Cosmological Plasma

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$10^{\rm th}$ EGYPlasma School – 2025





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Introduction

- It is highly advantageous to have several different models in order for the scientific method to work in the most efficient manner.
- Three well-known examples may show how wildly different descriptions can Successfully describe (almost) the same data:
 - 1. Classical Mechanics Theory: Newtonian Gravitation (gravitational forces) versus General Relativity (no gravitational forces, instead geodesic 'free-falling' motion in curved spacetime).
 - 2. **Particle Physics Theory:** S-matrix Theory (only observable entities) versus Quantum Field Theory (unobservable fields).
 - Quantum Mechanics Theory: Orthodox 'Copenhagen' Quantum Mechanics (intrinsically probabilistic and observer subjective) versus Bohm's Quantum Mechanics (deterministic and objective with non-local 'hidden variables').



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- Fate: $t \to \infty$.
- Length Scale: L > 100 Mpc



Histroy of the universe



Cosmology Models

• Standard Model: Hot Big Bang



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• Non-Standard Model: Cosmological Plasma





Radiation Era

• t = 0 S: Big Bang



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- t = 380,000 Y: First Atom





Matter Era

• t = 380,000 Y - 200 MY: Dark Age



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- t = 200 mY 1 BY: Cosmic Formation



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- t = 13.8 BY: Present Day
- $t \to \infty$: Far Future (Big Crunch OR Big Rip OR Big Freeze)





• The Big Bang

• The Black Hole

• The Dark Matter

• The Dark Energy



Universe Geoemetry Friedmann Equations

• The expansion:

$$\left(\frac{\dot{a}}{a}\right)^2 = \frac{8\pi G\varepsilon}{3} - \frac{kc^2}{a^2}$$

- -Einstein **Static** Universe: $\frac{8\pi G\varepsilon}{3} = |\frac{kc^2}{a^2}|$. -Expanding **Flat** Universe $(k = 0) \rightarrow$ **Big Freeze** -Expanding **Open** Universe $(k < 0) \rightarrow$ **Big Rip**
- -Contracting Close universe (k > 0): $\frac{8\pi G\varepsilon}{3} < |\frac{kc^2}{a^2}| \rightarrow$ Big Crunch

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- The acceleration:

$$\left(\frac{\ddot{a}}{a}\right) = -\frac{4\pi G}{3} \left(\varepsilon + \frac{3P}{c^2}\right)$$

(2)

- - $P \ge 0$: Normal Pressure \rightarrow Deceleration.
- -P < 0: Negative Pressure \rightarrow Acceleration.
- Note that $k \to 0$, $P \to 0$: Newtonian cosmology.

Universe Geometry and Fate Scenarios



Sum of angles > 180°

Sum of angles < 180°

Sum of angles = 180°



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- The beginning of the universe is: The Big Bang.
- The fate of the universe is: Big Crunch OR Big Rip OR Big Freeze.

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 - Cosmological Plasma



Cosmological Plasma (Non-Standard Cosmology)

-The Klein - Alfven model: The actualistic approach is preferred in the model, where we try to extrapolate back in time to even more ancient states,

- 1. The same basic laws of plasma physics hold everywhere; the use of plasma scaling to extrapolate the results of laboratory experiments and plasma physics observations and scale them over many orders of magnitude up to the largest observable objects in the universe.
- 2. Mapping of electric fields and currents is necessary to understand cosmic plasma
- 3. Space is filled with a network of currents leading to the cellular and filamentary structure of matter and which transfer momentum and energy over very large distances.
- 4. Double layers, critical velocity, and pinch effects are of decisive importance in how cosmic evolves.

The Klein - Alfven model

• Consequences of the Cosmological Plasma Model:

- 1. At very long time ago, there was an extremely low density ambiplasma in the universe. Ambiplasma filled in the sphere with a radius of 10^{12} light years.
- 2. By the simultaneous actions of gravity and electromagnetism, the observable universe is divided into a large number of cells, half of which contain matter and half antimatter. Symmetry between matter and antimatter throughout the cosmos.
- 3. Since its density was too law, one proton or antiproton in every , annihilation was negligible. The only important thing at that time was gravity.
- 4. Thus all spheres began to contract. When the density became one particle per cubic then there were a chance of collision between particles and antiparticles.
- 5. Thus, little by little, the annihilation began. During this annihilation process, a huge amount of radiation and heat released.
- 6. Annihilation is the only (known) source of energy large enough to cause the Hubble expansion.
- 7. In plasma cosmology there is no beginning and the universe is eternal.



Big-Bang Vs Continuus Creation



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Thank You! Questions are Welcome.



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