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# A Unified Program of Argon Dark Matter Searches: DarkSide-20k and The Global Argon Dark Matter Collaboration

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Experimenters from four different argon dark matter searches have joined their forces in the the "Global Argon Dark Matter Collaboration"to carry out a unified program for dark matter direct detection. The participants are researchers currently working on the ArDM experiment at LSC; on the DarkSide-50 experiment at LNGS; on the DEAP-3600 experiment at SNOLab; and on the MiniCLEAN experiment at SNOLab.
In 2015/2016 The DarkSide-50 experiment at LNGS produced two zero-background science results, along with a comparison of the results obtained with both atmospheric and underground argon fills, demonstrating the ability of large experiments to eliminate background from betas/gammas at the tens of tonne-year exposure. Early in 2018, the DarkSide Collaboration announced results from a 2-years campaign with DarkSide-50, resulting again in a zero-background, null observation of heavy (>50 GeV/c2) dark matter and in the best exclusion limits for light (<10 GeV/c2) dark matter.
The DEAP-3600 experiment at SNOLAB is the first tonne-scale experiment to achieve both stable operations and an extended physics run. DEAP-3600 has been collecting physics data with over 3 tonnes of argon since late 2016 and published its first results in 2017.
Researchers from the four experiments will jointly carry out as the single next step at the scale of a few tens of tonnes the DarkSide-20k experiment. DarkSide-20k was approved in 2017 by the Italian INFN, by the host laboratory LNGS, and by the US NSF. DarkSide-20k is also officially and jointly supported by the three underground laboratories LNGS, LSC, and SNOLab.
DarkSide-20k is a 20-tonne fiducial volume dual-phase TPC to be operated at LNGS with an underground argon fill, designed to collect an exposure of 100 tonne×years, completely free of neutron-induced nuclear recoil background and all electron recoil background. DarkSide-20k is set to start operating by 2021 and will have sensitivity to WIMP-nucleon spin-independent cross sections of 1.2 × 10−47 cm2 for WIMPs of 1 TeV/c2 mass, to be achieved during a 5 year run. An extended 10 year run could produce an exposure of 200 tonne×years, with sensitivity for the cross-section of 7.4 × 10−48 cm2, for the same WIMP mass. DS-20k will explore the WIMP-nucleon cross-section down to the edge of the 'neutrino floor', where coherent neutrino-nucleus scattering from environmental neutrinos induce nuclear recoils in the detector.
A second step in the program is the construction and operation of a detector with a fiducial mass of a few hundred tonnes, capable of collecting an exposure of several thousands of tonne×years, completely free of all backgrounds on top of CNNS. This follow-up experiment would also be capable of performing a set of very high precision measurement of several solar neutrino sources (location and laboratory t.b.d.). This includes exquisitely precise measurements of pep, CNO, as well as low energy 8B neutrinos, all in the region of transition between the vacuum- and matter-dominated regions of solar neutrino oscillations.

**Primary author:** Prof. GALBIATI, Cristiano (GSGC)

**Presenter:** Prof. GALBIATI, Cristiano (GSGC)

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