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Extra dimension(s) of vanishing proper length: A non-Einsteinian phase in gravity and the implications

A dynamical theory of gravity based on an extra dimension of vanishing
proper length is introduced and explored. Unlike the Kaluza-Klein framework, this formulation is free of an infinite tower of higher eigenmodes, and the fifth dimension cannot be detected in principle. The associated theory emerging from this new extra dimensional formulation in vacuum has a number of implications. We discuss these, in particular in the context of dark matter problem, non-Einsteinian black hole
solutions and cosmology. We also show that this formulation leads to a unique theory of quadratic curvature gravity (effective 4d Einstein-Gauss-Bonnet theory) which does not involve any singular limit such as D->4.
[Based on: S. Sengupta, JCAP 02, 2022, 020 (2022),
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