provide publication recommendations to the Editor-in-Chief.

**********

**1.** 

**ARTHUR, Gordon, PhD,** JSP Associate Editor, Theology at King's College, London, UK.

**For Bio Info**: www.linkedin.com/in/gdarthur.

**2.** 

**AUTINO, Adriano,** Founder, Space Renaissance International.

**For Bio Info**: www.spaceentrepreneurs.ning.com/profile/AdrianoAutino.

**3.** 

**BELL, Sherry, PhD,** Kepler Space Institute Dean, School of Psychology.

**For Bio Info:** www.nss.org/about/bios/bell_sherry/html.

**4.** 

**BLOOM, Howard K., Author, Scientist,** Founder Space Development Group, Publicist, Author on Human Evolution, Science, Technology, and Space. Photo by Luigi Novi.

**For Bio Info:** www.en.wikipedia.org/wiki/Howard_Bloom.

**5.** 

**BOLTON, Jennifer, PhD**, Co-Founder Virtual Space Orbiting Settlement VOSS. Veteran and molecular biologist, Space Pioneers Science Officer.

**For Bio Info:** Google Jennifer Bolton.

**6.** 

**BURGESS, Lowry, Professor,** Distinguished Fellow at the Studio for Creative Inquiry, Center for the Arts and Society, College of Fine Arts, Carnegie Mellon University.

**For Bio Info:** See Issue 1, no. 1 (Fall 2012), Article 13.

**7.** 

**CLEMENTS, Douglas H., MD**, American Board of Ophthalmology, "*Improving Human Vision for Space Exploration and Settlement".*

**For Bio Info:** Board Certified Ophthalmologist, University of Southern California Keck School of Medicine.

**8.** 

**DOWNING, Lawrence G., DMin,** Senior Pastor, Space Faith and Spirituality Pioneer, University Professor.

**For Bio Info:** See Issue 1, no. 1, Article 11.

**9.** 

**FITZPATRICK, Susan Beaman, DBA,** Vice Chairman, Oak Family Advisors, LLC based in Chicago. She earned her DBA with the University of South Australia in Zurich Switzerland, where she studied under the supervision of Dr. Bob Krone. She is an international health expert specializing in health risk management. She has consulted with governments, public and private providers, and within health systems projects sponsored by the World Bank, World Health Organisation, and the UK's National Health Service. Susan's research interests include management capacity development and the implementation of complex innovations and programs. She has been a keynote speaker at industry symposiums and professional organizations such as the National Risk Manager's Association, Excess Surplus Lines Claims Association, American Hospital Association, American Bar Association, and State Chambers of Commerce. Kepler Space Institute is proud to have her in the *Journal of Space Philosophy* Board of Editors.

**10** 

**HAYUT-MAN, Yitzhaq (Isaac), PhD,** Architect for the Universe, The Jerusalem Dome of the Rock as a memory site for theology, philosophy and humanity past, present and future.

**For Bio Info:** Google Yitzhaq Hayut-Man.

11. 

**HOPKINS, Mark, Chairman of the Executive Committee, National Space Society (NSS).** Space Economics. Important in founding of the L-5 Society and collaboration of the NSS with the Kepler Space Institute.

**For Bio Info:** www.nss.org/about/hopkins.html.

12. 

**ISAACSON, Joel D., PhD,** *Nature's Cosmic Intelligence*, pioneer of RD Cellular Automata since the 1960s.

**For Bio Info:** See Issue 1, no. 1 (Fall 2012), Article 7.

13. 

**IVEY, Janet,** is a Nashville TV treasure and a friend of Kepler Space Institute. Her *Janet's Planet* show is the recipient of 12 regional Emmys and five Gracie Allen Awards. She is an Ambassador of Buzz Aldrin's *Share Science Foundation*. A Google search will take you to delightful images and video clips of her teaching and entertaining children about Space.

14. 

**KHOVANOVA-RUBICONDO, Kseniya, PhD,** University of Chicago, Expert in public economics, innovation, policy and urban planning. Consultant to the Council of Europe and European Commission, proficient in six languages, Space International Economics.

**For Bio Info:** www.connect.tcp.org/profiles/profile.php?profileid=2296.

15. 

**KIM, KEE YOUNG, PhD,** Republic of Korea Senior University Academician and Administrator. Former President, Kwang Woon University; former Dean of the School of Business and Provost, Yonsei University; currently the Chairman of the Board of the prestigious Samil Foundation, the oldest Korean institution to award and provide scholarships to high-performing scientists, artist and engineers.

16. 

**KIKER, Edward, General Engineer, GS-13,** Office of the Chief Scientist, U.S. Army Space and Missile Defense Command/Army Forces Strategic Command, Kepler Space Institute Chief Scientist.

**For Bio Info:** www.indeed.com/r/Edward-Kiker/45bd40a86c090f07.

17. 

