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Constraining $f(R)$ gravity with cross-correlation of galaxies and cosmic microwave background lensing

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We look for signatures of the Hu-Sawicki $f(R)$ modified gravity theory, proposed to explain the observed accelerated expansion of the universe; in observations of the galaxy distribution, the cosmic microwave background (CMB), and gravitational lensing of the CMB.

We study constraints obtained by using observations of only the CMB primary anisotropies, before adding the galaxy power spectrum and its cross-correlation with CMB lensing. We show that cross-correlation of the galaxy distribution with lensing measurements is crucial to breaking parameter degeneracies, placing tighter constraints on the model. In particular, we set a strong upper limit on $\log|fR_0| < -4.61$ at 95% confidence level. This means that while the model may explain the accelerated expansion, its impact on large-scale structure closely resembles General Relativity. Studies of this kind with future data sets will probe smaller potential deviations from General Relativity.

Author: MURRAY, Calum (APC , University of Paris)

Presenter: MURRAY, Calum (APC , University of Paris)

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