



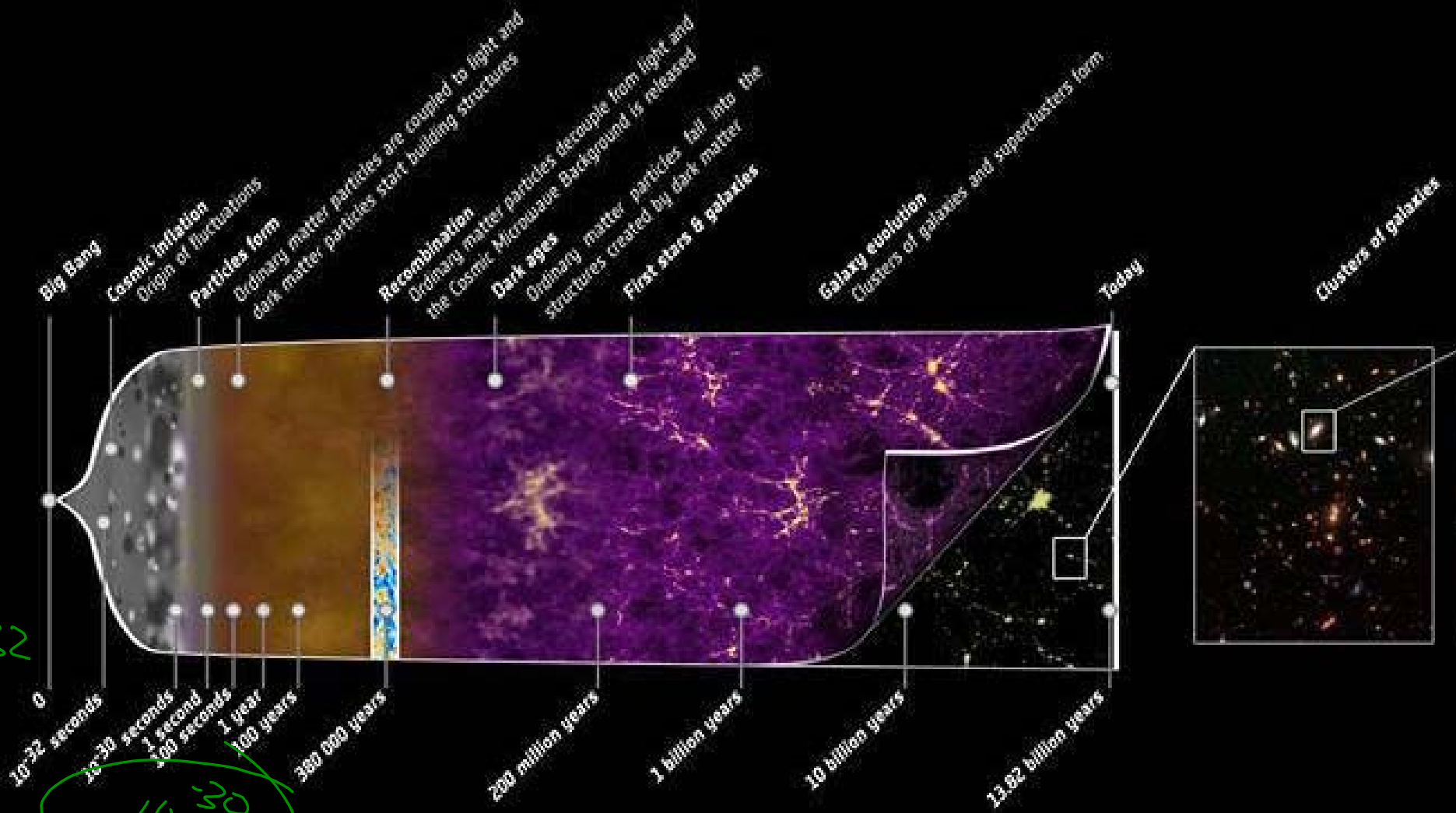
MODERN PHYSICS

1) Reality
→ Big bang
→ time dilation

2) Quantum physics
→ atoms

BIG BANG THEORY

- **Big Bang theory** is the most widely accepted cosmological explanation of how the universe formed.
- the universe began about 13.7 billion years ago.
- Everything that is now in the universe was squeezed into a very small volume
- An enormous explosion — a big bang — caused the universe to start expanding rapidly.
- All the matter and energy in the universe, and even space itself, came out of this explosion.

