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General dark matter electron interactions in graphene

Thursday, 14 September 2023 15:00 (15 minutes)

We employ a non-relativistic effective theory to model dark matter (DM) induced electron ejections from graphene and carbon nanotubes (CNTs), materials currently in the R&D phase for direct detection experiments. The material properties of graphene are modelled using Density Functional Theory, and we obtain observable ejection rates for arbitrary forms of scalar and spin-1/2 DM. We show how the anisotropy of graphene and CNTs cause a strong daily modulation in the rate of electron ejections, a smoking gun signal for DM. We project 3 sigma discovery potential of such a daily modulation pattern, as well as expected exclusion bounds in the case of no observed daily modulation.

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