

# SPECIAL CHEMICAL PHYSICS AND PIZZA SEMINAR SERIES

## *“Tangling with Entanglement: Polar Molecules as Qubits”\*\**

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### **Abstract**

Over the past decade, arrays of ultracold (<mK) polar molecules have come to be considered among the most promising platforms to implement a quantum computer. In principle, such a computer can perform a variety of calculations with exponentially fewer steps than a classical computer. A key requisite for quantum computing is *entangled* states. For a pair of entangled states, the wave function cannot be separated into a product of functions of the individual partner states. (Einstein found quantum entanglement intolerable, because it allowed “spooky action at any distance.”) For arrays of polar molecules, entanglement is supplied by dipole-dipole interaction. Previous studies of prospects for computing with polar molecules had identified experimental conditions deemed suitable and accessible. This talk reports the first calculations of entanglement pertaining to such conditions. The results show that pairwise entanglement would be entirely quenched for the ground state for diatomic or linear polar molecules, but not for many excited states, and also suggest means to revive it even for the ground state.

**Wednesday, September 15, 2010**

**11:30 a.m. IQSE 578**

**Mitchell Physics Building**

**Texas A&M University**

**Department of Physics**

(Pizza, salad, and soda to be served at 12:30 p.m. outside IQSE 578)

\*\* The work described in this seminar was carried out in collaboration with Dr. Qi Wei of IQSE, Prof. Sabre Kais of Purdue, and Dr. Bretislav Friedrich of the Fritz-Haber Institute, Berlin. Grad students and postdocs are invited to a discussion of further aspects of entanglement, pertaining to quantum optics as well as quantum computing, to be held on Thurs, 16 Sept, 10 AM – 12 noon, also in IQSE 578; it will be led by Dr. Qi Wei.