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The role of charge degrees of freedom in Mott insulators: coupling of dielectric and magnetic properties in Cr-trimer complexes. ROSS MCDONALD, OSCAR AYALA VALENZUELA, MARCELO JAIME, NHMFL-Los Alamos, JOHN MYDOSH, University of Koln — Materials that are insulating owing to strong electron correlations are pervasive in condensed matter physics-the parent phase of high-Tc cuprates, colossal magnetoresistive manganites and quantum magnets. All are characterized by a large onsite coulomb repulsion relative to the dominant electron hopping. As such, at half-band filling the charge is localized. The properties of these materials are therefore commonly described solely in terms of their spin degrees of freedom, with little attention given to any further role of the charge. Certain classes of Mott insulator are predicted to break this paradigm, providing a direct correlation between the magnetic spin texture and the dielectric properties of a material. We observe such a correlation in Cr- trimer systems, which combined with recent theoretical developments, indicates a purely electronic mechanism for multiferroic behavior. Magnetic field strengths of the order of the exchange interaction strongly perturb the spin texture, which is evident as steps and plateau in the magnetization. The corresponding shifts in dielectric properties reveal the role of the charge degrees of freedom. Electron Spin Resonance (ESR) results and the prospect of novel dipole-active ESR giving rise to the possibility of negative refractive indices will also be discussed.

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