Researchers detect B-mode polarization in cosmic microwave background

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Researchers working at the South Pole Telescope (SPT) have detected tiny fluctuations—known as B-mode polarization—in cosmic background radiation. The team describes their findings in their paper they've uploaded to the preprint server *arXiv*.

Scientists believe that approximately half a million years after the Big Bang, the universe began switching from a state of plasma and energy to one where temperatures had dropped to a point where the universe became transparent enough for light to pass through. That light is known as cosmic microwave background (CMB) and is still visible today. Cosmologists studying it have formed the basis of a theory known as inflation—where the universe came to exist as it does today through a process of very rapid expansion just after the Big Bang.

In order to prove that the inflation theory is correct, scientists have been studying minute fluctuations in the temperature of the CMB—they revel fluctuations in density of the early universe. They also study fluctuations of the polarization of the CMB which is due, it is believed, to radiation being scattered across the universe by the energy of the Big Bang. Fluctuations in polarization were for a time merely theory, but in 2002, they were actually detected, giving credence to inflation theory. Those fluctuations were given the name E-mode polarizations. Theory has also suggested that there are also B-mode fluctuations in polarization, which are far more subtle—they are thought to describe the rotation of CMB polarization. Finding evidence of them has been extremely difficult, however, as they exist as just one part in ten million in the CMB

temperature distribution. But now it appears the team at SPT has done just that, adding further credence to the inflation theory. The researchers report that they were able to detect E-mode polarization due mostly to improvements in detector technology.

Adding credence isn't the same as finding proof of a theory, of course, and that's why scientists believe the detection of E-mode polarizations is so important. Many believe it will ultimately lead to the detection of primordial gravitational waves—immense ripples in space-time that theory suggests should have come about as a result of the force of inflation. If they can be detected, the theory of inflation would likely become the accepted theory regarding the early formation of the universe.

More information: *Nature* doi:10.1038/nature.2013.13441