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Attenuation of Cosmic-Ray Up-Scattered Dark Matter

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GeV-scale dark matter particles with strong coupling to baryons evade the standard direct detection limits as they are efficiently stopped in the overburden and, consequently, are not able to reach the underground detectors. On the other hand, novel direct detection bounds were found when the flux of dark matter particles boosted by interactions with cosmic rays was taken into account. We revisit these bounds paying particular attention to interactions of the relativistic dark matter particles in the Earth's crust. The effects of nuclear form factors, inelastic scattering and extra dependence of the cross sections on transferred momentum (e.g., due to presence of light mediators) were studied and were found to be crucial for answering the question as to whether the window for GeV-scale strongly interacting dark matter is closed or not.

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