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Messenger Yukawa Alignment and Misalignment in Flavored Gauge Mediated Supersymmetry Breaking Models with Higgs-Messenger Multiplets

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We explore flavored gauge mediation models in which the electroweak Higgs fields and the $SU(2)$ doublet messengers of gauge mediation are embedded in multiplets of a non-Abelian discrete group (the Higgs-messenger group), as motivated by earlier work of Perez, Ramond, and Zhang. The Higgs-messenger group is part of a larger structure that includes a family symmetry group for the Standard Model (SM) matter fields. A subset of the flavon fields that break these symmetries also break supersymmetry, resulting in gauge-mediated supersymmetry breaking with nontrivial messenger Yukawa couplings. %These couplings are governed not only by the (model-dependent) details of the family symmetry breaking, but also by the mixing of the Higgs fields and the messengers.

The framework allows not only for the possibility of concrete examples of messenger Yukawa alignment with the SM Yukawa couplings, but also the possibility that these couplings are misaligned in a specific way that may be consistent with the bounds on flavor-changing processes, depending on the details of the flavor model. We present examples of each type, taking a relatively model-independent approach for the family symmetry structure but specifying for concreteness a S_3 Higgs-messenger group. We also point out that such flavored gauge mediation models in which the Higgs fields and the doublet messengers are part of a larger non-Abelian multiplet are subject to a severe μ/B_μ problem, and comment on methods to alleviate this difficulty.

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