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NEWS: Nuclear Emulsions for WIMP Search

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Summary

Nowadays there is compelling evidence for the existence of dark matter in the Universe. A general consensus has been expressed on the need for a directional sensitive detector to confirm, with a complementary approach, the candidates found in ?conventional? searches and to finally extend their sensitivity beyond the limit of neutrino-induced background. We propose here the use of a detector based on nuclear emulsions to measure the direction of WIMP-induced nuclear recoils. The production of nuclear emulsion films with nanometric grains has been recently established. Several measurement campaigns have demonstrated the capability of detecting sub-micrometric tracks left by low energy ions in such emulsion films with nanometric grains. Innovative analysis technologies with fully automated optical microscopes have made it possible to achieve the track reconstruction for path lengths down to one hundred nanometres and there are good prospects to further exceed this limit. The detector concept we propose foresees the use of a bulk of nuclear emulsion films surrounded by a shield from environmental radioactivity, to be placed on an equatorial telescope in order to cancel out the effect of the Earth rotation, thus keeping the detector at a fixed orientation toward the expected direction of galactic WIMPs. We report the performances and the schedule of the NEWS (Nuclear Emulsions for WIMP Search) experiment, with its one-kilogram mass pilot experiment, aiming at delivering the first results on the time scale of five years.

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