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Andrew Renshaw (U. of Houston): URANIA and ARIA, Low radioactivity Argon for rare event searches

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The DarkSide-50 two-phase liquid argon (LAr) detector has been searching for weakly interacting massive particle (WIMP) dark matter for more than three years, and during last two and a half years has been successfully operating the detector with argon that was extracted from underground CO₂ wells in Cortez, Colorado in the US. This source of argon has been long shielded from cosmic rays entering Earth's atmosphere, and thus has a lower concentration of the cosmogenically produced isotope of ³⁹Ar that beta decays with an endpoint energy that causes the beta spectrum to entirely cover the LAr WIMP search region. A 70-day exposure of the underground argon (UAr) inside DS-50 demonstrated that the UAr extracted from Colorado contains ³⁹Ar a factor >1000 less than atmospheric argon. This large reduction in ³⁹Ar opens the door for the construction of much larger LAr detectors that can be used for the direct detection of WIMP dark matter, as well as other rare-event searches. This talk will focus on the details of two new projects called Urania and Aria. Urania aims to extract 100 kg/day of UAr from the same source of gas as that used to extract the UAr for DS-50. Aria will then further purify the extracted UAr to produce >35 tonnes of detector grade UAr for use in a 20-tonne fiducial volume detector called DarkSide-20k, set to begin operations at the beginning of the next decade.

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