Abstract Submitted
for the DAMOP15 Meeting of
The American Physical Society

Aspects of Quantum Computing with Polar Paramagnetic Molecules[1] MALLIKARJUN KARRA, BRETISLAV FRIEDRICH, Fritz-Haber Institute — Since the original proposal by DeMille, arrays of optically trapped ultracold polar molecules have been considered among the most promising prototype platforms for the implementation of a quantum computer. The qubit of a molecular array is realized by a single dipolar molecule entangled via its dipole-dipole interaction with the rest of the array's molecules. A superimposed inhomogeneous electric field precludes the quenching of the body-fixed dipole moments by rotation and a time dependent external field controls the qubits to perform gate operations. Much like our previous work in which we considered the simplest cases of a polar $^1\Sigma$ and a symmetric top molecule, here we consider a $X^2\Pi_{3/2}$ polar molecule (exemplified by the OH radical) which, by virtue of its nonzero electronic spin and orbital angular momenta, is, in addition, paramagnetic. We demonstrate entanglement tuning by evaluating the concurrence (and the requisite frequencies needed for gate operations) between two such molecules in the presence of varying electric and magnetic fields. Finally, we discuss the conditions required for achieving qubit addressability (transition frequency difference, $\Delta\omega$, as compared with the concomitant Stark and Zeeman broadening) and high fidelity.

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Date submitted: 16 Jan 2015 Electronic form version 1.4