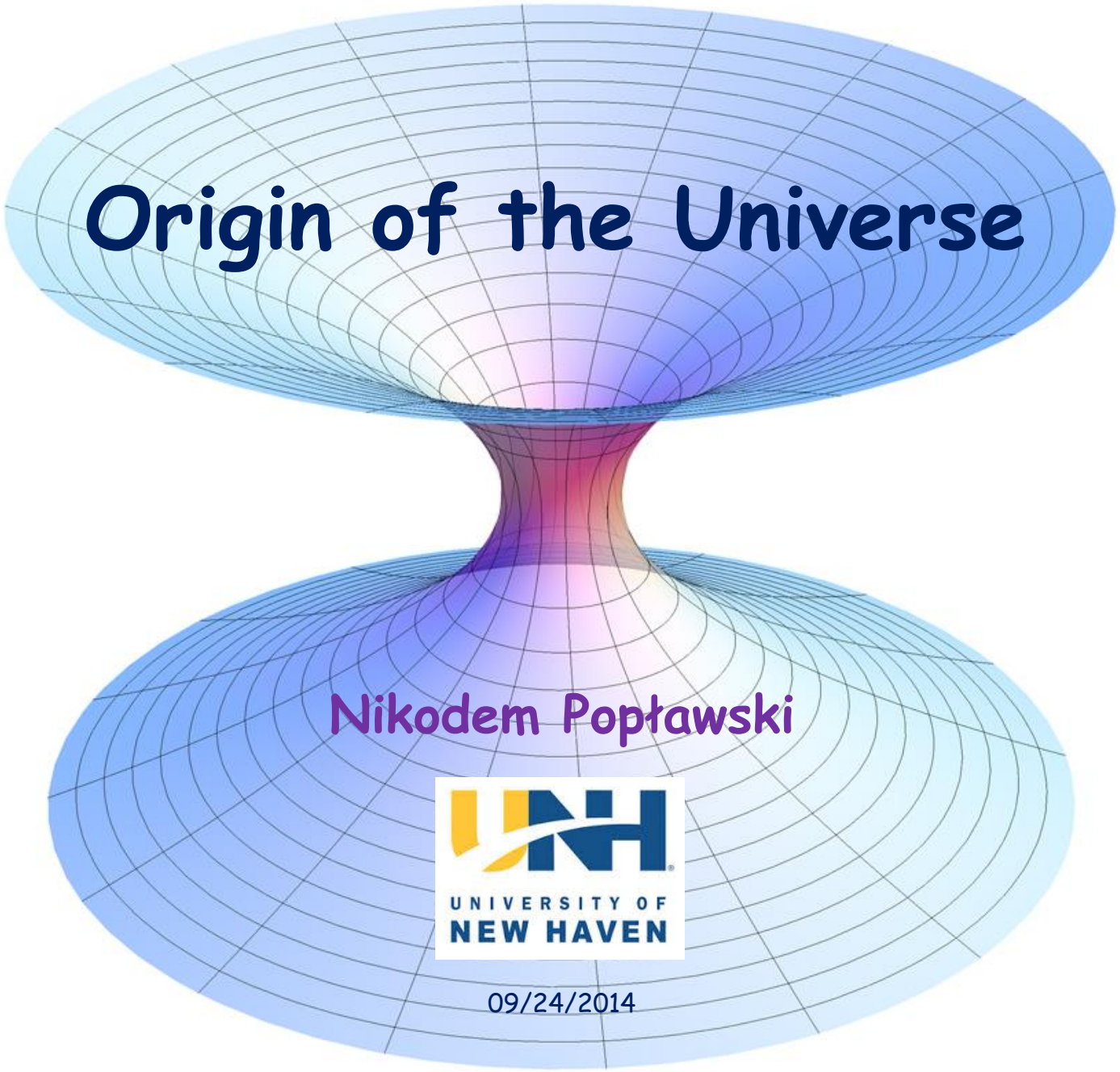

Origin of the Universe

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