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Constraining Fermion Bulk Mass in Flat Extra Dimensions

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Abstract:

In models with extra dimensions, vectorlike Dirac masses for fermion fields are generically allowed. These masses are independent of electroweak symmetry breaking and do not contribute to the known masses for the quarks and leptons. They control the profile of the bulk wave functions, the mass spectra of Kaluza-Klein modes, and interactions that could be tested in experiments. In this article, we study the effects of bulk masses in electroweak precision measurements and in dark matter and collider searches, to set bounds on the bulk mass parameters in models with a flat universal extra dimension, namely, Split-UED. We find the current bound on the universal bulk-mass to be smaller than $(0.2-0.3)/R$, where R is the radius of the extra dimension. Similar but slightly relaxed bounds are obtained in the non-universal bulk mass case. The LHC is expected to play an important role in constraining the remaining parameter space.

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