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New constraints on multiply-interacting ultra-heavy dark matter from the LUX-ZEPLIN (LZ) experiment

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Despite the wealth of gravitational evidence, little is known about the nature of dark matter. Searches for dark matter with liquid xenon (LXe) Time Projection Chamber (TPC) experiments have focused on the traditional mass range of weakly interacting massive particle (WIMP) dark matter candidates from a few GeV/c^2 to hundreds of TeV/c^2. The lack of WIMP signal thus far motivates a broader search for dark matter at less traditional masses. Dark matter candidates heavier than the unitarity limit of a few hundred TeV/c^2 for particles produced by thermal freeze-out could form for example as composite states bound by an attractive hidden sector force. In this talk, we present an analysis of the first science run (SR1) of the LUX-ZEPLIN (LZ) experiment to extend sensitivity to ultra-heavy dark matter (UHDM) with high cross section. The signal topology consists of multiple deposits in the active region forming a straight line. Rich information is available in such a dark matter signal, including the means to reconstruct the incident particle's full velocity vector on an event-by-event basis. This search sets new experimental limits on spin-independent dark matter-nucleus interactions to masses above 10^{17} GeV/c^2.

Primary author: SMITH, Ryan (UC Berkeley)

Presenter: SMITH, Ryan (UC Berkeley)

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