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Fifth forces and discrete symmetry breaking

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Modifications of general relativity often involve coupling additional scalar fields to the Ricci curvature, leading to scalar-tensor theories of Brans-Dicke type. If the additional scalar fields are light, they can give rise to long-range fifth forces, which are subject to stringent constraints from local tests of gravity. In this talk, we show that fifth forces only arise for the Standard Model (SM) due to mass mixing with the Higgs field, and we emphasise the pivotal role played by discrete and continuous symmetry breaking. Quite remarkably, if one assumes that such light, non-minimally coupled scalar fields exist in nature, the non-observation of fifth forces has the potential to tell us about the structure of the SM Higgs sector and the origin of its symmetry breaking. Moreover, with these observations, we argue that certain classes of scalar-tensor theories (as studied in cosmology and astro-particle physics) are entirely equivalent to Higgs-portal theories (as studied in high-energy physics) at the level of their dimension-four operators.

Content of the contribution

Theory

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