



Contribution ID : 292

Type : Oral talk

Stable gravity based on Ricci, Gauss-Bonnet, Weyl scalars for cosmology and astrophysics

Thursday, 29 October 2026 17:10 (15)

Ricci–Gauss–Bonnet–Weyl (RGW) gravity, based on a pure geometric Lagrangian defined by a specific combination of the Ricci (R), Gauss–Bonnet (G), and Weyl (W) scalars, is proposed and discussed as a potentially viable generalization of General Relativity (GR) for cosmology, astrophysics, and the Solar System. In this RGW gravity, there are no ghosts or unstable perturbations. Within the Parameterized Post-Newtonian (PPN) formalism, it is shown that RGW gravity has the same PPN parameter values as GR. Without the need for a cosmological constant or dark matter, this RGW gravity agrees well with Solar System data, cosmological data, and the latest data for the scalar spectral index and tensor-to-scalar ratio determined by the evolution of random metric fluctuations during the inflationary stage of the primordial Universe. The physics of the gravitational field arising from RGW gravity is considered in the contexts of all cosmological stages, black holes, supernovae, neutron stars, compact binary systems, galaxy rotation curves, and weak-field gravity. Finally, RGW gravity is discussed in the context of predictions for possible new experiments.

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Session Classification : Gravitation and cosmology

Track Classification : Gravitation and cosmology