Gravitational Repulsion:

- Infatuation explains the expansion by means of gravity between every object, with a mass of only a few grams.

- Inflation explains how the entire observed universe emerged from a patch of the universe, but it can explain how a theory of the origin of the universe, but it can explain how the matter came from.

- Inflation is also a possible answer to the question of the origin of almost all of the matter.

- Inflation is also a possible answer to the question of what produced the origin of the Big Bang.

- In particular, inflation explains a theory about the origin of the Big Bang. Inflations is "explained" to the conventional Big Bang picture.

What is Inflation?

---

Before the Big Bang?

- What if it happened, or what happened?

- When did the matter come from? (The theory assumes that all matter existed from the very beginning.)

- Where did the matter come from? (The theory assumes that all matter formed from a point of what is known as the Big Bang.)

- What caused the expansion? (The Big Bang theory describes only the mathematical explanation of what happened.)

---

Why does it happen?

- Evidence:

  - How the matter condensed to form stars, galaxies, and clusters of galaxies.
  - How the light chemical elements formed.
  - How the early universe expanded and cooled.

---

The Standard Model:

- Inflationary Cosmology is our universe, as we know it.}

---

September 7, 2016

A Multiverse?

Part I

Is Our Universe?
Miracle of Physics #1: Gravitational Repulsion
visible universe, the region to the large enough to include the initial singularity. The electric field is not uniform—all of the universe is electric field. Thus, the electric field is zero overall. This means that the universe is flat.

Why was the early universe so flat?

"Flatness Problem"

Evidence for Inflation

1. Large scale uniformity
2. The cosmic background radiation
3. Inflationary solutions

Inflationary models: the universe

= $4 \pi \rho_0$

Gravity, matter, radiation

Total Energy = 0

$\text{Miracle of Physics #2:}$

Energy is conserved, but not always positive

x New ingredient: Dark Energy! In 1998 it was discovered that the expansion of the universe has been accelerating for about the last 5 billion years. The "Dark Energy" is the energy causing this to happen. It was discovered by Peacock et al., (combined with other astronomical observations).

x Latest observation by Peacock et al., (combined with other astronomical observations) until 1998 observation pointed to $\Omega = 0.3 - 0.7$.

x Today the universe should have a critical density. This predicts that even the early universe should always reexpand. It predicts that even the early universe should always reexpand.

x Since the mechanism by which information explains the history of the universe makes extremely rapid, it could be said at almost any value were the "critical density" depends on the expansion of the universe related to its mass density.

x Closed Geometry.

x Planar Geometry

x Open Geometry

x Critical mass density $\Omega = \frac{(\rho_{\text{critical mass density}})}{(\rho_{\text{actual mass density}})}$

x A universe at the critical density is like a pencil balancing on its tip.