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First Search for Ultralight Dark Matter Using a Magnetically Levitated Particle

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We performed the first search for ultralight dark matter using a magnetically levitated particle. A sub-millimeter permanent magnet was levitated in a superconducting found with a measured force sensitivity of 0.2 fN/$\sqrt{\text{Hz}}$. We find no evidence of a signal and derive limits on dark matter coupled to the difference between baryon and lepton number, B–L, in the mass range $(1.10360 - 1.10485)\times10^{-13}$ eV. Our most stringent limit on the coupling strength is $g_{B-L}2.98 \times 10^{-21}$. We propose the POLONAISE (Probing Oscillations using Levitated Objects for Novel Accelerometry in Searches of Exotic physics) experiment, featuring short-, medium-, and long-term upgrades that will give us leading sensitivity in a wide mass range and demonstrating the promise of this novel sensing technology in the hunt for dark matter.

This talk will review our recent PRL while discussing the general landscape of mechanical sensing for dark matter.

Collaboration you are representing

POLONAISE

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Session Classification: Dark Matter and Its Detection

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