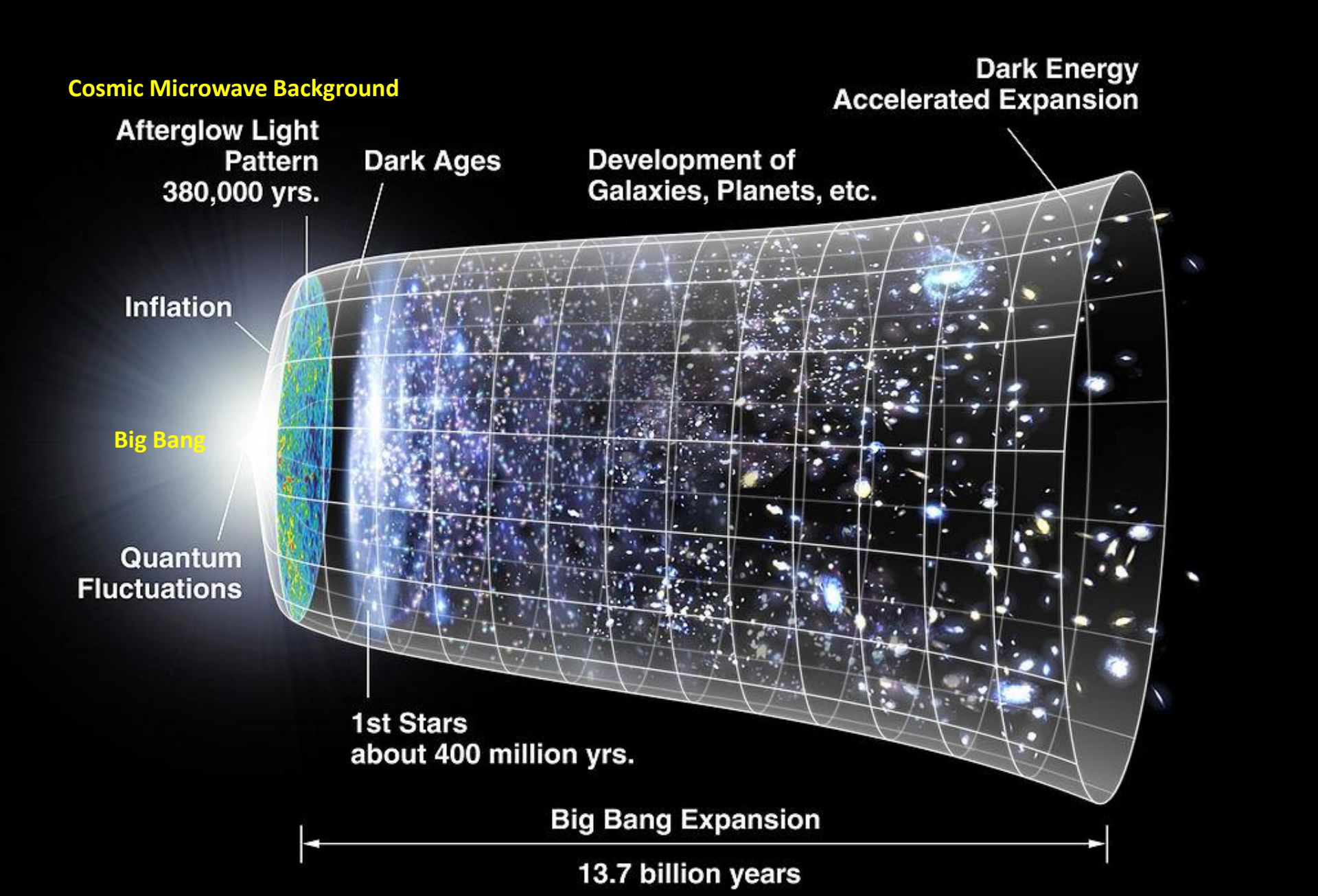
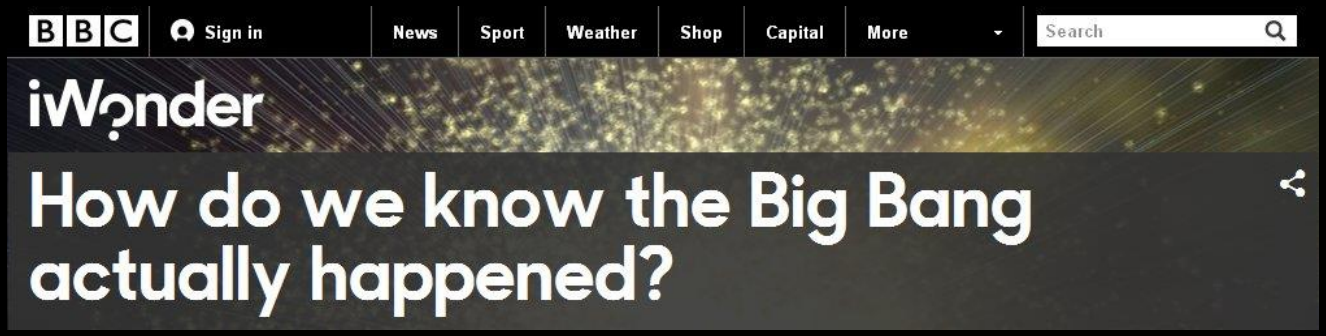
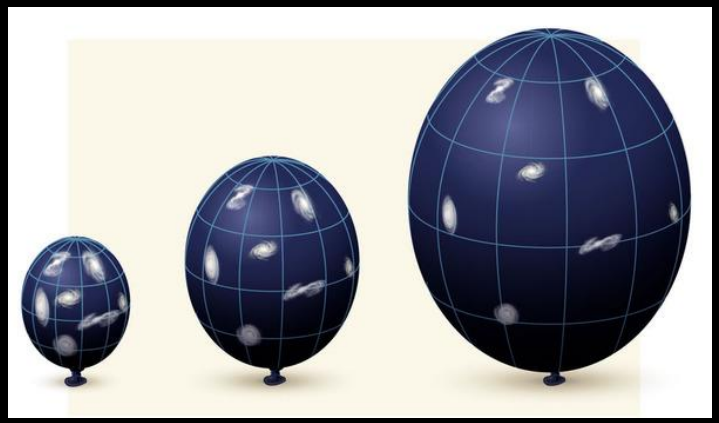
09/24/2014





