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Probing Dark Matter in Milky Way Dwarf Galaxies: Modeling and Forecasts

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Dwarf spheroidal galaxies (dSphs) offer a unique opportunity to probe the nature of dark matter (DM) due to their proximity and high dark matter content. In this project, we investigate whether future spectroscopic data, such as that from the Dark Energy Spectroscopic Instrument (DESI), could enable us to distinguish between cusped and cored dark matter profiles in these systems. To test this, we generate mock catalogs using the Galpy library, modeling stars embedded in generalized NFW dark matter halos with varying inner slopes. These catalogs are then analyzed using spherical Jeans modeling to assess how well the original DM profiles can be recovered under controlled conditions. Our preliminary results show promising agreement between input and recovered properties. This work aims to build a realistic forecasting framework, which, if successful, could support a future proposal for DESI-like instruments and apply this methodology to real observational data.

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