A Universe from Nothing?
(Did the universe REALLY create itself?)

An analysis of the book “A Universe from Nothing” by Lawrence M. Krauss
In August 2008 I joined the faculty at Arizona State University as Foundation Professor in the School of Earth and Space Exploration and the Department of Physics in the College of Liberal Arts and Sciences, and Director of the University's Origins Initiative.
His main thesis

“It can be truly said that we all are here today because of quantum fluctuations in what is essentially nothing.”

“under the right conditions, not only can nothing become something, it is required to.”

“I think it is extremely significant that a universe from nothing ... that arises naturally, and even inevitably, is increasingly consistent with everything we have learned about the world.”
Krauss is an “anti-theist”

- “I wouldn’t want to live in a universe with a God.”

- “I would find little purpose living in a world ruled by some divine Saddam Hussein-like character ... who not only makes all the rules, but punishes those who disobey them with eternal damnation.”

- “In this sense, science ... does not make it impossible to believe in God, but rather makes it possible to not believe in God.”
Why is this topic important?

Ideas have consequences.

But well-articulated and widely distributed ideas from authority figures can have a large influence with large consequences!
“If *On the Origin of Species* was biology’s deadliest blow to supernaturalism, we may come to see *A Universe from Nothing* as the equivalent from cosmology.”

-- Richard Dawkins, in the Afterword of the book

(Cosmology: the study of the origin and general structure of the universe)
“those who ... require the existence of something for which there is no observable evidence whatsoever (like divine intelligence) to reconcile their view of creation with their a priori prejudices”

Some of the Top Evidences for God:
- Information
- Formation of First Life
- Design and Beauty of Living Things
- Second Law of Thermodynamics
- Irreducible Complexity
- Fine-tuning of Physics
- Fine-tuning of Earth for Life
- Human Reasoning and Logic
- Sexual Reproduction
“You are all stardust. You couldn’t be here if stars hadn’t exploded, because the elements - the carbon, nitrogen, oxygen, iron, all the things that matter for evolution and for life - weren’t created at the beginning of time. They were created in the nuclear furnaces of stars, and the only way for them to get into your body is if those stars were kind enough to explode. **So, forget Jesus. The stars died so that you could be here today.**”
Two views of origins and endings

Purpose is the most fundamental differentiator

Secular

“‘Why’ implicitly suggests purpose, and when we try to understand the solar system in scientific terms, we do not generally ascribe purpose to it.”

-- Krauss

Biblical

For this is what the LORD says— he who created the heavens, he is God; he who fashioned and made the earth, he founded it; he did not create it to be empty, but formed it to be inhabited

-- Isaiah 45:18
Contrasting evolutionary and biblical beginnings

Secular

Big Bang: 15 Billion years ago
Stars: 10 Billion years ago
Sun: 5 Billion years ago
Molten Earth: 4.5 Billion years ago
First Oceans: 3.8 Billion years ago

Biblical

Day 1-2: Water covered Earth
Day 3: Dry land and plants
Day 4: Sun, moon, and stars
Day 5: Sea and flying creatures
Day 6: Land animals and Man
Contrasting evolutionary and biblical endings

Secular

Big Bang Future of the Universe

Biblical Future of the Universe

Biblical

Six-Day Creation

Thousands of Years

Sin and Death

Eternity

Genesis

2 Peter 3

Revelation

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Secular Cosmology

Review of some relevant concepts

- Big Bang
- Cosmic Evolution
- Abiogenesis (non-life to life)
- Biological Evolution
Standard model of cosmology (the “Big Bang”)

Formation of atoms

The Big Bang (a second view)
Big Bang concepts

- Space and time begin with the Big Bang
- It is not really an explosion, it is an expansion
- It is not an expansion into pre-existing space, space is being created with the expansion
- It is an expansion in a “fourth dimension”
  - The expansion has no center
- The universe is homogeneous (the same in every direction)
  - There is no special place in the universe
Expansion is in a fourth dimension

Buttons on a balloon provide a 2D objects expanding in 3D analogy – here 3D galaxies are expanding into a 4D space.

