COSMOLOGY

Blockbuster claim could collapse in a cloud of dust

Smoking-gun evidence for cosmic inflation may actually be radiation from within our galaxy

By Adrian Cho

Perhaps it was too good to be true. Two months ago, a team of cosmologists reported that it had spotted the first direct evidence that the newborn universe underwent a mind-boggling exponential growth spurt known as inflation (*Science*, 21 March, p. 1296). But last week a new analysis suggested the signal, a subtle pattern in the afterglow of the big bang, or cosmic microwave background (CMB), could be an artifact produced by dust within our own galaxy.

"We're certainly not retracting our result," says John Kovac, a cosmologist at the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts, and co-leader of the team, which used a specialized telescope at the South Pole known as BICEP2. Others say the BICEP team has already lost its case. "At this time, I think the fair thing to say is that you cannot claim detection—period," says Paul Steinhardt, a theoretical physicist at Princeton University.

From 2010 through 2012, BICEP2 peered at a small patch of the CMB to measure the polarization of the microwaves as it varies from point to point. On 17 March, BICEP researchers announced at a press conference in Cambridge that they had spotted ultrafaint pinwheel-like swirls in the sky. Those swirls, or B modes, are most likely traces of gravitational waves rippling through space and time during the 10^{-32} seconds that inflation lasted, the BICEP team says, and they fulfill a key prediction of the theory of inflation. Many cosmologists hailed the detection as a "smoking gun" for that theory.

But dust within our galaxy can also emit microwaves that mimic the signal. Much or all of the BICEP signal could come from that dust, says Raphael Flauger, a theoretical physicist at the Institute for Advanced Study in Princeton, New Jersey, who performed the new analysis. He presented it at Princeton University on 15 May.

BICEP researchers estimated that "galactic foreground" was negligible. They modeled it several ways, as they report in the paper announcing their claim, which has been submitted to a journal that Kovac declined to name. The most sophisticated model relied on a map of the foreground generated by the European Space Agency's spacecraft Planck, which mapped the CMB across the entire sky from 2009 until last year. Because Planck has not yet released that data, researchers scanned the map from a slide presented at a talk.

The BICEP team apparently assumed the map shows radiation only from dust inside our own galaxy. In reality, it may also contain an unpolarized haze from other galaxies, which would make the microwaves from within the galaxy look less polarized than they are. So using the map could have led the researchers to underestimate the galactic foreground and overestimate the CMB signal.

To test that idea, Flauger used other Planck data—also scraped from a talk—to correct the map BICEP used (see figure). The foreground appears stronger in the corrected map and could account for the entire BICEP signal, he reported.

BICEP's Kovac says his team always made it clear that they couldn't be sure how much of their signal really comes from the CMB. And he won't put a number on it. "The six models of polarized dust that we use are all quite uncertain," he says, "so the statements that we make about the interpretation are necessarily more qualitative."

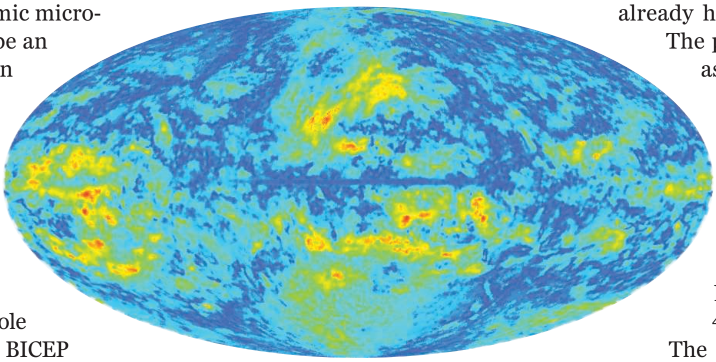
Flauger stresses that he hasn't proved that BICEP's signal is spurious. "I'm still hoping that after all I've done there is a signal there," he says. However, the claim already has a couple of strikes against it.

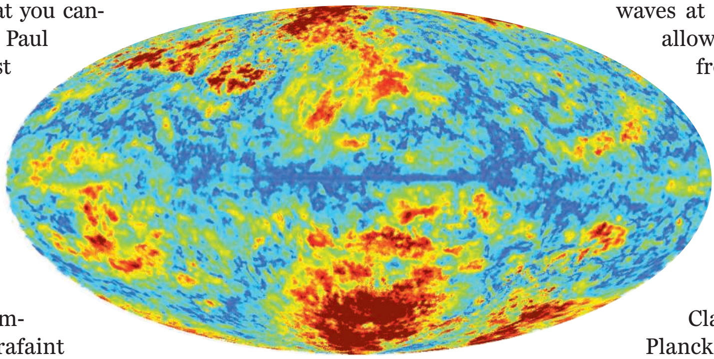
The polarization signal is twice as big as an upper limit Planck researchers set indirectly by measuring temperature variations in the CMB. Making the two results jibe would be difficult, researchers say. The size of the signal also causes headaches for theorists trying to explain how inflation happened (*Science*, 4 April, p. 19).

The flap over the BICEP signal may have been predictable. Sampling microwaves at multiple frequencies would have allowed BICEP2 to separate foreground from CMB by itself. But the telescope was designed to maximize overall sensitivity and tracked only one frequency. "All the other experiments that I know of use multiple frequencies," says Charles Bennett of Johns Hopkins University in Baltimore, Maryland.

Clarity may come in October, when Planck researchers plan to release their polarization data. If Planck shows that the foreground is small and the BICEP signal is real, then the BICEP team should still get credit for the discovery, says Marc Kamionkowski, a cosmologist at Johns Hopkins. But David Spergel, a cosmologist at Princeton, says that in that case, the Planck team alone should get the credit.

If Planck shoots down the result, the credibility of science may suffer, Bennett says: "You talk about something like climate change and the public says, 'Yeah, but you guys say you found something and then you take it back all the time.' " ■





A reconstruction of the contaminated foreground map BICEP used (*top*) and the corrected map.

PHOTOS: RAPHAEL FLAUGER