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Is there evidence for anisotropy in CMB data?

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Large scales in the Cosmic Microwave Background (CMB) may break statistical isotropy. Bianchi models are often invoked as a possible explanation for these low-\ell features: they provide an anisotropic underlying pattern over which the usual stochastic fluctuations are superimposed. However, the Bianchi models generally employed in the analysis of CMB data —despite mimicking the anomalies in the CMB temperature map — overproduce B-mode polarisation due to the very specific way in which they break isotropy.

In this work, we consider the most general way to break Friedmann-Robertson-Walker isotropy that still preserves homogeneity and test for its signatures in Planck temperature and polarisation map; WMAP data are also analysed for comparison. In addition to the well-known Bianchi models that are more commonly employed in the literature, we consider more physical and untested-for Bianchi models that comply with polarisation constraints. We also show that improved constraints on anisotropy may be obtained by extending the likelihood to high \ell. Nested sampling techniques are employed to determine whether the Bayesian evidence favours anisotropic universes over the standard Lambda-CDM scenario.

Author: Ms SAADEH, Daniela (University College London)

Co-authors: Dr PONTZEN, Andrew (University College London); Prof. PEIRIS, Hiranya (University College London); Dr MCEWEN, Jason (Mullard Space Science Laboratory, University College London); Dr FEENEY, Stephen (Imperial College London)

Presenter: Ms SAADEH, Daniela (University College London)

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