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Directional Dark Matter Search with NEWSdm

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In spite of the extensive search for the detection of the dark matter (DM), experiments have so far yielded null results: they are probing lower and lower cross-section values and are touching the so-called neutrino floor. A way to possibly overcome the limitation of the neutrino floor is a directional sensitive approach: one of the most promising techniques for directional detection is nuclear emulsion technology with nanometric resolution. Nano Imaging Trackers (NIT) is the last generation of nuclear emulsions, designed on purpose for a directional DM search. It has an extremely high granularity, and it required the development of fast super-resolution imaging technique for its readout. The NEWSdm experiment, located in the Gran Sasso underground laboratory in Italy, uses the NIT emulsion acting both as the Weakly Interactive Massive Particle (WIMP) target and as the nanometric-accuracy tracking device. This would provide a powerful method of confirming the Galactic origin of the dark matter, thanks to the cutting-edge technology developed to readout sub-nanometric trajectories. In this talk we discuss the newly-developed super-resolution readout technique, the NEWSdm experiment design, its physics potential, the performance achieved in test beam measurements and the near-future plans.

Your name

Andrey Alexandrov

email

andrey.alexandrov@na.infn.it

Title

Dr

Nationality

Russian

Institute

National Institute of Nuclear Physics (INFN) and University of Naples "Federico II", Italy

Author: ALEXANDROV, Andrey (Universita e sezione INFN di Napoli (IT))

Co-author: NEWSDM COLLABORATION

Presenters: ALEXANDROV, Andrey (Universita e sezione INFN di Napoli (IT)); ALEXANDROV, Andrey (INFN sez. di Napoli)

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