How to lose a hole the size of a universe

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Steve Nadis

NOW you see it, now you don't. A giant hole in the cosmos that shocked astrophysicists last year may not exist after all. A re-examination of the area has found that the "void", which supposedly contained far fewer stars and galaxies than expected, could be a statistical artefact.

The apparent void was spotted by Lawrence Rudnick and colleagues at the University of Minnesota in Minneapolis. Rudnick had become intrigued by another puzzling finding: a cold spot in the cosmic microwave background measured by the WMAP spacecraft. He used data from the Very Large Array telescope at the National Radio Astronomy Observatory near Socorro, New Mexico, to study the area and concluded that the cold spot coincided with a void almost 1 billion light years across, the largest anyone had ever seen.

The story grabbed headlines with reports of "a huge hole in outer space", which no current theories of cosmology could explain. If the void were real, astronomers would need to rewrite their theories of structure formation in the universe. Some astrophysicists even claimed it was the unmistakable imprint of another universe (*New Scientist*, 24 November 2007, p 34).

But a new analysis casts doubt on Rudnick's conclusion. The existence of voids is really a matter of interpretation, says Kendrick Smith, an astronomer at the University of Cambridge, whose work with Dragan Huterer of the University of Michigan, Ann Arbor, suggests that Rudnick got it wrong. They plan to submit their paper to the *Monthly Notices of the Royal Astronomical Society*.

Because there will always be some stars in front of it and behind it, a void cannot be seen with the naked eye, so must be inferred statistically. Smith and Huterer raise doubts about the statistics on two fronts. First, they say the cold spot and the alleged void don't coincide exactly but have different centres. Second, Smith says that the Minnesota group had to make a particular set of choices to "see" the void. They focused on the portion of the cold spot with the fewest galaxies and counted only galaxies above a certain luminosity.

Make equally valid though different choices regarding the luminosity cut-off and the portion of the cold spot to concentrate on, and the void disappears entirely, says Smith. It is even possible to find a region with an overabundance of galaxies within the cold spot with the same degree of statistical significance.

Rudnick and his co-authors acknowledged "statistical uncertainties" in their paper. Others now agree that the case for a void is weakening. "I think Smith and Huterer have made a good case that there is no void in the radio data at this location," says WMAP theorist David Spergel of Princeton University.

Eiichiro Komatsu, an astronomer at the University of Texas at Austin, says the best way to settle the matter is to point an optical telescope at the cold spot and count the number of galaxies at different distances. You could then construct a 3D map of the region and see whether there is a large empty patch or not.

However, even if the void turns out not to exist, Komatsu says, "there is still this mysterious cold spot that we'd like to learn more about".

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Lawrence Rudnick at the University of Minesota
http://webusers.astro.umn.edu/~larry/

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http://huterer8.physics.lsa.umich.edu/~huterer/

Press release about Rudnick's finding from the University of Minnesota
http://www1.umn.edu/umnnews/news_details.php?release=070823_3456&page=NS

From issue 2656 of New Scientist magazine, 14 May 2008, page 11