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Enhancing Direct Detection of Higgsino Dark Matter

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While much supersymmetric WIMP parameter space has been ruled out, one remaining important candidate is Higgsino dark matter. The Higgsino can naturally realize the "inelastic dark matter" scenario, where the scattering off a nucleus occurs between two nearly-degenerate states, making it invisible to WIMP direct detection experiments if the splitting is too large to be excited. It was realized that a "luminous dark matter" detection process, where the Higgsino upscatters in the Earth and subsequently decays into a photon in a large neutrino detector, offers the best sensitivity to such a scenario. We consider the possibility of adding a large volume of a heavy element, such as Pb or U, around the detector. We also consider the presence of U and Th in the Earth itself, and the effect of an enhanced high-velocity tail of the dark matter distribution due to the presence of the Large Magellanic Cloud. These effects can significantly improve the sensitivity of detectors such as JUNO, SNO+, and Borexino, potentially making it possible in the future to cover much of the remaining parameter space for this classic SUSY WIMP dark matter.

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