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Sub-GeV dark matter detection with superfluid He-4: an EFT approach (C)

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We employ an effective field theory to study the detectability of sub-GeV dark matter through its interaction with the gapless excitations of superfluid He-4. In a quantum field theory language, the possible interactions between the dark matter and the superfluid phonon are solely dictated by symmetry. We compute the rate for the emission of one and two phonons, and show that these two observables combined allow for a large exclusion region for the dark matter masses. Our approach overcomes some limitations of standard techniques, and allows to easily compute differential distributions. The method presented here is extendible to different models of dark matter.

Summary

I will briefly overview the relativistic effective field theory approach to superfluidity. Then I will explain why superfluid He-4 might play a crucial role in the search for sub-GeV dark matter and apply the previous formalism to the description of the interaction between dark matter and the superfluid phonon. Finally I will present future prospects and possible new ideas.

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