

Non-invertible Peccei-Quinn symmetry, natural 2HDM alignment, and the visible axion

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We identify m_{12} as a spurion of non-invertible Peccei-Quinn symmetry in the type II 2HDM with gauged quark flavor. Thus a UV theory which introduces quark color-flavor monopoles can naturally realize alignment without decoupling and can furthermore revive the Weinberg-Wilczek axion. As an example we consider the $SU(9)$ theory of color-flavor unification, which needs no new fermions. This is the first model-building use of non-invertible symmetry to find a Dirac natural explanation for a small relevant parameter.

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