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Cosmological Constrains on 4-dimensional Einstein-Gauss-Bonnet Gravity

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In the last few years the contribution of higher-curvature terms in modified gravity has received quite a lot of attention. This is due to the discovery of a 4-dimensional limit of Einstein-Gauss-Bonnet theory that has non-trivial contributions from the Gauss-Bonnet invariant. The theory is a very interesting phenomenological competitor to General Relativity insofar as it passes all solar-system tests, but has notably different strong field behaviour.Cosmological spacetimes have been investigated in this context but are less well studied. We consider the theoretical and observational implications of this theory in both the early and late universe, (re-)deriving background and perturbation equations and constraining its characteristic parameters with data from cosmological probes. We particularly focus on the sound and particle horizons and show how this theory can resolve the horizon problem for certain values of the coupling parameter α. The theory also includes a geometric term in the equations of motion that resembles dark radiation for the background spacetime, but whose influence on the perturbed equations is qualitatively distinct from that of standard forms of dark radiation. In this limit, only one beyond-ΛCDM degree of freedom persists, which we denote as $\tilde{\alpha}_C$. Our analysis yields the estimate $\tilde{\alpha}_C = (-9 \pm 6) \times 10^{-6}$ thereby providing a new constraint of a previously untested sector of 4DEGB.

Primary authors: HULL, Brayden R. (University of Waterloo); ZANOLETTI, Carola; Dr LEONARD, Danielle; Prof. MANN, Robert B.

Presenter: HULL, Brayden R. (University of Waterloo)

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