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Complete Scheme for Two-Qubit Quantum Computing using Pulsed ESR of ^{15}N@C$_{60}$ GAVIN W. MORLEY, Materials Department, University of Oxford, JOHAN VAN TOL, National High Magnetic Field Lab at Florida State University, JINYING ZHANG, MARK A.G. JONES, Materials Department, University of Oxford, ANDREI N. KHLOBYSTOV, Chemistry Department, University of Nottingham, KYRIAKOS PORFYRAKIS, Materials Department, University of Oxford, ARZHANG ARDAVAN, Clarendon Laboratory, University of Oxford, G. ANDREW D. BRIGGS, Materials Department, University of Oxford — ^{15}N@C$_{60}$ is a fullerene molecule containing an atom of nitrogen-15. Its long electron spin decoherence time makes it attractive for quantum computing. The electronic and nuclear spins of the nitrogen atom are good quantum numbers in a strong magnetic field, coupled by the hyperfine interaction. Pulsed electron nuclear double resonance (ENDOR) can be used to initialize, manipulate and measure this two-qubit system. We used dynamic nuclear polarization (DNP) to prepare an initial state in which the nuclear and electronic spins were aligned with the applied field. We measured this to be an 80% pure state. The decoherence time of N@C$_{60}$, T_2, can be increased to 215 μs at 4 K. The electronic T_1 time is the relevant timescale for reading out the result of a computation. At 4.2 K this is 4.5 minutes, and the nuclear T_1 is greater than 12 hours. www.nanotech.org

Gavin Morley
Materials Department, University of Oxford

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