Abstract Submitted
for the DAMOP12 Meeting of
The American Physical Society

Entanglement of cold molecules using strong optical pulses FELIPE HERRERA, ROMAN V. KREMS, University of British Columbia — We show that a strong off-resonant optical pulse can be used to create entanglement in an ensemble of polar molecules. The laser field modifies the rotational structure of molecules, enhancing the effect of the dipole-dipole interaction between molecules. This generates entanglement between molecules in different rotational states after the pulse is over. The degree of entanglement can be controlled by shaping the intensity and duration of the pulse. We show that a single nanosecond pulse can be used to produce an entangled state of molecules separated by several hundreds of nanometers, and that a sequence of pulses generate entanglement between molecules separated by tens of micrometers. We describe the possibility of using molecules trapped on an optical lattice to test Bell's inequalities by measuring orientation and alignment correlations. We also analyze the main sources of decoherence in the system and estimate the efficiency of two-qubit quantum gates for universal quantum computation with trapped polar molecules. Reference: F. Herrera, Ph.D. thesis, University of British Columbia, 2012

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Date submitted: 26 Jan 2012 Electronic form version 1.4