



All Bulk and Boundary Unitary Cubic Curvature Theories in Three Dimensions

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We construct all the bulk and boundary unitary cubic curvature parity invariant gravity theories in three dimensions in (anti)-de Sitter spaces. For bulk unitarity, our construction is based on the principle that the free theory of the cubic curvature theory reduces to one of the three known unitary theories which are the cosmological Einstein-Hilbert theory, the quadratic theory of the scalar curvature or the new massive gravity (NMG). Bulk and boundary unitarity in NMG is in conflict; therefore, cubic theories that are unitary both in the bulk and on the boundary have free theories that reduce to the other two alternatives. We also study the unitarity of the Born-Infeld extensions of NMG to all orders in curvature.

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