

Towards a Supersymmetric Description of the Fermi Galactic Center Excess

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We attempt to build a model that describes the Fermi galactic gamma-ray excess (FGCE) within a UV-complete Supersymmetric framework; we find this to be highly non-trivial. At the very least a successful Supersymmetric explanation must have several important ingredients in order to fit the data and satisfy other theoretical and experimental constraints. Under the assumption that a single annihilation mediator is responsible for both the observed relic density as well as the FGCE, we show that the requirements are not easily satisfied in many TeV-scale SUSY models, but can be met with some model building effort in the general NMSSM with 10 parameters beyond the MSSM. We find that the data selects a particular region of the parameter space with a mostly singlino lightest Supersymmetric particle and a relatively light CP-odd Higgs boson that acts as the mediator for dark matter annihilation. We study the predictions for various observables within this parameter space, and find that searches for this light CP-odd state at the LHC, as well as searches for the direct detection of dark matter, are likely to be quite challenging. It is possible that a signature could be observed in the flavor sector; however, indirect detection remains the best probe of this scenario.

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