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The DarkSide program: toward a background-free DM search

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The DarkSide programme aims to perform direct search for Dark Matter exploring WIMP-nucleon cross section down to the neutrino floor employing a dual phase TPC filled with Argon. Liquid argon is a unique scintillating material allowing an exceptional rejection of electron induced background events by means of pulse shape discrimination. This, together with neutron and muon vetoes, allows the current experiment, DS-50, to perform a background free direct search. Building on the experience acquired with the DS-50 detector, the DarkSide collaboration is proposing to build a 20 tons fiducial volume Liquid Argon TPC. Two important technological breakthroughs will allow DS-20K to achieve a sensitivity approaching the neutrino floor for high mass WIMPs. Firstly, Argon depleted of its radioactive isotope 39Ar extracted deep underground and purified to an unprecedented level thanks to the URANIA & ARIA programs will be used. Secondly, Silicon PhotoMultiplier arrays will replace traditional photo-multiplier tubes further suppressing the radioactivity inside the TPC, simultaneously providing the detector with higher photon detection efficiency and better resolution. The latest results from DS-50 and the current status of the DS-20k proposal, with particular attention to the advancement in the photo-electronics design will be discussed.

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