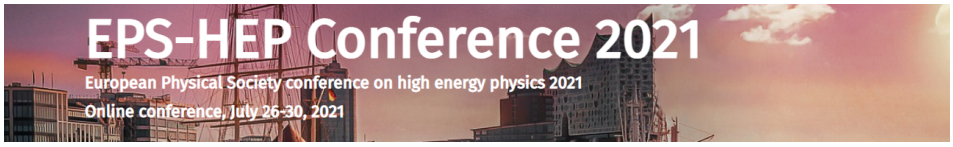

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The Higgs field in brane-worlds

Wednesday 28 July 2021 17:25 (20 minutes)

The problematic huge hierarchy between the usual 4-dimensional Planck mass scale of gravity and the ElectroWeak symmetry breaking scale can interestingly disappear at some point-like location along extra space-like dimensions where the effective gravity scale is reduced down to the TeV scale. Field theories with point-like particle locations (3-dimensional brane-worlds) or point-like interactions deserve special care. In particular it can be shown that, in contrast with usual literature, brane-scalar fields –like the Standard Model Higgs boson –interacting with fermions in the whole space (bulk) do not need to be regularized if rigorous 4- or 5-dimensional treatments are applied: standard regularization introduces a finite width wave function for scalar fields localized along extra dimensions. The variational calculus of least action principle must also be applied strictly to derivate the fermion (Kaluza-Klein) masses and couplings, in particular by distinguishing the natural and essential boundary conditions: the higher-dimensional model –based in particular on extra compact spaces of type interval or circle (orbifold) –must be defined either completely through the action expression [necessity then for new specific brane terms bilinear in the fermion fields] or partially from additional so-called essential boundary conditions. Besides, the correct action integrand definition requires to introduce improper integrals in order to remain compatible with the fermion wave function discontinuities induced by point-like Higgs interactions. These presented new brane-Higgs treatments have phenomenological impacts and in particular the relaxing of previously obtained strong bounds on Kaluza-Klein masses, induced by flavour changing reactions generated through exchanges of the Higgs field.

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Collaboration / Activity

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