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Electron dephasing and decoherence of neutral donor bound electrons in GaAs KAI-MEI FU, SUSAN CLARK, Stanford University, CHARLES SANTORI, Hewlett-Packard Laboratories, BINGYANG ZHANG, Stanford University, COLIN STANLEY, M.C. HOLLAND, University of Glasgow, YOSHIHISA YAMAMOTO, Stanford University — Strong oscillator strengths, small inhomogeneous broadenings of the optical transitions, and semiconductor device integration possibilities make the GaAs donor-bound exciton (D0X) system an attractive candidate for electromagnetically induced transparency based applications. However, the recent observation of coherent population trapping in the GaAs D0X system indicates a fast (1-2 ns) dephasing rate of the bound- electron spin states which severely limits the achievable transparency. Theoretical and experimental research in other groups indicate the fast dephasing is due to the random nuclear spin environment in the GaAs lattice. We perform measurements of the electron Zeeman Raman transition linewidth which confirm the 1-2 ns dephasing rate. Using this technique, we study the effect of doping density and magnetic field on the Raman linewidth. Both variables can theoretically affect the inhomogeneous broadening due to the nuclear spin environment. If the inhomogeneous broadening can be decreased, spin-echo techniques should be possible to further increase the spin dephasing time to the homogeneous microsecond regime.

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