**KRONE, Bob, PhD,** *Journal of Space Philosophy* Editor-in-Chief, President, Kepler Space Institute (KSI), sponsor of this Journal.

**For Bio Info:** www.bobkrone.com/node/103.

18. 

**LIVINGSTON, David, PhD,** Founder and host, *The Space Show*.

**For Bio Info:** www.thespaceshow.com.

**19.** 

**MARZWELL, Neville, PhD,** Space Solar Power and Robotics Scientist. Career at JPL as Manager for Advanced Concepts and Technology.

**For Bio Info:** www.spaceinvestment.com/lcr2_bios.html.

**20.** 

**MATULA, Thomas L., PhD,** Business and Management Professor, Lunar Commercial scholar.

**For Bio Info:** www.trident.edu/dr-thomas-matula.

**21.** 

**MAYNARD, Elliott, PhD**, Founder, ArcoCielos Research Center, Sedona Arizona, www.arcocielos.com.

**For Bio Info:** www.fasiwalkers.com/featured/ElliottMaynard.html.

**22.** 

**MOOK, William, PE,** Trained in aerospace engineering, 15 years in alternative energy, Space Commerce Technology.

**For Bio Info:** www.vimeo.com/user1527401.

**23.** 

**OLSON, Thomas H., PhD, DBA,** Professor of Clinical Management and Organization, University of Southern California Marshall School of Business, Los Angeles, California, USA. Dr. Olson's specialty in research and consulting is on strategy, development, organization. and human capital. He has authored four books and 100 professional articles.

**For Bio Info:** www.marshall.usc.edu/faculty/directory/tholson.

**24.** 

**PALMA, Bernardino,** Historian, Portuguese Age of Discovery.

**For Bio Info:** See Issue 1, no. 1 (Fall 2012), Article 8.

**25.** 

**PEART, Kim,** Co-Founder, Virtual Orbiting Space Settlement (VOSS). Artist, visionary, virtual worlds.

**For Bio Info:** www.independentaustralia.net/about/ia-contributors/kim-peart-bio/.

**26.** 

**ROBINSON, George S., III, LLD,** Space law pioneer and international space expert. Smithsonian Institute Legal Counsel.

**For Bio Info:** See Issue 1, no. 1 (Fall 2012), Article 14.

**27.** 

**SCHORER, Lonnie Jones,** *Kids to Space* author and teacher. Architect, aviator.

**For Bio Info:** See Issue 1, no. 1 (Fall 2012), Article 17.

**28.** 

**SCHRUNK, David, MD,** Aerospace engineer, Founder, Quality Laws Institute, KSI Faculty.

**For Bio Info:** See Issue 1, no. 1 (Fall 2012), Article 18.

**29.** 

**SCHWAB, Martin, PhD,** International Space author, KSI Faculty, Aerospace Technology Working Group.

**For Bio Info:** See Issue 1, no. 1 (Fall 2012), Article 21.

**30.** 

**SCOTT, Winston E.,** American Astronaut, Vice President for Development, Florida Institute of Technology.

**For Bio Info:** www.en.wikipedia.org/wiki/Winston_E.Scott.

**31.** 

**STEPHANOU, Stephen E., PhD,** Emeritus Professor of Systems Technology, University of Southern California, Los Angeles, California, USA.

**For Bio Info:** See Issue 2, no. 2 (Fall 2013), Article 26.

**32.** 

**TANG, Terry, PhD,** Kepler Space Institute Director of Research.

**For Bio Info:** See Issue 1, no. 1 (Fall 2012), Article 24.

**33.** 

**THORBURN, Stephanie Lynne,** Author, Astrosociology.

**For Bio Info:** See Issue 1, no. 1 (Fall 2012), Article 12.

**34.** 

**WERBOS, Paul, PhD,** U.S. National Science Foundation, Space scholar.

**For Bio Info:** See Issue 1, no. 1 (Fall 2012), Article 19.

**35.** 

**WHITE, Frank, MSc,** Founder, The Overview Effect Institute.

**For Bio Info:** See Issue 1, no. 1 (Fall 2012), Article 9.

**36.** 

**WILKINS, John, PhD,** Professor of Space Settlements.

**37.** 

**WOLFE, Steven**, Space advocate and author of the 2013 Space novel, *The Obligation.*

**For Bio Info:** See Issue 2 no. 2 (Fall 2013), Article 26.

**38.** 

**YACOUB, IGNATIUS, PhD,** Founder and first Dean of the School of Business and Management, La Sierra University, Riverside, California. Currently Professor of Graduate Studies, Loma Linda University School of Social Work and Social Ecology, Loma Linda, California.

**39.** 

**ZUBRIN, Robert, PhD,** President, Mars Society.

**For Bio Info:** www.en.wikipedia.org/wiki/Robert_Zubrin.

**In Memoriam**

**BEN-JACOB, Eshel, PhD,** Former President of Israel Physical Society; Founder Science of Bacterial Intelligence. Tel Aviv University. We grieve the passing of Dr. Ben-Jacob in 2015.

