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Light Dark Matter Search with Dual-Phase Argon Time Projection Chamber

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The DarkSide experiment is a direct dark matter search using dual-phase argon time projection chamber. Its preceding experiment, DarkSide-50, produced world-class result for light dark matter search based on a low-threshold electron-counting measurement. A new proposed detector, DarkSide-LowMass, is optimized for such measurement based on the success of the DarkSide-50 and progress towards the DarkSide-20k. The sensitivity is explored for various potential energy thresholds and background rates. Our studies show that 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 MeV/c², taking into account the Migdal effect or interactions with electrons. Requirements for optimizing the detector's sensitivity are explored, as well as potential gains from modeling and mitigating spurious electron backgrounds that may dominate the signal at the lowest energies.

In this talk, we present the overview of the DarkSide-LowMass, followed by the recent results from the DarkSide-50.

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