Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Structure determination of individual electron-nuclear spin complexes in a solid-state matrix ABDELGHANI LARAOUI, DANIELA PAGLIERO, CARLOS MERILES, CUNY-City College of New York — A spin-based quantum computer will store and process information via "spin complexes" formed by a small number of interacting electronic and nuclear spins within a solid-state host. Unlike present electronic circuits, differences in the atomic composition and local geometry make each of these spin clusters distinct from the rest. Integration of these units into a working network thus builds on our ability to determine the cluster atomic structure, a problem we tackle herein with the aid of a magnetic resonance protocol. Using the nitrogen-vacancy (NV) center in diamond as a model system, we show analytically and numerically that the spatial coordinates of weakly coupled 13C spins can be determined by selectively transferring and retrieving spin polarization. The technique's spatial resolution can reach up to 0.1 nm, limited by the NV spin coherence lifetime. No external magnetic field gradient is required, which makes this imaging scheme applicable to NV-13C complexes buried deep inside the crystal host. Further, this approach can be adapted to nuclear spins other than 13C, and thus applied to the characterization of individual molecules anchored to the diamond surface.

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Date submitted: 14 Nov 2014 Electronic form version 1.4