New approach to determine the nucleation efficiency of nuclear recoils in superheated liquids DANIEL DURNFORD, MARIE-CCILE PIRO, University of Alberta, SBC COLLABORATION, PICO COLLABORATION — Knowing the nucleation efficiency of low-energy nuclear recoils in superheated liquids plays a crucial role in interpreting results from direct searches for WIMP dark matter. An extensive neutron calibration campaign was performed by the PICO Collaboration over the past 6 years with 5 distinct neutron spectra at various thermodynamic thresholds ranging from 2.1 to 3.9 keV. In lieu of an adequate theoretically-motivated functional form for nucleation efficiency, a generic piecewise linear model is used, with systematic errors incorporated as nuisance parameters. A Markov Chain Monte Carlo routine is then applied to fit the nucleation efficiency model at thresholds of 2.45 keV and 3.29 keV simultaneously [C. Amole et al., Phys. Rev. D 100 (2) 022001, 2019]. After describing the fit method and results obtained, I will present the outcomes of a parametric Monte Carlo study to test the efficacy of the fit paradigm. I will demonstrate how expected WIMP interaction rates in PICO bubble chambers can be calculated - a direct input to the derivation of cross-section exclusion limits. Finally, I will discuss the application of this method to other superheated liquid experiments such as the Scintillating Bubble Chamber (SBC) project.

Daniel Durnford
University of Alberta

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