

# DarkSide: a direct dark matter search project using liquid argon

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DarkSide run since mid-2015 a 50-kg-active-mass dual-phase argon Time Projection Chamber (TPC), filled with low radioactivity argon from an underground source and produced world-class results for both the low mass ( $M_{WIMP} < 20\text{GeV}/c^2$ ) and high mass ( $M_{WIMP} > 100\text{GeV}/c^2$ ) direct detection search for dark matter. The next stage of the DarkSide program will be new generation experiments involving a global collaboration named the Global Argon Dark Matter Collaboration (GADMC) from all the current argon based experiments. DarkSide-20k is designed as a 20-tonne fiducial mass dual-phase Liquid Argon TPC with SiPM-based cryogenic photosensors and is expected to be free of any instrumental background for an exposure of  $>200$  tonne x year. Like its predecessor, DarkSide-20k will be housed at the INFN Gran Sasso underground laboratory (LNGS), and it is expected to attain a WIMP-nucleon cross-section exclusion sensitivity of  $7.4 \times 10^{-48}, \text{cm}^2$  for a WIMP mass of  $1\text{TeV}/c^2$  in a 200 t yr exposure. DarkSide-LowMass is an ultimate low-mass dark matter search experiment optimized for low-threshold electron-counting measurements, with sensitivity to light dark matter explored across various potential energy thresholds and background rates. DarkSide-LowMass can achieve sensitivity to light dark matter down to the level of the solar neutrino fog for GeV-scale masses and significant sensitivity down to  $10 \text{MeV}/c^2$ , considering the Migdal effect or interactions with electrons. CJPL-II is the candidate laboratory for constructing the DarkSide-LowMass experiment. This talk will provide the latest updates on the DarkSide-20k project and the prospects of the DarkSide-LowMass project.

## Collaboration (if any)

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