

DISCRETE 2014: Fourth Symposium on Prospects in the Physics of Discrete Symmetries



Contribution ID: 22

Type: **not specified**

Order and Anarchy hand in hand in 5D SO(10)

Thursday 4 December 2014 15:00 (30 minutes)

A mechanism to generate flavour hierarchy via 5D wave-function localization is revisited in the context of SO(10) grand unified theory. In an extra-dimension compactified on an orbifold, fermions (living in the same 16 representation of SO(10)) result having exponential zero-modes profiles. The breaking of SO(10) down to $SU(5) \times U(1)_X$ provides the key parameter that distinguishes the profiles of the different SU(5) components inside the same 16 representation. Utilizing suitable scalar fields, a predictive model for fermion masses and mixing is constructed and shown to be viable with the current data through a detailed numerical analysis. All the Yukawa couplings in the model are anarchical and of order unity, while the hierarchies among different fermions result only from zero-mode profiles. The naturalness of anarchical Yukawa couplings is studied, showing a preference for a normal ordered neutrino spectrum; predictions for various observables in the lepton sector are also derived. The scalar field content of the model is also suitable to solve the doublet-triplet splitting problem through the “missing partner” mechanism.

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Session Classification: Parallel 1: Discrete symmetries (T, C, P), flavour, accidental symmetries