

Dark Matter Direct Detection With the PICO collaboration

Content

Dark matter is expected to constitute a large fraction of the universe and may interact with terrestrial detectors through a variety of channels. The PICO collaboration leverages bubble chamber technology to search for these interactions, operating its detectors 2 km underground at SNOLAB to suppress cosmogenic backgrounds. Bubble chamber detectors offer two key advantages: insensitivity to gamma-induced recoils and flexibility in the choice of active fluid (PICO has previously operated with both C_3F_8 and CF_3I). While most direct detection experiments rely on heavier target nuclei, PICO's use of fluorinated organic compounds provides superior sensitivity to spin-dependent dark matter couplings; the low-mass nuclei also enable previous-generation detectors to set world-leading limits in exothermic channels such as fermionic absorption.

PICO-40L is currently operating with C_3F_8 , taking advantage of fluorine's strong proton coupling. Unlike its predecessor PICO-60, PICO-40L employs a right-side-up geometry designed to minimize particulate-induced backgrounds, a significant departure from previous generations. The detector serves as a proof-of-concept platform for the next-generation PICO-500, a 260 L detector projected to deliver world-leading sensitivity in this channel. This talk will present the current status of PICO-40L, provide an overview of the underlying bubble chamber technology, and outline projected sensitivities for PICO-500.

Summary

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