Expanding distance between galaxies

http://universe-review.ca/F02-cosmicbg.htm
The universe is structured

- Stars
- Organized into galaxies
- Form clusters
- Form filaments and superclusters
- Separated by immense voids
- Creating a “cosmic web”
Large scale universal structures

Sloan Great Wall – 11,243 galaxies

CfA2 Great Wall – 1,732 galaxies

http://pil.phys.uniroma1.it/twiki/bin/view/Pil/GalaxyStructures
Inflation Theory Solves

- The horizon problem
  - The temperature of the CMB (Cosmic Microwave Background) radiation is essentially the same in all directions (without inflation there has not been enough time for thermal equilibrium to be reached)

- The flatness problem
  - The expansion rate of the universe is very finely balanced with gravity (without inflation this is a fantastic coincidence as the accidental byproduct of a Big Bang)
The horizon problem
How can A & B have uniform temperatures if they have never communicated?

Big Bang expansion

Maximum distance light could have travelled since

A & B became far apart due to expansion. Not enough time for light to travel between A & B and establish equilibrium temperature.
### Curvature of the universe

<table>
<thead>
<tr>
<th>Density condition</th>
<th>Curvature</th>
<th>Universe Type</th>
</tr>
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<tbody>
<tr>
<td>Density greater than the critical density</td>
<td>Positive curvature</td>
<td>Closed universe</td>
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<tr>
<td>Density equal to the critical density</td>
<td>Flat</td>
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We appear to live in a "flat" universe.
a  Spherical space
\[ \rho_0 > \rho_c, \Omega_0 > 1 \]

b  Flat space
\[ \rho_0 = \rho_c, \Omega_0 = 1 \]

c  Hyperbolic space
\[ \rho_0 < \rho_c, \Omega_0 < 1 \]

Parallel light beams converge

Parallel light beams remain parallel

Parallel light beams diverge

http://crabo.astr.nthu.edu.tw/~hchang/ga2/f2804-geometry.JPG
Measurement of the cosmic background radiation indicates a flat universe

http://scienceblogs.com/startswithabang/files/2012/07/model_maps-600x590.jpg
Dark matter and dark energy

- **Dark matter**: needed to account for gravitational forces within and between galaxies
- **Dark energy**: needed to account for the accelerating expansion of the universe

Nobody knows what they really are!

http://www.nrao.edu/index.php/learnsciencedarkmatteranddarkenergy
Sir Fred Hoyle put it succinctly when he referred to the Big Bang model as a
  “dull-as-ditchwater expansion which degrades itself adiabatically [without loss or gain of heat] until it is incapable of doing anything at all. The notion that galaxies form, to be followed by an active astronomical history, is an illusion. Nothing forms; the thing is dead as a doornail”

Biblical Cosmology
The beginning as revealed by God in the Bible

- Eternal God
- Six-day creation
- Life from God
What is the biblical purpose of the universe?

Practical

“And God said, “Let there be lights in the vault of the sky to separate the day from the night, and let them serve as signs to mark sacred times, and days and years, and let them be lights in the vault of the sky to give light on the earth.” – Genesis 1:14-15

Theological

“The heavens declare the glory of God; the skies proclaim the work of his hands.” – Psalm 19:1
Biblical references to the universe being "stretched out"

- **Job 9:8** - He alone stretches out the heavens
- **Ps 104:2** - He stretches out the heavens like a tent
- **Isa 40:22** - He sits enthroned above the circle of the earth, and its people are like grasshoppers. He stretches out the heavens like a canopy, and spreads them out like a tent to live in.
- **Isa 42:5** - He who created the heavens and stretched them out
- **Isa 45:12** - My own hands stretched out the heavens
- **Jer 10:12** - [God] stretched out the heavens by his understanding
- **Zec 12:1** - The LORD, who stretches out the heavens
Extension of work done by theoretical physicist Moshe Carmeli. The universe is an expanding white hole with our galaxy at the center.

- The theory is a 5-dimensional modification and extension of Einstein’s general theory (“spacevelocity” instead of “spacetime”) – the fabric of space itself is expanding
- Assumes a spherically symmetric, finite, bounded universe with the earth near the center
- Does away with need for dark matter and dark energy
- We are seeing the creation process in the heavens as it was happening on day four of the creation week
Day four process

Initial radius = 8 million light years
God stretches the heavens on day four
Galaxies were created closer to earth
God expanded the space dragging them apart
Additional galaxies were created during the expansion
“These "quantum fluctuations" imply something essential about the quantum world: nothing always produces something if only for an instant.”

