Contribution ID: **93** Type: **not specified**

Improving the Proportional Scintillation Signal of Liquid Argon by Xenon Doping

Thursday, 18 March 2021 15:00 (20 minutes)

Argon has advantages over xenon in cost, kinetic matching, and ease-of-purification when used as a target for the detection of nuclear recoils from coherent neutrino-nucleus scattering (CENNS) and light WIMP dark matter. However, the detection of low-energy ionization signals in argon by the proportional scintillation signal (S2) mechanism is frustrated by the long lifetime and short wavelength of the argon proportional scintillation light. Doping the argon gas with small (tens of ppm) quantities of xenon shortens the emission lifetime and shifts the wavelength to 149 nm, which can be efficiently sensed by SiPMs. We describe a system to measure the range of mixtures that can be stably maintained and the improvements to proportional scintillation light and nuclear recoil ionization yield they provide.

Prepared by LLNL under Contract DE-AC52-07NA27344

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Session Classification: Noble Elements

Track Classification: Noble Elements