We can see the Universe expanding: galaxies look redder as they speed away (just as sirens sound lower pitched).



The 2-dimensional surface of the balloon is an analog to our 3-dimensional space.

The 3-dimensional space in which the balloon expands is not analogous to any higher dimensional space. Points off the surface of the balloon are not in the Universe in this simple analogy.

The Universe may be finite or infinite.

Image credit: One-Minute Astronomer

So what caused the Big Bang?

What triggered the Big Bang is a question that still puzzles some of the best scientific minds. Could one of these theories be the answer? (Image: NASA)

Explosion from a black hole	Cycles of death and rebirth	Bubbles in a parent multiverse	There is no cause
			
Physicist Nikodem Poplawski's theory. Image credit: NASA/JPL-Caltech.	The Big Bounce theory. Image credit: NASA/GSFC/Dana Berry.	The Chaotic Inflation theory. Image credit: NASA/ESA /Johan Richard.	Prof Stephen Hawking's theory. Image credit: BBC.

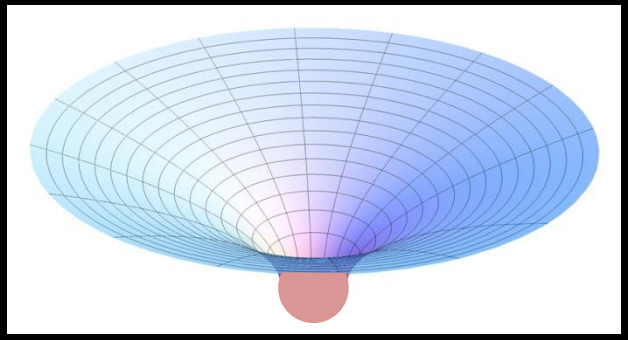
Explains what happens in black holes (regions of space from where nothing can escape).

Every black hole becomes a doorway (Einstein-Rosen bridge) to a new, growing universe on the other side of its boundary (event horizon).

