Experts hail the gravitational-wave revolution

Top researchers react as the discovery of evidence for cosmic inflation ripples through the scientific community.

Ron Cowen

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Robert Schwarz/University of Minnesota

The Amundsen-Scott South Pole Station, with the BICEP2 telescope on the right.

The evidence of gravitational waves from the early Universe found by researchers working at the South Pole has been hailed as a landmark discovery in cosmology, astronomy and physics. The announcement was made by astronomer John Kovac on 17 March at the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts. He and his collaborators used the BICEP2 radio telescope to see the imprint of the gravitational waves in the cosmic microwave background, the relic radiation from the early Universe — and specifically in a curly pattern known as the B mode. Here *Nature* has collected reactions from leading researchers.

Linda A. Cicero /

“It’s just amazing because many great intellectual discoveries are never confirmed at the time when the authors are still alive. I’m not dead yet and they are already seeing this gravitational-wave signal. So I was just flying there on the airplane thinking is this going to break? If my life ends right now I’m not going to know.”
Andrei Linde, theoretical physicist at Stanford University in California, and one of the founders of inflation theory, flew to Massachusetts to attend the announcement

“This is Nobel prize material, no question. It’s not everyday that you wake up and learn something fundamentally new about

Stanford U.

the Universe, a telegram from the very earliest moments of the Universe. It also is the first detection of the effects of a gravitational wave on matter: that's a great landmark achievement just in time for the one-hundredth birthday of Einstein's general [theory of] relativity next year."

Marc Kamionkowski, cosmologist at Johns Hopkins University in Baltimore, Maryland

W. Kirk/ Hornewood Photography

"Measuring the amplitude, or strength, of the primordial B modes at different angular scales tells you how the inflationary expansion rate changed with time during the period of inflation. Understanding the extent to which it varies is an important clue to determining details of what drove the inflation. Alternative models to inflation, like the ekpyrotic models that Paul Steinhardt and Neil Turok are pushing, predict incredibly small levels of gravitational waves, essentially zero on any measurable scale. This would, at face value, completely rule out those models."

Alan Guth, theoretical physicist at the Massachusetts Institute of Technology (MIT) in Cambridge, who proposed the idea of cosmic inflation in 1980

Justin Knight Photography

"This is a very happy time for everyone in the field. We've been waiting for this for 30 years. If true, this is one of the most important results in the history of science. It's a sensational breakthrough involving not only our cosmic origins, but also the nature of space: the BICEP2 team has found the first experimental evidence of quantum gravity."

Max Tegmark, theoretical physicist at MIT

Justin Knight Photography

"There's no doubt that the gravitational waves, if confirmed, would kill the cyclic and ekpyrotic models that my collaborators and I proposed. We have always been very clear about that. But that is a big if."

Paul Steinhardt, theoretical physicist Princeton University in New Jersey

Brian Wilson/Princeton U.

"If the BICEP2 result holds up, this is really big — as important as the discovery of dark energy, cosmic microwave background anisotropy or the Higgs boson. It tells us the time of inflation and its energy scale. The inflation-produced gravitational waves are what I have been calling the smoking gun of inflation for almost 30 years! I said that because the other predictions of inflation — almost scale invariant density perturbations and flat Universe — are closer to being post-dictions. And of course, this will begin to single out models of inflation and shed light on the particle physics unification scale."

Michael Turner, theoretical physicist at the University of Chicago

"Maybe it's the pride thing going on, with knowing this group so well, but I'm elated and thrilled. What an amazing story. It's the very origin of our observable universe. I can't think of any physics discovery that ranks above this one. It's up there with the discovery of the Higgs boson."

John Carlstrom, astronomer at the University of Chicago; lead researcher of the South Pole Telescope project, a BICEP2 competitor; former thesis adviser to BICEP2's John Kovac

"It's an exciting discovery, but as with any new measurement you want to be careful about it."

Charles Lawrence, member of the Planck science team at the NASA Jet Propulsion Laboratory in Pasadena, California

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