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Carbon Nanotubes as anisotropic target for dark matter

Directional detection of Dark Matter particles (DM) could be accomplished by studying either ion or electron recoils in large arrays of parallel carbon nanotubes. For instance, a MeV mass DM particle could scatter off a lattice electron, resulting in the transfer of sufficient energy to eject the electron from the nanotube surface. The electron can eventually be detected whenever an external electric field is added to drive it from the open ends of the array. This detection scheme would offer an anisotropic response and could be used to select an orientation of the target with respect to the DM wind. A compact sensor, in which the cathode element is substituted with a dense array of parallel carbon nanotubes, could serve as the basic detection unit which - if adequately replicated -would allow to explore a significant region of light DM mass and cross-section. A similar detection scheme can be devised in case DM would scatter on the surface of a CNT and a carbon ion might be ejected –allowing to investigate the existence of a few GeV mass DM particle.

We report about the Monte Carlo simulations of such a system and the R&D towards a prototype detector.

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