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New model on nucleation efficiency of bubble chamber detectors

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Bubble chambers using fluorocarbons or liquid noble gases are promising technologies for detecting low-energy nuclear recoils from weakly interacting massive particles (WIMPs), a potential candidate for dark matter. In this study, we used molecular dynamics simulations to determine the energy threshold in superheated liquids and Monte Carlo simulations with SRIM to obtain the bubble nucleation efficiency of bubble chamber detectors. We aim to construct an accurate physics model to explain the discrepancy observed between experimental results and the current theoretical model. The new model combines the Lindhard theory, resulting in improved accuracy and a better prediction of the bubble nucleation efficiency and energy threshold. Our preliminary results are promising and will be presented against experimental data from C3F8 and xenon superheated liquid detectors.

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