

Dynamically Mapping the Satellite Galaxies in the Outer Halo of the Milky Way

Scientific Category: Stellar Populations and the Interstellar Medium

Alternate Category: Galaxies

Scientific Keywords: Astrometry, Dwarf galaxies, Galaxy kinematics

Instruments: ACS, WFC3

Exclusive Access Period: 6 months

Proposal Size: Medium

Long-Term Monitoring: Yes

Orbit Request

Prime

Parallel

Cycle 33

64

64

Abstract

The satellite galaxies of the Milky Way (MW) constitute the benchmark for studies of faint galaxies, including the effects of cosmic reionization, and testing cold dark matter. We propose to use HST ACS/WFC and WFC3/UVIS for second-epoch imaging of 14 ultra-faint satellite galaxies of the MW that have existing first-epoch imaging from HST, in order to measure high-precision proper motions. We target the most distant satellites, $d = 80$ to 420 kpc, which uniquely probe 3D dynamics in the outer halo of the MW, and which have large uncertainties from Gaia. Through these precise proper motions, we will match each satellite's stellar mass, distance, and 3D velocity to statistical analogs from cosmological simulations to infer full orbital histories in a cosmological context. We will use these orbits to address diverse science cases, including testing models of patchy reionization, testing the origin and significance of the MW's plane of satellites, and robustly determining the total mass profile of the MW's dark-matter halo out to its virial radius. Ultimately, completing the dynamical catalog of MW satellites at these distances will enable a novel and robust modeling framework that will place the entirety of the MW satellite population in its cosmological context for the first time.