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Neutrino observatories in high-pressure salt caverns

High-pressure time projection chambers have superb rare-event detection capabilities. However, putting a high-pressure vessel of any size in a conventional underground lab is prohibitively difficult. Gigantic, inexpensive salt caverns are routinely used as high-pressure storage vessels by the natural gas industry. Here, we describe the conceptual designs of several detectors which can realistically be deployed in flooded salt caverns (via a borehole, with no human travel underground) for neutrino and dark matter physics. In particular, we show a 1 kiloton, 100 bar neon TPC with applications in solar neutrino physics; a 20-t pure hydrogen TPC (equivalent to 250 t scintillator) for antineutrino physics and light dark matter searches. We are beginning engineering and science studies to develop CUSO (Case Underground Salt Observatory), a small R&D borehole and cavern in the Salina formation under Case Western Reserve University.

Mini-abstract

Large high-pressure TPCs salt caverns can do neutrino physics with Ne, H₂, and other gases.

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