Phenomenology 2025 Symposium



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Ultralight dark matter detection with trapped-ion interferometry

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We explore how recent advancements in the manipulation of single ionic wave packets open new avenues for detecting weak magnetic fields sourced by ultralight dark matter. By leveraging the entanglement between the ion's spin and motional degrees of freedom, proposed trapped-ion matter-wave interferometers enable the measurement of the dynamical Zeeman phase shift accrued by the ion over its trajectory, which results in a parametrically enhanced sensitivity to weak magnetic fields. Considering the relevant boundary conditions, we demonstrate that a single trapped ion can probe unexplored regions of kinetically-mixed dark photon dark matter parameter space in the 10^{-15} eV

$lesssimm_{A'}$

 $lesssim 10^{-14}$ eV mass window. We also show how these table-top quantum devices will serve as a complementary probe of axion-like particle dark matter in the same mass window.

Mini Symposia (Invited Talks Only)

Plenary (Invited talks only)

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