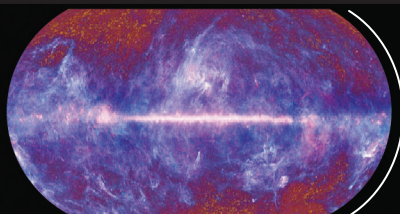


Direct evidence of cosmic inflation

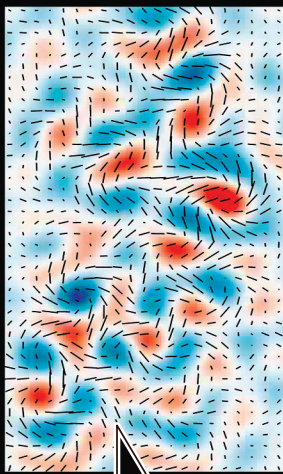
Albert Einstein first predicted primordial gravitational waves in deep space – so-called cosmic inflation – triggered by the rapid expansion of the universe during its earliest moments following the Big Bang.

A century later, the *Background Imaging of Cosmic Extragalactic Polarization 2* (Bicep2) experiment – a microwave-sensitive telescope at the South Pole – has been able to measure them directly



Oldest light: Gravitational waves imprinted onto Cosmic Microwave Background (CMB).

CMB radiation was discovered in 1964 – Bicep2 was designed to measure its polarisation



Polarisation: Gravitational waves create twisting patterns in light from Big Bang

Source: Harvard-Smithsonian Center for Astrophysics
Pictures: Bicep2, ESA, NASA, AFP/Getty Images

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1 Big Bang: In searing fireball with temperature of 100,000 billion billion degrees, universe expands generating gravitational waves

2 Cosmic inflation: Waves amplified as universe expands from infinitesimally small space to size of an egg in trillion of a trillion of a trillionth of a second

3 100 seconds later: Temperature falls to 1 billion degrees. Fundamental particles and radiation are linked together

4 380,000 years after Big Bang: Temperature falls to 3,000 degrees. Atoms of hydrogen formed. Radiation and matter travel freely for first time – CMB radiation is released, preserving record back to this time

5 Dark Ages: Stars have not yet been born – there is no other light except CMB afterglow

6 200 million years after Big Bang: First stars and galaxies form

7 Nine billion years after Big Bang: Our Sun is formed from collapse of cloud of gas and dust in Milky Way galaxy. 500 million years later Earth is formed from leftovers

8 Today: 13.82 billion years after Big Bang

