

Directional Search for Dark Matter Using Nuclear Emulsion

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Abstract : A variety of experiments have been developed over the past decades, aiming at the detection of Weakly Interactive Massive Particles (WIMPs) via their scattering in an instrumented medium. The sensitivity of these experiments has improved with a tremendous speed, thanks to a constant development of detectors and analysis methods. Detectors capable of reconstructing the direction of the nuclear recoil induced by the WIMP scattering are opening a new frontier to possibly extend Dark Matter searches beyond the neutrino background. Measurement of WIMP's direction will allow us to detect the galactic origin of dark matter and, therefore to have a clear signal-background separation. The NEWSdm experiment, based on nuclear emulsions, is intended to measure the direction of WIMP-induced nuclear recoils with a solid-state detector, thus with high sensitivity. We discuss the discovery potential of a directional experiment based on the use of a solid target made of newly developed nuclear emulsions and novel read-out systems achieving nanometric resolution. We also report results of a technical test conducted in Gran Sasso.

Keywords : dark matter, direct detection, nuclear emulsion, WIMPS

Conference Title : ICPCDM 2018 : International Conference on Physical Cosmology and Dark Matter

Conference Location : Paris, France

Conference Dates : June 25-26, 2018