

Abstract Submitted
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Spin-dependent excitation of plasma modes in non-neutral ion plasmas¹ BRIAN C. SAWYER, JOE W. BRITTON, JOHN J. BOLLINGER, NIST, Boulder, CO 80305 — We report on a new technique for exciting and sensitively detecting plasma modes in small, cold non-neutral ion plasmas. The technique uses an optical dipole force generated from laser beams to excite plasma modes. By making the force spin-dependent (i.e. depend on the internal state of the atomic ion) very small mode excitations (< 100 nm) can be detected through spin-motion entanglement. Even when the optical dipole force is homogeneous throughout the plasma, short wavelength modes on the order of the interparticle spacing can in principle be excited and detected through the spin dependence of the force. We use this technique to study the drumhead modes of single plane triangular arrays of a few hundred Be^+ ions. Spin-dependent mode excitation is interesting in this system because it provides a means of engineering an Ising interaction on a 2-D triangular lattice.² For the case of an anti-ferromagnetic interaction, this system exhibits spin frustration on a scale that is at present computationally intractable.

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²Porras and Cirac, PRL **92**, 207901 (2004)

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