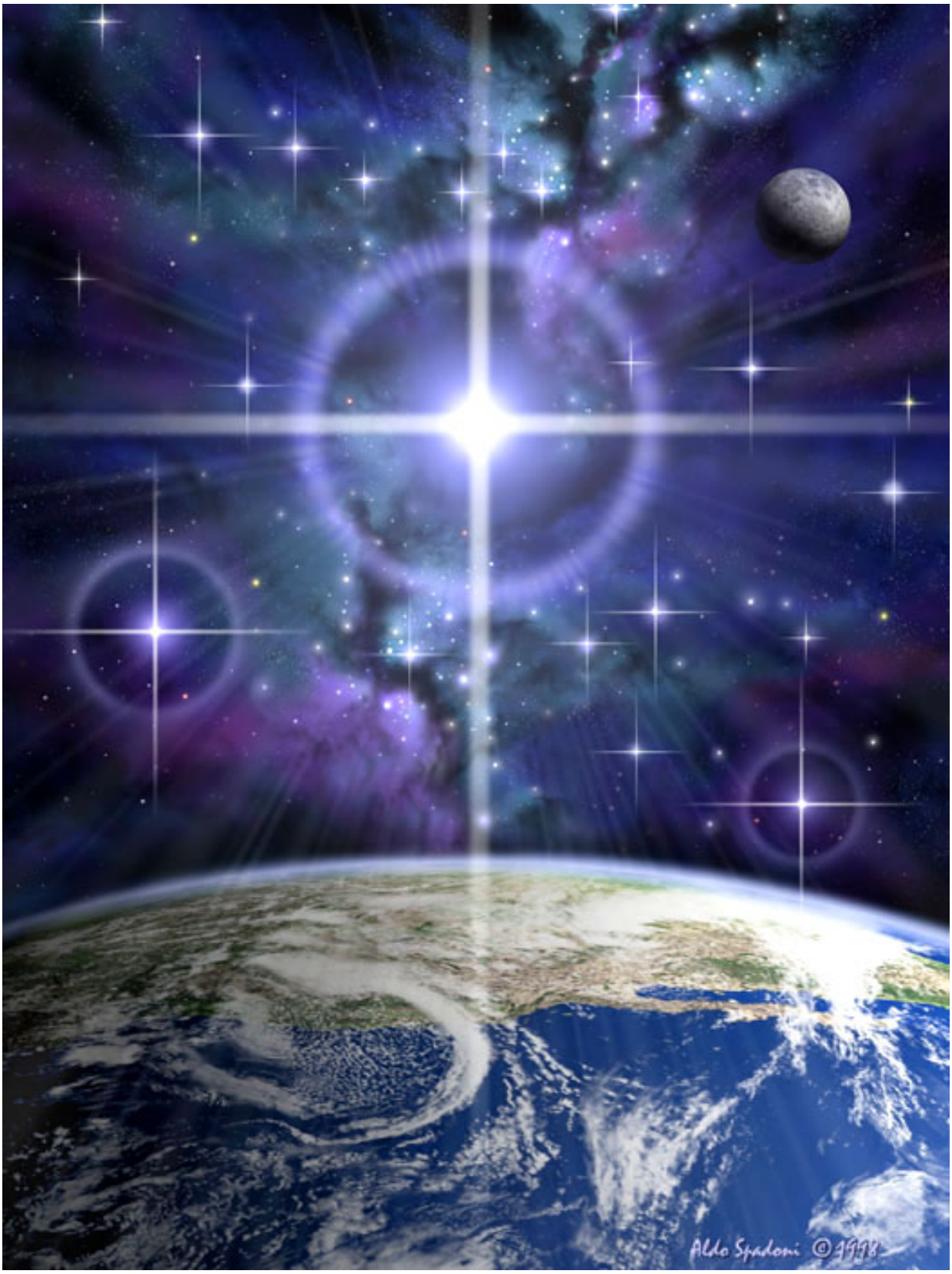
**For Bio Info:** Google Eshel Ben-Jacob.

**MITCHELL, Edgar Dean, ScD,** Captain, U.S. Navy (Ret), Apollo 14 Astronaut, sixth person to walk on the Moon, Founder Institute of Noetic Sciences. We grieve Edgar Mitchell's passing in 2016.

**For Bio Info:** Google Edgar Mitchell.

**O'DONNELL, Declan J., JD,** Space law attorney, Fifty publications in Space Law and Policy, Publisher, Space Governance Journal, President, United Societies in Space, Inc. We grieve Declan's passing in 2015.

**"The greatest use of a life is to spend it for something positive that outlasts it."** Dr. Max T. Krone, Dean, Institute of the Arts, University of Southern California and Founder, Idyllwild School of Music and the Arts, 1950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