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# Theoretical upper bounds on the dark matter-electron scattering rate in the generalised susceptibility formalism

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Direct-detection experiments seek signals generated by dark matter particles interacting with the microscopic constituents of detector materials.

In our work, we combine a non-relativistic effective theory for DM-electron interactions with the linear response theory to describe the scattering of sub-GeV DM particles in Si, Ge, Xe and Ar detectors.

Within this formalism, the detector response to an arbitrary DM-electron interaction is described in terms of generalised susceptibilities, which extend the notion of dielectric function to general DM-detector couplings.

It can be shown that due to the requirement of analyticity and causality, some of those generalised susceptibilities, and thus the associated scattering rates, are bounded from above.

We compare the expected scattering rates in currently used detector materials with our predicted theoretical upper bound and explore the properties an optimal material should have in order to saturate this bound and thus maximize the possible detector response.

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