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Optical Control of a Nuclear Spin in Diamond DAVID LEVONIAN, MICHAEL GOLDMAN, KRISTIAAN DEGREVE, SOONWON CHOI, Harvard Univ, MATTHEW MARKHAM, DANIEL TWITCHEN, Element Six Ltd, MIKHAIL LUKIN, Harvard Univ — The nitrogen-vacancy (NV) center in diamond has emerged as a promising candidate for quantum information and quantum communication applications. The NV center's potential as a quantum register is due to the long coherence time of its spin-triplet electronic ground state, the optical addressability of its electronic transitions, and the presence of nearby ancillary nuclear spins. The NV center's electronic spin and nearby nuclear spins are most commonly manipulated using applied microwave and RF fields, but this approach would be difficult to scale up for use with an array of NV-based quantum registers. In this context, all-optical manipulation would be more scalable, technically simpler, and potentially faster. Although all-optical control of the electronic spin has been demonstrated, it is an outstanding problem for the nuclear spins. Here, we use an optical Raman scheme to implement nuclear spin-specific control of the electronic spin and coherent control of the ^{14}N nuclear spin.

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