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### **Quantum Entanglement of Matter and Light<sup>1</sup>**

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A peculiar phenomenon called the entanglement is responsible for those features of quantum mechanics which Albert Einstein called “the spooky action at a distance.” Indeed, quantum systems in an entangled state seem to violate either the locality, or physical reality, or even both. Local measurements performed on one part of an entangled system *instantly* influence the outcome of local measurements on the other part. I will describe experiments in which quantum states of matter (in the form of trapped atomic ions) and light (in the form of single photons) are entangled. The matter-light system offers many advantages for fundamental studies of quantum mechanics, as well as applications in quantum computation and quantum information.

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