

Discoveries from Planck may mean rethinking how the universe began

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This spring, humanity was shown its most detailed map of the early universe ever created. Generated by observations from the Planck spacecraft, the map revealed fluctuations in temperature in the relic radiation left over from the Big Bang—what we call the Cosmic Microwave Background (CMB).

Recently, scientists on the Planck team announced finding certain large-scale features on the CMB sky that they cannot explain. One of them: a large cold spot, which corresponds to an anomalously large area of high density.

What does this mean? To discuss the findings, The Kavli Foundation held a discussion with three key members on the team. One important question: Will the theory for how the universe began need to be modified, amended or even fundamentally changed?

"[T]he theory of inflation predicts that today's universe should appear uniform at the largest scales in all directions," says George Efstathiou, professor of Astrophysics at the University of Cambridge and director of the Kavli Institute for Cosmology at Cambridge (KICC). "That uniformity should also characterize the distribution of fluctuations at the largest scales within the CMB. But these anomalies, which Planck confirmed, such as the cold spot, suggest that this isn't the case."

Efstathiou has been involved in the Planck mission since it was first proposed to the European Space Agency in 1993. "[T]his is very strange," he says. "And I think that if there really is anything to this, you have to question how that fits in with inflation.... It's really puzzling."

Says Anthony Lasenby, a member of the Planck Core Team and professor of astrophysics and [cosmology](#) at Cambridge and Deputy Director of KICC: "[This] data is really putting pressure on some alternative inflation models.... Inflation

actually may have been more limited in scope than previously theorized."

Says Krzysztof Gorski, a Planck Collaboration scientist and senior research scientist at the Jet Propulsion Laboratory in Pasadena, CA: "Perhaps we may still eliminate these anomalies with more precise analysis; on the other hand, they may open the door to something much more grand—a reinvestigation of how the whole structure of the [universe](#) should be."

Provided by The Kavli Foundation

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