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Toward a next-generation dark matter search with the PICO-40L bubble chamber

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The PICO-60 bubble chamber has concluded its dark matter search runs using a superheated liquid C_3F_8 target. Its replacement currently under commissioning, PICO-40L, is a redesigned bubble chamber with an inverted vertical orientation. This design allows the replacement of the water buffer with a second fused silica jar acting as a piston. The removal of the buffer fluid is intended to eliminate backgrounds caused by water droplets, particulates, and surface tension effects. This redesign also lifts buffer compatibility constraints on potential target fluids, allows a wider range of operating temperatures, and enables full target recirculation and purification. A larger stainless steel pressure vessel will reduce the expected neutron backgrounds to a level permitting a background-free 40L one-year exposure. In addition to its extended physics reach beyond that of PICO-60, this detector will act as a prototype and proof-of-principle for the proposed tonne-scale bubble chamber PICO-500.

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