“I want to stress that a multiverse is inevitable if inflation is eternal, and eternal inflation is by far the most likely possibility in most, if not all, inflationary scenarios.”
Virtual particles

Most of Space

Virtual pairs of electrons and positrons continually appear and annihilate each other.

Pairs of virtual electrons and positrons can pop into existence, as long as they annihilate each other before they can be detected.

Lamb Shift
(shows virtual particles are a reality)

Effects of virtual particles are needed to match theory with measurement – considered strong support of quantum electrodynamics

http://universe-review.ca/l15-63-Lambo.jpg

http://people.seas.harvard.edu/~xiaofeng/Lamb-shift.jpg
the quantum vacuum cannot be perceived or measured directly since it appears to be empty, in fact it is filled with potentiality

within the quantum vacuum, pairs of virtual matter and anti-matter particles are continually created and destroyed, borrowing their mass/energy by the uncertainty principle. They do not exist as observable entities, but their existence is exerted on other particles as a subtle pressure (called the Casimir effect)

http://abyss.uoregon.edu/~js/images/quantum_vacuum.gif
Heisenberg Uncertainty Principle (HUP)

There is a fundamental limit to the precision with which both particle position and momentum can be known at the same time.

http://universe-review.ca/l15-80-uncertainty.jpg
At home with the Heisenbergs

I can’t find my car keys.

You probably know too much about their momentum.
Virtual particles that carry away zero energy can exist for arbitrarily long times.

At precisely zero energy, particle duration time can be long.
The law of conservation of energy states that the total energy of an isolated system cannot change. A zero-energy universe hypothesis states that the total amount of energy in the universe is exactly zero. That is the only kind of universe that could come from nothing, assuming such a zero-energy universe is, already, nothing. Such a universe needs to be flat.
Tiny closed universe with zero total energy rapidly inflates to a flat universe, before it collapses.
A generic property of inflation is the balancing of the negative gravitational energy, within the inflating region, with the positive energy of the inflaton field to yield a post-inflationary universe with negligible or zero energy density. It is this balancing of the total universal energy budget that enables the open-ended growth possible with inflation; during inflation energy flows from the gravitational field (or geometry) to the inflaton field—the total gravitational energy decreases (i.e. becomes more negative) and the total inflaton energy increases (becomes more positive). But the respective energy densities remain constant and opposite since the region is inflating. Consequently, inflation explains the otherwise curious cancellation of matter and gravitational energy on cosmological scales.
Quantum gravity allows space-time to spontaneously appear (from nothing)
The idea that there may be an almost infinite number of universes, each having different laws of physics
We happen to live in one “just right” for life

Used to avoid the “fine-tuning” problem, that our universe seems to be special
All models of eternal inflation produce an infinite multiverse, typically a fractal

A universe from nothing key steps

1. Quantum gravity forms a space-time region
2. The space-time region is a quantum vacuum (quantum laws operational)
3. Virtual particle forms having precisely zero total energy
4. Zero total energy allows it to exist longer
5. Positive kinetic energy is precisely balanced by negative gravitational energy
6. Tiny closed universe is formed
7. Rapidly inflates to a flat universe
8. This universe happens to have just the right physics and properties for cosmic and biological evolution
Problems with the Krauss view

He conveniently glosses over a number of logical and scientific issues

1. Arbitrary definition of “nothing”
2. Krauss nothing is not true nothing
3. Cosmological Argument
4. A necessarily existent, transcendent mind is required
5. Laws of nature are descriptive not creative
6. Quantum states are arrangements of physical stuff and not creation from nothing
7. His “science” (mostly speculation) ASSUMES there is no God to show that God is not necessary
8. Evolutionary claims have poor scientific status
Krauss defines “nothing” = “quantum vacuum”

- Why would that have been the initial default state of the universe?
- Where did the quantum vacuum come from?

- Where did the laws of quantum mechanics come from?
- Is there some point at which there are no further preconditions to be explained?
One of the oldest principles of rational philosophy is *ex nihilo nihil fit*: out of nothing, nothing comes.

“Nothing could be more irrational than the idea that something comes from nothing.”

-- R.C. Sproul
Biblical creation is *creatio ex nihilo*, meaning ‘creation [by a creator] not out of any pre-existing stuff’.

