

PICO: A Search for Dark Matter with Superheated Liquid Targets

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One of the most enduring mysteries in science is the explanation for the evidence that, on all scales larger than a single star, far more gravitating material is seen to exist than can be accounted for by the atoms in these systems. Dark Matter (DM) is intrinsically invisible and has only conclusively been seen by its gravitational effects in aggregate. The objective of this project is to test the hypothesis that DM is an exotic particle, with a mass in the 1-1000 GeV/c² range, having weak interactions with ordinary baryons.

PICO is a collaboration formed by the merger of the PICASSO and COUPP teams which is using various room temperature superheated fluids to make detectable the 1-100 keV kinetic energies of nuclei scattered by these particles. The moderately superheated bubble chamber technique represents a unique approach in the field for two main reasons. First, it is inherently immune to sparsely ionizing particles (such as electrons) which are serious backgrounds to other DM detectors. Second, if DM were to be observed in this detector, the project would, with relative ease, be able to characterize basic properties of such a particle by filling the chamber with an assortment of target fluids.

Two bubble chambers, filled with different target fluids, have been successfully operated at SNOLAB. This talk will discuss the recent searches and the technical challenges facing the experiment.