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Status of PICO: Searching for WIMPs with Bubble Chambers

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We report on recent results from the PICO program to search for WIMPs using bubble chambers and plans for future experiments. Our most recent results come from the operation of the PICO-60 detector, which operated in the SNOLAB underground laboratory and contained a 52-kg target volume of liquid C3F8 . This chamber exhibits exhibits excellent electron recoil and alpha decay rejection, and the observed multiple-scattering neutron rate indicates a single-scatter neutron background of less than 1 event per month. A blind analysis of an efficiency-corrected 1167-kg-day exposure at a 3.3-keV thermodynamic threshold reveals no single-scattering nuclear recoil candidates, consistent with the predicted background. These results set the most stringent direct-detection constraint to date on the WIMP-proton spin-dependent cross section at 3.4 × 10−41 cm2 for a 30-GeVc−2 WIMP, a factor of 17 improvement over previous results. We are conducting R&D on new type of bubble chamber for WIMP searches that has the potential to scale to very large target sizes. Construction is starting this year on the PICO-500 experiment, which will have an order of magnitude larger target volume than PICO-60.

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