- Belief in a necessarily existent being who grounds the potential for the existence of contingent things and who actualises that potential via a freely chosen act of omnipotence is a logically coherent answer to the question of why the physical universe exists. Moreover, this answer is supported by the cosmological argument.
1. Everything that exists has an explanation of its existence, either in the necessity of its own nature or in an external cause.
2. The universe exists.
3. Therefore the universe has an explanation of its existence.
4. If the universe has an explanation of its existence, that explanation is God.
5. Therefore, the explanation of the universe’s existence is God.
A necessarily existent, transcendent mind is required

If the process of everything getting its existence from something else went on to infinity, then the thing in question would never have existence. And if the thing has existence then the process hasn’t gone on to infinity. There was something that had existence without having to receive it from something else.

http://www.bethinking.org/is-there-a-creator/a-universe-from-someone-against-lawrence-krauss
Cause and effect illustration

Great First Cause (God)

No space No time

Time starts here

Back in Time

October 2014

NJBibleScience.org
Laws of nature are descriptive not creative

David Albert, *The New York Times* review:

- What the fundamental laws of nature are *about*, and *all* the fundamental laws of nature are about, and *all there is* for the fundamental laws of nature to be about, insofar as physics has ever been able to imagine, is how that elementary stuff is *arranged*.

- But the laws have no bearing whatsoever on questions of where the elementary stuff came from, or of why the world should have consisted of the particular elementary stuff it does, as opposed to something else, or to nothing at all.

Quantum states are arrangements of physical stuff

Relativistic-quantum-field-theoretical vacuum states — no less than giraffes or refrigerators or solar systems — are particular arrangements of elementary physical stuff. The true relativistic-quantum-field-theoretical equivalent to there not being any physical stuff at all isn’t this or that particular arrangement of the fields — what it is (obviously, and ineluctably, and on the contrary) is the simple absence of the fields! The fact that some arrangements of fields happen to correspond to the existence of particles and some don’t is not a whit more mysterious than the fact that some of the possible arrangements of my fingers happen to correspond to the existence of a fist and some don’t. And the fact that particles can pop in and out of existence, over time, as those fields rearrange themselves, is not a whit more mysterious than the fact that fists can pop in and out of existence, over time, as my fingers rearrange themselves. And none of these poppings — if you look at them aright — amount to anything even remotely in the neighborhood of a creation from nothing.

If there is no God...

- Then the universe must have come from nothing or created itself, because there was no one to start it!
- Then inflation must be true, because the scientific facts of near-constant background temperature and flat universal geometry demand it.
- Then the multiverse must be true, because the scientific facts of fine-tuning and improbability demand it.
- Then cosmic evolution must be true, because we are on the Earth, a planet well-suited for life!
- Then abiogenesis and biological evolution must be true, because here we are, living beings!
The “science” used to show that God is unnecessary (and therefore probably doesn’t exist) is based on the ASSUMPTION that God does not exist.
Because if God does exist we have excellent explanations

- God created the universe (from true nothing)
- There is no need for inflation
- There is no need to think there may be other universes
- There is no need for cosmic evolution as God made the Earth directly to be inhabited
- God turned non-life into life (breathing life into Adam)
- God created the kinds of plants and animals directly
Evolutionary claims have poor scientific status

- Creation of the universe – could never happen from true nothing
- Inflation – speculation, not reproducible
- Multiverse – speculation, could NEVER be proven
- Cosmic evolution – speculation never observed (takes too long they say)
- Abiogenesis – anti-science, against the Law of Biogenesis
- Biological evolution – never observed, many scientific reasons against it even being possible (e.g. information, irreducible complexity)
20 For since the creation of the world God’s invisible qualities—his eternal power and divine nature—have been clearly seen, being understood from what has been made, so that people are without excuse...

22 Although they claimed to be wise, they became fools...

25 They exchanged the truth about God for a lie, and worshiped and served created things [evolutionary theories] rather than the Creator.
Conclusions

- True “nothing” cannot produce “something”
- Krauss has NOT SHOWN how our universe could have created itself from nothing
- There is no getting away from the need for an ultimate beginning by an uncaused, eternal, transcendent mind
- God exists and He is the creator!
God created. The Bible says so. Science confirms it.