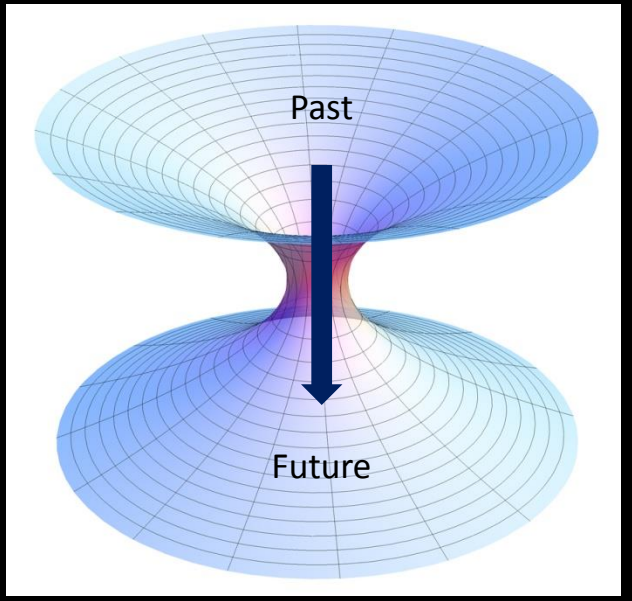
Black holes are wormholes

A child universe in a black hole is invisible for observers outside the black hole (which exists in a parent universe) because the black hole forms in infinite future for such observers.

For observers in the child universe, the bridge looks like a white hole (the opposite of a black hole).



The motion of matter through a bridge is one-directional and can define the arrow of time.



To form a bridge, we need a mechanism which avoids a singularity in a black hole.

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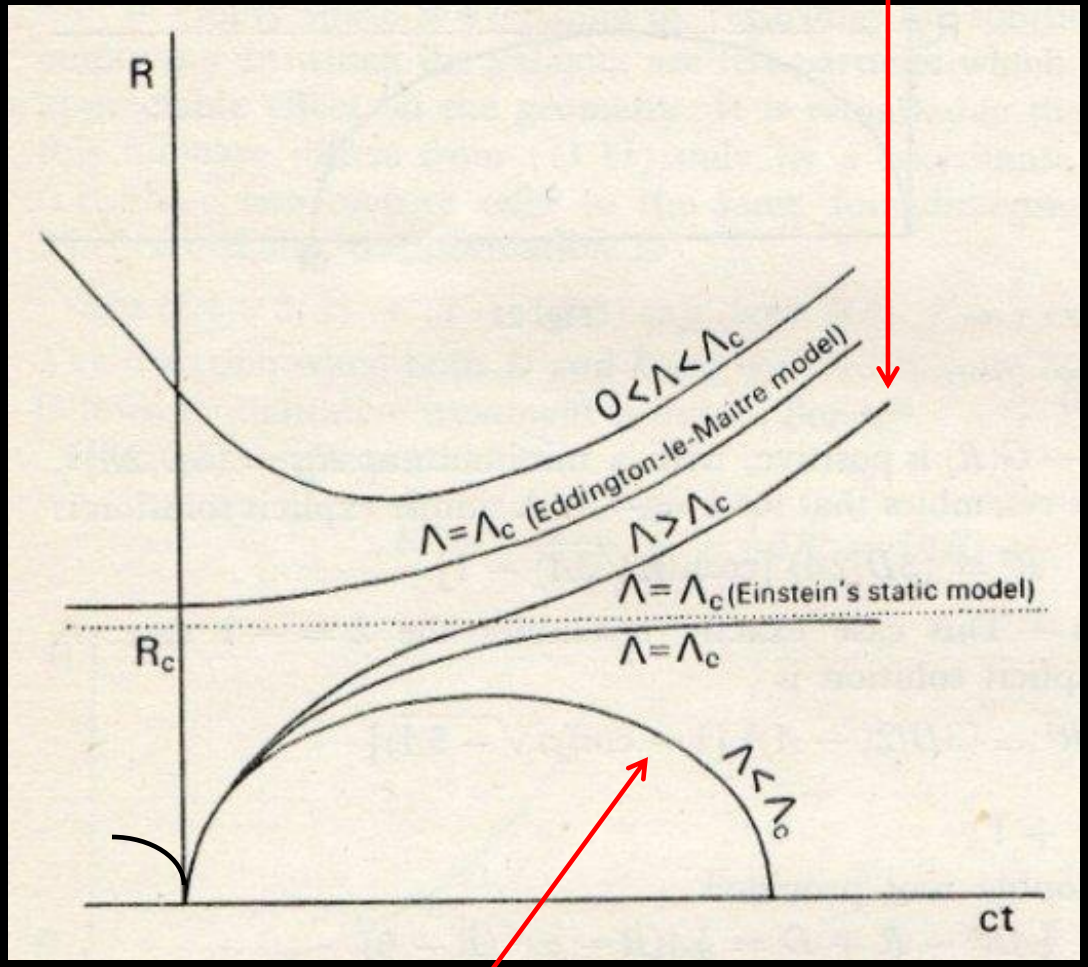
Cosmology with torsion: An alternative to cosmic inflation

