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WIMP Search at Low Energy Threshold with PICO-60 C3F8

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During its first physics run the PICO-60 C_3F_8 bubble chamber was operated at a thermodynamic energy threshold of 3.3 keV, acquiring a background-free WIMP-search exposure of 1167 kg-days.

Following the acquisition of this dataset, the temperature and pressure of the superheated C_3F_8 target were altered to lower the energy threshold across a range of values from 2.5 keV to 1.8 keV. Stable operation at very low pressure is made possible by a 100 Hz recompression trigger on changes in the information content of live images of the chamber as seen by four high-speed cameras.

The background gamma rates measured at these thresholds were several times lower than predicted by conservative Monte Carlo estimates of the environmental gamma flux, suggesting the possibility of background-free operation at some subset of these lowered thresholds. Such a dataset would have significantly increased sensitivity to WIMP masses below 10 GeV/c^2.

Primary author: FALLOWS, Scott (University of Alberta)

Presenter: FALLOWS, Scott (University of Alberta)

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