APSA 先端光量子科学アライアンス 談話会

UT-PSC 光量子科学研究センター セミナー

# Engineering Defect Spin States in SiC for Sensing and Computation

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日 時 ： 平成 25 年 10 月 7 日(月) 11:00-

場 所 ： 東京大学工学部 2 号館 33A 号室

## Abstract

Crystal defects can confine isolated electronic spins and are promising candidates for solid-state quantum bits [1]. Alongside research efforts focusing on nitrogen vacancy (NV) centers in diamond, an alternative approach seeks to identify and control new spin systems with an expanded set of technological capabilities, a strategy that could ultimately lead to “designer” spins with tailored properties. We discuss recent experimental results identifying such spin systems in the 4H, 6H, and 3C crystal polymorphs of silicon carbide (SiC) [2,3]. Using infrared light at near-telecom wavelengths and gigahertz microwaves, we show that these spin states can be coherently addressed at temperatures ranging up to room temperature. Long spin coherence times allow us to use double electron-electron resonance to measure magnetic dipole interactions between spin ensembles in inequivalent lattice sites of the same crystal. Since such inequivalent spin states have distinct optical and spin transition energies, these interactions could lead to dipole-coupled networks of separately addressable spins (Fig. 1). Together with the availability of industrial scale crystal growth and advanced microfabrication techniques for SiC, these results make SiC a promising platform for photonic, spintronic, and quantum information applications that merge quantum degrees of freedom with classical electronic and optical technologies.

[1] J. R. Weber, *et al.*, Proc. Natl. Acad. Sci. USA **107**, 8513 (2010).
[2] W. F. Koehl *et al.*, Nature **479**, 84 (2011).
[3] A. L. Falk *et al.*, Nat. Commun., **4**, 1819 (2013).

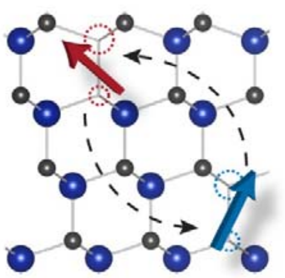

Fig. 1. Interacting spin states based on inequivalent neutral divacancies in SiC

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