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Psuedo-entanglement between nuclear spins in photoexcited functionalized fullerenes VASILEIA FILIDOU, STEPHANIE SIMMONS, University of Oxford, HARRY L. ANDERSON, University of Oxford, G. ANDREW D. BRIGGS, ARZHANG ARDAVAN, University of Oxford, STEVEN KARLEN, University of Chicago, FELICIANO GIUSTINO, JOHN J.L. MORTON, University of Oxford — Optically excited triplet electron spins can be used to polarise, manipulate, couple and measure nuclear spins. Here we present photoexcited pulsed magnetic resonance experiments for the characterization of functionalized fullerene structures with homo and hetero nuclear spins. We use density functional theory in order to predict the hyperfine interaction between the photoexcited triplet and various nuclear spins in the structure, and then use magnetic resonance (ENDOR) to investigate these values experimentally. In addition to the hyperfine coupling strength, we measure the relevant relaxation rates and initial hyperpolarisation of the triplet in order to understand the possible degree of entanglement of nuclear spins through the optically excited mediator spin. We measure an increased nuclear-nuclear coupling in the presence of the triplet which permits fast nuclear controlled-NOT gates.These operations, in conjunction with the transfer of electron polarisation to the nucleus, allow the demonstration of nuclear-nuclear pseudo-entanglement, measured using quantum state tomography.

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