

Natural axion model from flavour

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We explore a common symmetrical origin for two long standing problems in particle physics: the strong CP and the fermion mass hierarchy problems. The Peccei-Quinn mechanism solves the former one with an anomalous global $U(1)_{PQ}$ symmetry. Here we investigate how this $U(1)_{PQ}$ could at the same time explain the fermion mass hierarchy. We work in the context of a four-Higgs-doublet model which explains all quark and charged fermion masses with natural, i.e. order 1, Yukawa couplings. Moreover, the axion of the model constitutes a viable dark matter candidate and neutrino masses are incorporated via the standard type-I seesaw mechanism. A simple extension of the model allows for Dirac neutrinos.

Orateur: CENTELLES CHULIÁ, Salvador (Max-Planck-Institut für Kernphysik)

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