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Dipole-dipole interaction-induced spin-orbit coupling of polar molecules in optical lattices M.L. WALL, JILA, S.V. SYZRANOV, University of Colorado at Boulder, A.M. REY, JILA — Long-range dipole-dipole interactions between polar molecules in an optical lattice enable rotational excitations to move through the lattice even when the molecules themselves cannot, as has been directly observed in recent experiments [Yan *et al.*, Nature **501**, 521-525 (2013)]. We study the dynamics of rotational excitations in a 2D lattice of (bosonic or fermionic) polar molecules in the presence of electric dipole-dipole interactions which exchange rotational "spin" angular momentum projection with orbital angular momentum, forming a cold molecule analog of the Einstein-de Haas effect. In particular, we present analytic results for the statics and dynamics of a dilute gas of rotational excitations in a unit-filed lattice. Prospects for observing such processes in near-term polar molecule experiments are discussed.

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