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The NEWSdm experiment for directional dark matter searches

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Despite great efforts to directly detect dark matter (DM), experiments so far have found no evidence. The sensitivity of direct detection of DM approaches the so-called neutrino floor below which it is hard to disentangle the DM candidate from the background neutrino. One of the promising methods of overcoming this barrier is to utilize the directional signature that both neutrino- and dark-matter-induced recoils possess. The nuclear emulsion technology is the most promising technique with nanometric resolution to disentangle the DM signal from the neutrino background. The NEWSdm experiment, located in the Gran Sasso underground laboratory in Italy, is based on novel nuclear 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 experiment design, its physics potential, the performance achieved in test beam measurements and the near-future plans. After the submission of a Letter of Intent, a new facility for emulsion handling was constructed in the Gran Sasso underground laboratory which is now under commissioning. A Conceptual Design Report is in preparation and will be submitted in 2022.

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