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Direct searches for cold dark matter in DarkSide-20k

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Many astronomical observations indicate that the known matter accounts only for a small fraction of the observed gravitational matter of the Universe. The remaining mass, called dark matter, could be explained by weakly interacting particles with properties different from ordinary matter. Direct detection of that dark matter would be a changing discovery in the history of science and would open a gateway for further investigation of a major part of our Universe. A leading candidate for dark matter are weakly interacting massive particles, WIMPs, a relic of the Big Bang with mass in the GeV/c2 - TeV/c2 range.
In the talk the current status of the DarkSide-20k experiment will be presented. DarkSide-20k is a low-energy-threshold liquid argon based detector (TPC containing 50 tons of LAr, 20 tons fiducial) capable of identifying nuclear recoils from WIMP over the course of a very large exposure. Due to its unique light emission properties and pulse shape discrimination abilities, liquid argon can provide excellent sensitivity for WIMP collisions and strong background suppression. The DarkSide-20k experiment will reach the cross section vs. mass range in the search for dark matter of 4.6 x 10^{-48} cm^2 for the 90% C.L. exclusion and 1.5x 10^{-47} cm^2 for the 5 discovery significance for a 1 TeV/c2 WIMP after a 500 t yr exposure. It is well beyond any current or presently funded experiments. This will allow us to discover, confirm or exclude the WIMP dark matter hypothesis down to the level where atmospheric neutrinos induce an irreducible background, the so-called neutrino floor. Unique features of DarkSide-20k is usage of depleted LAr (1500 lower specific activity of Ar-39 with respect to normal argon) and large-surface array of low-background SiPMs for scintillation light detection.

Primary author: HARANCZYK, Malgorzata (Jagiellonian University)

Presenter: HARANCZYK, Malgorzata (Jagiellonian University)

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