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Electron Spin Coherence of Silicon Vacancies in Proton-Irradiated 4H-SiC[1] JOHN COLTON, JACOB EMBLEY, KYLE MILLER, MARGARET MORRIS, MICHAEL MEEHAN, SCOTT CROSSEN, Brigham Young Univ - Provo, BRADLEY WEAVER, EVAN GLASER, SAM CARTER, Naval Research Lab - Washington, D.C. — We report T_2 spin coherence times for electronic states of Si vacancies in 4H-SiC. Our spin coherence study included two SiC samples that were irradiated with 2 MeV protons at different fluences (10^{13} and 10^{14} cm^{-2}). Using optically detected magnetic resonance and spin echo, the coherence times for each sample were measured across a range of temperatures from 8 K to 295 K. All echo experiments were done at a magnetic field strength of 0.371 T and a microwave frequency of 10.49 GHz. The longest coherence times were obtained at 8 K, being 270 μs for the 10^{13} cm^{-2} proton-irradiated sample and 104 μs for the 10^{14} cm^{-2} sample. The coherence times for both samples displayed unusual temperature dependences; in particular, they decreased with temperature until 60 K, then increased until 160 K, then decreased again. This increase between 60 and 160 K is tentatively attributed to a motional Jahn-Teller effect. The consistently longer lifetimes for the 10^{13} cm^{-2} sample suggest that a significant source of the spin dephasing can be attributed to dipole-dipole interactions between Si vacancies or with other defects produced by the proton irradiation. The lack of a simple exponential decay for our 10^{14} cm^{-2} sample indicates an inhomogeneous distribution of defect spins.

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