

Two-Ion Tricks for Entanglement

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Abstract

A first step in the realization of quantum computation with multiple trapped ions—the generation of entangled states—requires some form of differential addressing. As a simpler alternative to individual addressing via tightly focused laser beams,¹ ion micromotion can be used to control the rate of interaction between a single, spatially extended laser beam and each ion. In particular, when two $^9\text{Be}^+$ ions in an elliptical rf (Paul) trap² have different micromotion amplitudes (induced by a controlled shift in the trap center relative to the rf null position), the Rabi flopping frequency associated with each ion can be appreciably different.³ Differential Rabi frequencies are sufficient to generate Bell-like entangled states (EPR pairs) of the spins associated with each ion. Experimental progress towards generation and measurement of two entangled spins will be discussed.

¹J. I. Cirac and P. Zoller, Phys. Rev. Lett. **74**, 4091 (1995).

²B. E. King, et al., submitted for publication, 1998; also in this meeting.

³C. J. Myatt, et al. SPIE Photonics West proceedings, 1998.