Nikodem J. Popławski

We propose a simple scenario which explains why our Universe appears spatially flat, homogeneous and isotropic. We use the Einstein–Cartan–Kibble–Sciama (ECKS) theory of gravity which naturally extends general relativity to include the spin of matter. The torsion of spacetime generates gravitational repulsion in the early Universe filled with quarks and leptons, preventing the cosmological singularity: the Universe expands from a state of minimum but finite radius. We show that the dynamics of the closed Universe immediately after this state naturally solves the flatness and horizon problems in cosmology because of an extremely small and negative torsion density parameter, $\Omega_S \approx -10^{-69}$. Thus the ECKS gravity provides a compelling alternative to speculative mechanisms of standard cosmic inflation. This scenario also suggests that the contraction of our Universe preceding the bounce at the minimum radius may correspond to the dynamics of matter inside a collapsing black hole existing in another universe, which could explain the origin of the Big Bang.

If quantum effects in the gravitational field near the bounce produce enough matter (the total energy does not change), dark energy takes over at later times and a universe in a black hole expands forever.



Otherwise, such a universe contracts back and starts over.

General relativity:
Matter tells spacetime how to curve, spacetime tells matter how to move.

Quantum mechanics:
Elementary particles possess an intrinsic angular momentum (spin) which does not represent rotation.

Gravity with spin requires curvature and torsion

Curvature – "bending" of spacetime by energy and momentum.
Torsion – "twisting" of spacetime by spin.

Twisting a thin rod is less apparent than bending. Effects of torsion are important only at extremely high densities (in black holes and in the very early Universe).

Torsion in Einstein-Cartan theory manifests itself as a repulsive force which opposes gravitational attraction and prevents singularities (points of infinite density).

A new universe in a black hole forms because of torsion

Cosmic inflation (exponential expansion of the very early Universe) uses hypothetical fields to explain why the present Universe:

- Looks the same (at largest scales) in all directions,
- Has the same properties at all points in space,
- Is nearly flat.

Cosmology with torsion also explains these three phenomena. In addition, it:

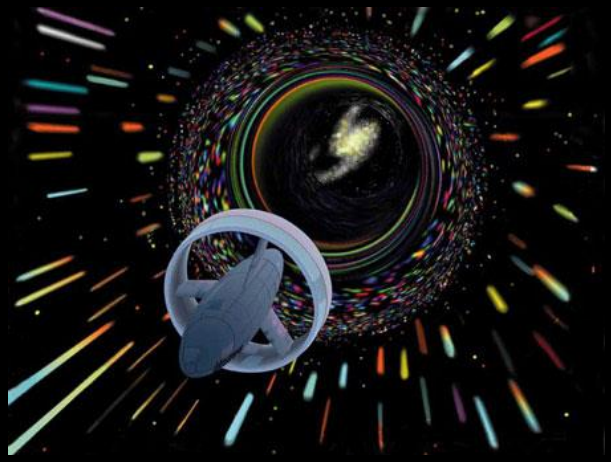
- Explains what existed before the Big Bang,
- Removes a singularity at the Big Bang, replacing it with a “Big Bounce”,
- Explains what happens in black holes,
- Predicts that our Universe is closed – can be tested (density parameter).

Inflation predicts the observed patterns in the Cosmic Microwave Background. Effects of torsion – work in progress.

There are still questions which need to be answered:

- What is dark energy? (68% of the Universe)
- What is dark matter? (27% of the Universe)
- What happened to antimatter? (torsion may explain the observed asymmetry between matter and antimatter)
- Nature of Multiverse.

How to test that every black hole is a doorway to another universe?
To boldly go where no one has gone before.



Since all stars rotate, all black holes rotate. A universe in a rotating black hole inherits its axis of rotation as a preferred direction, which may be supported by the observed motion of galaxy clusters and chirality of spiral galaxies.

More accurate observations of the Cosmic Microwave Background may support torsion.

Torsion predicts that elementary particles are spatially extended (10^{-27} m) which may be observed one day.