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Quantum technologies: manipulating individual spins

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The coherent manipulation of individual quantum degrees of freedom, such as single spins, was long considered to be possible only in thought experiments. At the end of last century this became routine in labs around the world, opening up new possibilities for technological applications. Pseudospins associated to electronic states in single trapped atoms or to quantum electronic circuits can be used as quantum bits to build quantum computers; coupled spins in controlled arrays can be employed as quantum simulators; individual electron spins in solid state (for instance defect centers in diamond) can be applied to sensing tiniest external fields; single photons' angular momenta can be exchanged between distant locations to establish secure communication channels. In this talk I will present an overview of such emerging quantum technologies and of the worldwide efforts to bring them to wider fruition.

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