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Dark matter search with PICO bubble chambers

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Modern bubble chambers offer a unique opportunity to probe the dark matter parameter space. These detectors use superheated fluids such as C_3F_8 to detect elastic scatters on target nuclei. Nuclear recoils that deposit energy above the detector's thermodynamic threshold—set by its operating temperature and pressure—nucleate visible bubbles, which are recorded by high-speed cameras.

The PICO collaboration is leading the effort with bubble chambers at the SNOLAB underground laboratory in Sudbury, Canada. PICO-40L is a fully assembled and operational detector that uses a new “Right Side Up” design, placing the compression and expansion system below the target fluid to reduce background signals observed in earlier detectors. PICO-500 is the next-generation, ton-scale bubble chamber currently under construction. Building on experience from previous detectors, it incorporates major improvements in size, design, and background control.

This talk will present an overview of both detectors, their design improvements, background mitigation strategies, and early commissioning results.

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