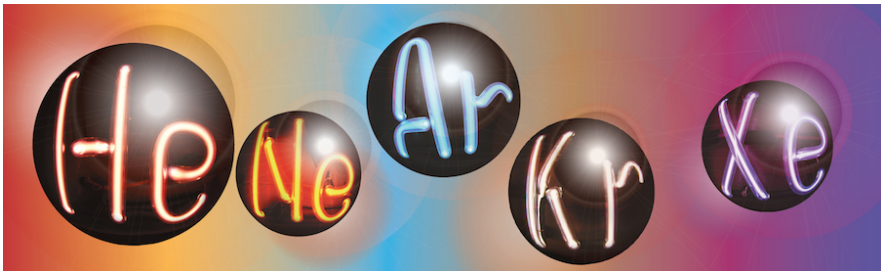

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Enhancing sensitivity to low-mass WIMPs with an improved ionization response model of liquid argon within the DarkSide programme

Tuesday, 21 October 2025 14:40 (20 minutes)

The search for dark matter with liquid argon detectors critically depends on a precise modeling of the ionization response to nuclear recoils. We present a unified analysis of ionization data from the ReD experiment, in combination with existing measurements from DarkSide-50, ARIS, and SCENE. This combined approach allows us to place stronger constraints on electron-ion recombination and screening effects, refining the ionization response model for nuclear recoils. Integrating this improved model into the DarkSide analysis framework leads to significantly enhanced sensitivity to low-mass WIMPs. In particular, we report updated exclusion limits that improve upon previous DarkSide-50 results, setting new world-leading constraints in the 1–3 GeV/c^2 mass range. Additionally, we present updated sensitivity projections for the next-generation DarkSide-20k detector, highlighting its enhanced potential for probing low-mass dark matter interactions.

Primary author: PANDOLA, Luciano (INFN Laboratori Nazionali di Frascati)

Presenter: FRANCO, Davide (APC)

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