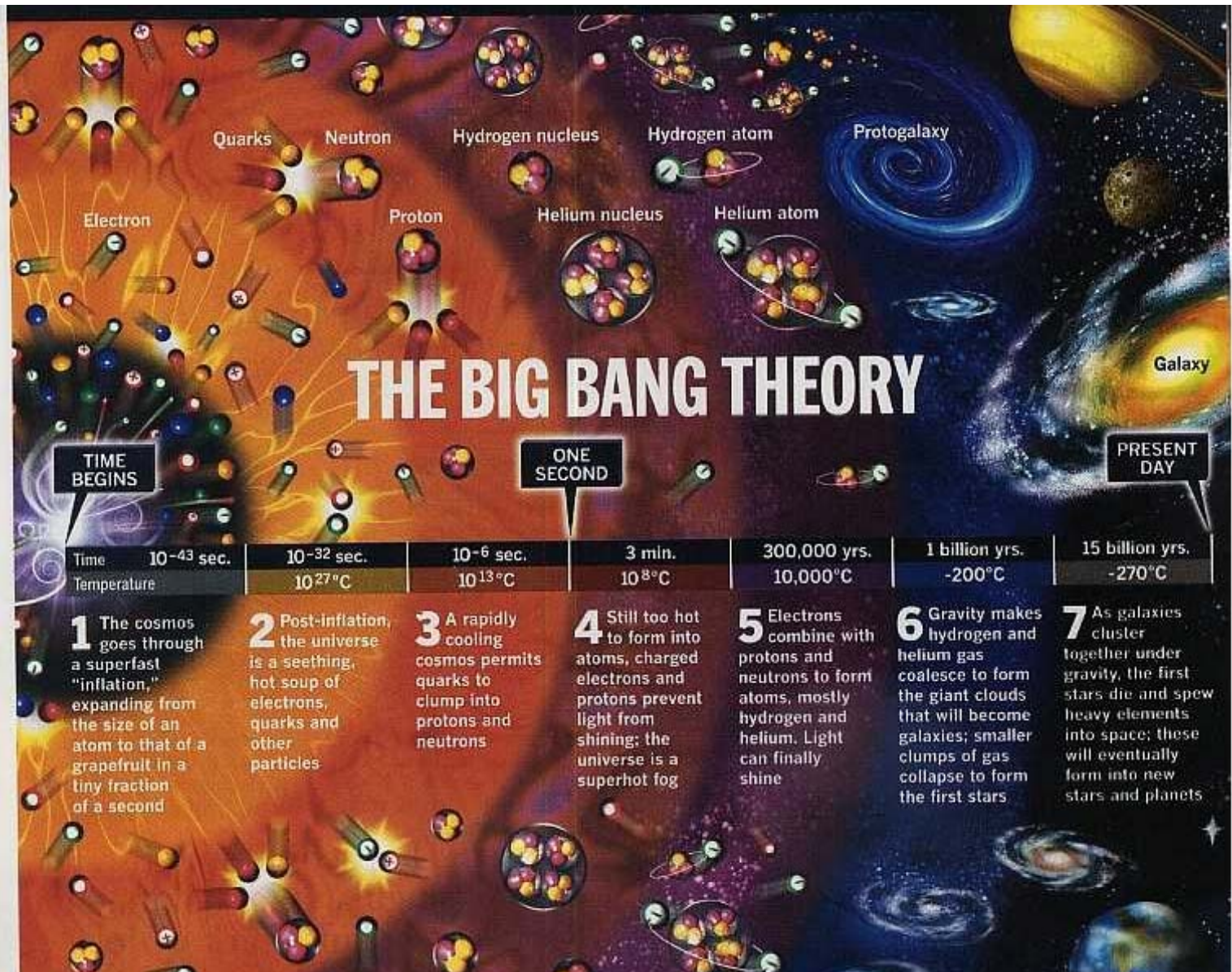


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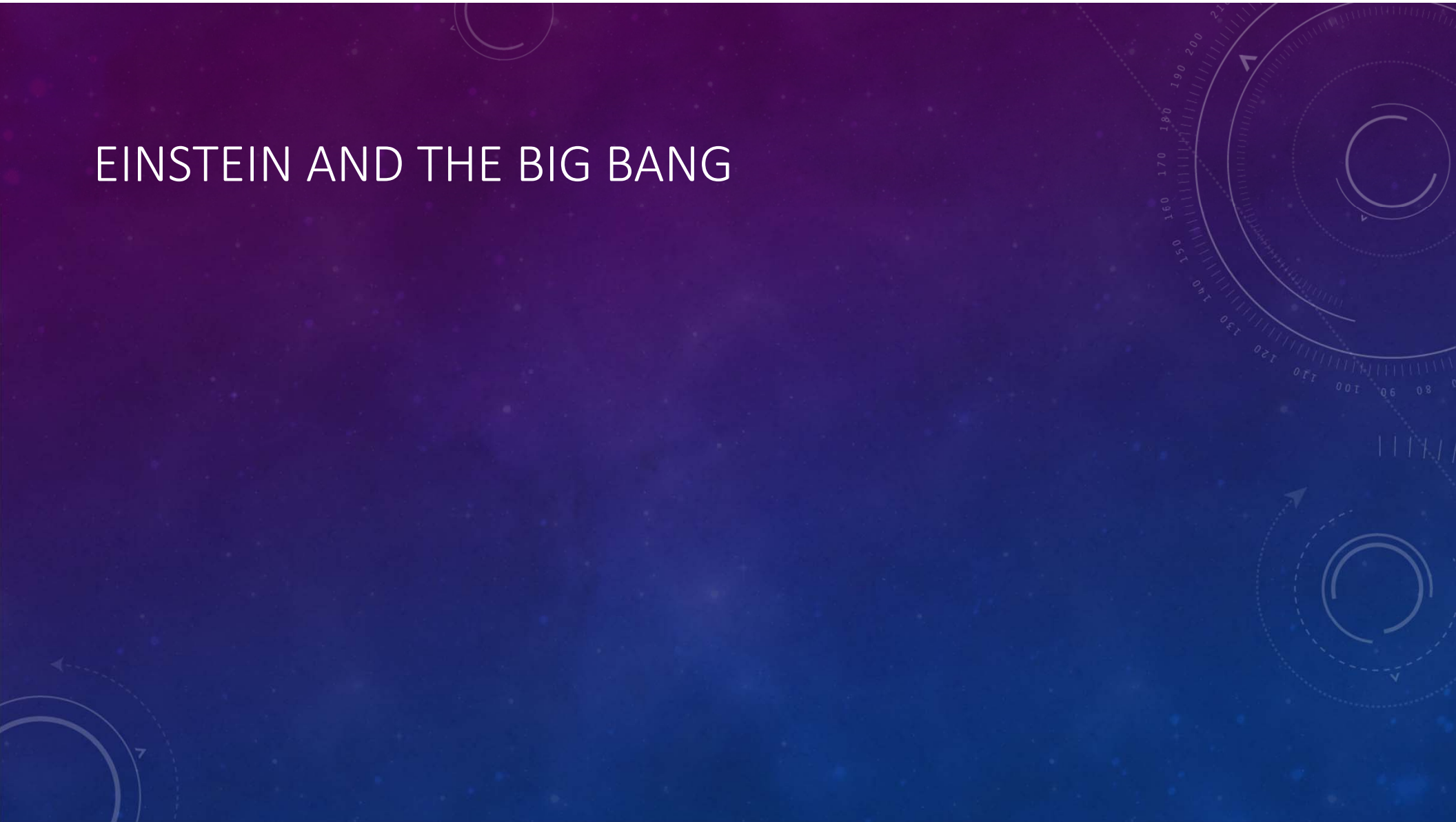
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Clusters of galaxies



EINSTEIN AND THE BIG BANG



AFTER THE EXPLOSION

- first few moments after the Big Bang, the universe was unimaginably hot and dense. As the universe expanded, it became less dense and began to cool
- After only a few seconds, protons, neutrons, and electrons could form
- After a few minutes, those subatomic particles came together to create hydrogen.
- Energy in the universe was great enough to initiate nuclear fusion, and hydrogen nuclei were fused into helium nuclei.
- The first neutral atoms that included electrons did not form until about 380,000 years later.

HOW GALAXIES ARE FORMED

- The matter in the early universe was not smoothly distributed across space.
- Dense clumps of matter held close together by gravity were spread around.
- Eventually, these clumps formed countless trillions of stars, billions of galaxies, and other structures that now form most of the visible mass of the universe.



AFTER BILLIONS OF YEARS, IS THE UNIVERSE STILL
EFFECTED BY THE BIG BANG?

