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Dark matter boosted by terrestrial collisions

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Inelastic dark matter (IDM) models feature an energy threshold for scattering with Standard Model particles, which enables their consistency with the increasingly stringent limits placed by direct detection experiments. In a typical construction, elastic scattering is absent at tree level, and a lighter dark matter state must first upscatter into a heavier state in order to interact with the nuclei in the detector. We model the excitation of IDM in the Earth followed by its downscattering inside a detector, and we show that considering this process markedly enhances the sensitivity of existing detectors. In particular, current limits based on XENON100 and XENON1T data can be extended to significantly larger mass splittings.

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