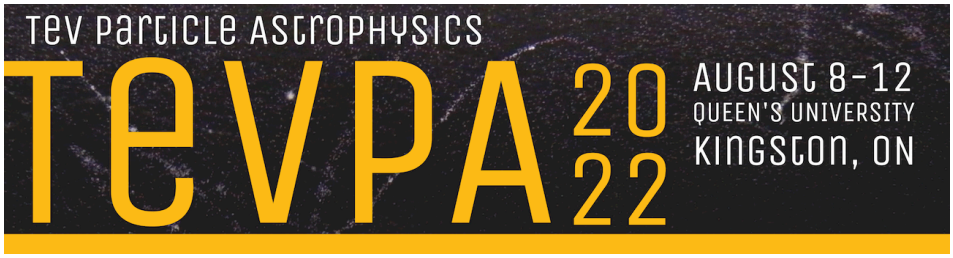

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Ab initio calculations of structure factors for dark matter searches

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We present converged ab initio calculations [1] of structure factors for elastic spin-dependent WIMP scattering off all nuclei used in dark matter direct-detection searches: 19F, 23Na, 27Al, 29Si, 73Ge, 127I, 129Xe, and 131Xe. From a set of established two- and three-nucleon interactions derived within chiral effective field theory, we construct consistent WIMP-nucleon currents at the one-body level, including effects from axial- vector two-body currents. We then apply the in-medium similarity renormalization group to construct effective valence-space Hamiltonians and consistently transformed operators of nuclear responses. Combining the recent advances of natural orbitals with three-nucleon forces expressed in large spaces, we obtain basis-space converged structure factors even in heavy nuclei. Generally, results are consistent with previous calculations, but in certain cases can differ by as much as 80-90% at low momentum transfer.

[1]. Ab initio structure factors for spin-dependent dark matter direct detection. B.S. Hu, et al. Phys. Rev. Lett. 128 (2022) 072502. arXiv:2109.00193.

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