

2nd Terrestrial Very-Long-Baseline Atom Interferometry Workshop



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In this study, we extend the physics case of future terrestrial very-long baseline and space-based atom gradiometers by considering the reach of such experiments to ultra-heavy dark matter with masses exceeding the Planck scale. We study the phase-shift signatures in a coordinate-invariant fashion and find three distinct contributions that would be measurable in experiments such as AION, MAGIS and AEDGE: the gravitational redshift, the Doppler effect (i.e. the acceleration of the atoms) and the Shapiro effect (i.e. the gravitational time delay accumulated during photon propagation). Although our work finds that only AEDGE may be able to probe unexplored regions of dark matter parameter space, we highlight that our framework can be used to analyze the phase shifts induced by slow-varying and weak Newtonian potentials independently of their nature, which will prove especially helpful in systematically studying the phase shift noise from transient objects.

Session Classification: Poster Session & Wine & Coffee