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Anapole Moment of Majorana Fermions and Implications for Direct Detection of Neutralino Dark Matter

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In many theories dark matter is assumed to be a Majorana fermion, for which the electromagnetic anapole moment can induce an effective interaction with targets in direct detection experiments. After discussing briefly the experimental limit on the anapole moment of a DM candidate using direct detection data, we will formalize theoretical predictions for this coupling for general P breaking interactions between the Majorana fermion, a charged fermion and a scalar or vector.

This formalism is then applied to the lightest neutralino of the MSSM, for which we will present numerical results for both simplified limits and the full pMSSM. We find that the anapole moment can be enhanced by either allowing light sfermions in the spectrum or by considering a mixed neutralino state. Although the enhancement in the former case is typically larger, for the latter case the vector contribution can still lead to sizeable values of the anapole moment testable by next generation direct detection experiments.

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