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Low-scale flavon model with a Z_N symmetry

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We propose a model that explains the fermion mass hierarchy by the Froggatt-Nielsen mechanism with a discrete Z_N flavor symmetry. As a concrete model, we study a supersymmetric model with a single flavon coupled to the minimal supersymmetric Standard Model. Flavon develops a TeV scale vacuum expectation value for realizing flavor hierarchy, an appropriate μ-term and the electroweak scale, hence the model has a low cutoff scale. We demonstrate how the flavon is successfully stabilized together with the Higgs bosons in the model. The discrete flavor symmetry Z_N controls not only the Standard Model fermion masses, but also the Higgs potential and a mass of the Higgsino which is a good candidate for dark matter. The hierarchy in the Higgs-flavon sector is determined in order to make the model anomaly-free and realize a stable electroweak vacuum. We show that this model can explain the fermion mass hierarchy, realistic Higgs-flavon potential and thermally produced dark matter at the same time. We discuss flavor violating processes induced by the light flavon which would be detected in future experiments.

Author: HIGAKI, Tetsutaro (Keio University)

Co-author: KAWAMURA, Junichiro

Presenter: HIGAKI, Tetsutaro (Keio University)