Spin-Based Quantum Sensing with Endohedral Fullerenes

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Quantum sensing is one of the promising emerging technologies that constitute the so-called second quantum revolution, which aims to harness basic quantum physical effects for novel applications. Spin-based quantum sensors are extremely sensitive to tiny magnetic fields and may find applications in semiconductor technology, materials science and bio-medical imaging with unprecedented spatial and temporal resolution. In this project, the scientists aim to significantly improve a very general method for spin-based sensing, which is analogous to the well-known Magnetic Resonance Imaging used in hospitals, but promises to be many orders of magnitude more sensitive. They focus on a remarkable type of molecule, the endohedral fullerene N@C60, which is a tiny football made entirely of 60 carbon atoms that can incorporate an extra nitrogen atom at the center of the football. This extra atom is the true quantum sensor, which can monitor the tiniest variations of magnetic fields and temperature in its environment. Due to its extremely small size, the N@C60 molecule can also be 'smuggled' into biological cells or even single proteins, where it can constitute an ultra-sensitive probe for chemical and biological processes.

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