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A Galactic Kinematic Method to Bound the Cosmological Constant: Oort Constant Corrections from the Schwarzschild–de Sitter Metric

The cosmological constant Λ , the leading candidate driving cosmic acceleration, remains poorly constrained at sub-galactic scales. Current bounds come from solar-system tests via planetary perihelion precession (10^{-39} – 10^{-43} m $^{-2}$) or from stellar orbits near Sgr A* ($\sim 5.67 \times 10^{-40}$ m $^{-2}$, the tightest sub-galactic bound to date), but the solar-neighborhood scale has not been systematically exploited despite its much larger gravitational lever arm. We present an original method that derives corrections to the classical Oort constants A and B induced by a Λ -term in the Schwarzschild–de Sitter metric, predicting a distinctive signature $\delta B = 3\delta A$. We construct a high-precision kinematic ensemble of solar-neighborhood stars, applying strict astrometric quality cuts ($\text{RUWE} < 1.4$, $\omega/\sigma\omega > 10$), and develop a three-dimensional galactic potential model (bulge + disk + halo + Λ -term) for Bayesian MCMC inference designed to statistically separate the cosmological term from the enclosed-mass degeneracy. We present the theoretical framework and the computational pipeline, validated using mock catalogs, together with preliminary results from its ongoing application to real Gaia DR3 data, and discuss its future extension to Gaia DR4/DR5 data, stellar streams, and globular clusters.

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