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TALK: Dark Matter Raining on DUNE and Other Large Volume Detectors

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Direct detection is a powerful means of searching for particle physics evidence of dark matter (DM) heavier than about a GeV with volume, low-threshold detectors.

In many scenarios, some fraction of the DM may be boosted to large velocities enhancing and generally modifying possible detection signatures. We investigate the scenario where 100% of the DM may be boosted at the Earth due to new attractive long-range forces. This opens up two main improvements in detection capabilities: 1) the detection signatures are stronger opening up large-volume neutrino detectors, such as DUNE, Super-K, Hyper-K, and JUNO, as possible DM detectors, and 2) the large boost allows for detectable signatures of sub-GeV DM. At lower boosts, a modified, higher-than-usual energy signal could be accessible at direct detection experiments such as LZ. In addition, the model leads to a significant anisotropy in the signal with the DM flowing dominantly vertically at the Earth's surface instead of the typical approximately isotropic DM signal. We develop the theory behind this model and also calculate realistic constraints using a detailed GENIE simulation of the signal inside detectors.

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