DAMOP17-2017-020133

Abstract for an Invited Paper
for the DAMOP17 Meeting of
the American Physical Society

Exploring Quantum Physics with Trapped Ions

DIETRICH LEIBFRIED, National Institute of Standards and Technology

Trapped ions were among the first systems, where a single quantum particle can be confined and manipulated in almost perfect isolation from its environment. This makes ions prime candidates for high precision experiments and for demonstrating textbook quantum mechanical principles. Several ions in the same trap can couple strongly to each other through their Coulomb interaction. This enables entangling quantum logic gates and as a consequence, many experiments with trapped ions have concentrated on advancing quantum information processing in the last 20 years. While much work still needs to be done before a scalable, fault tolerant universal quantum processor can be realized in any system, the advances with ions have enabled exploration of new avenues, such as quantum simulation, quantum logic spectroscopy for ion clocks, and for molecular ion and highly charged ion spectroscopy. Lately, ion-based sensors and ideas for hybrid quantum systems that aim to couple trapped ions to photons, neutral atoms, superconducting circuits, micro-mechanical oscillators or other quantum coherent entities are gaining momentum.

Reference: R. Blatt and D. Wineland, Entangled states of trapped atomic ions, Nature 453, 1008 (2008)