Invited talk

New pathway to universal quantum computing and entanglement generation

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Trapped-ions are one of the most mature platforms for quantum computation and quantum simulation. In trapped-ion quantum simulators the spin-spin interactions mediated by the collective motion of the ions in the crystal (phonons) are of the form r^{-a} where 0<a<3. I will show that the addition of optical tweezers opens a new pathway for generating spin-dependent optical forces. The tweezers can be used to both enhance the programmability of the quantum simulator and to create new quantum computing architectures.
Next, I will discuss a new pathway to multi parameter sensing in trapped ion quantum simulators which can be readily implemented. Here, spin-dependent squeezing is used for the simultaneous sensing of x and p. I will discuss the advantages of this protocol compared to prior protocols which require phase-locking and/or two-mode squeezing.