



Contribution ID: 3

Type: **not specified**

Sub-GeV Dark Matter in Superfluid He-4: an Effective Theory Approach

Thursday, 28 November 2019 11:00 (30 minutes)

One of the most urgent problems in physics is understanding the nature of Dark Matter: finding the Dark Matter in the form of a particle would open a brand new branch of physics beyond the Standard Model. Many experiments until now have excluded a large spectrum of values for the WIMP exclusion plot, hence it may be relevant to consider a Dark Matter with lower mass. In a scattering based detection very soft recoils would be expected, hence sub-GeV Dark Matter particles require original detection methods, as scatterings in superfluid He-4 targets may be. The gapless excitations produced by superfluid helium would be the object of detection. Since it is still not possible to analytically deduce the superfluid He dispersion curve, an EFT is given for the phonons description, which is found to be in agreement with experimental results. Further, we build a model describing the DM and its mediator and the way this mediator interacts with He. Having a full description of the dynamics of the system, decay rates and exclusion plots are built, placing this work in a favourable position in the current Dark Matter detection panorama

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Session Classification: Young scientists series