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Cooperative shielding in three-dimensional lattices[1] JOSHUA T CANTIN, Univ of British Columbia, TIANRUI XU, Univ of California, Berkeley, ROMAN V KREMS, Univ of British Columbia — Cooperative shielding is the phenomenon that can make quantum systems with long-range interactions behave effectively as those with short-ranged interactions. Cooperative shielding has been previously demonstrated for both single-particle and many-body systems in *one*-dimensional (1D) lattices. We demonstrate that cooperative shielding extends to single-particle systems with *isotropic* long-range hopping in *three*-dimensional (3D) lattices. We analytically diagonalize a Hamiltonian containing isotropic long-range hopping terms of the form $r^{-\alpha}$ for a 3D lattice, under periodic boundary conditions, and where α is an arbitrary, real constant. We find that the obtained energy level structure is analogous to that observed in 1D. We also find that, for the 3D system of sidelength N, the shielding gap responsible for cooperative shielding diverges as $\Delta \propto N^3$, in contrast to the 1D case where $\Delta \propto N$. We further demonstrate, via numerical diagonalization, that cooperative shielding also extends to 3D systems with open boundary conditions.

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