Solid State Materials as Quantum Information Platforms

S&T Campaign: Materials Research
Photonics
Quantum Information Science

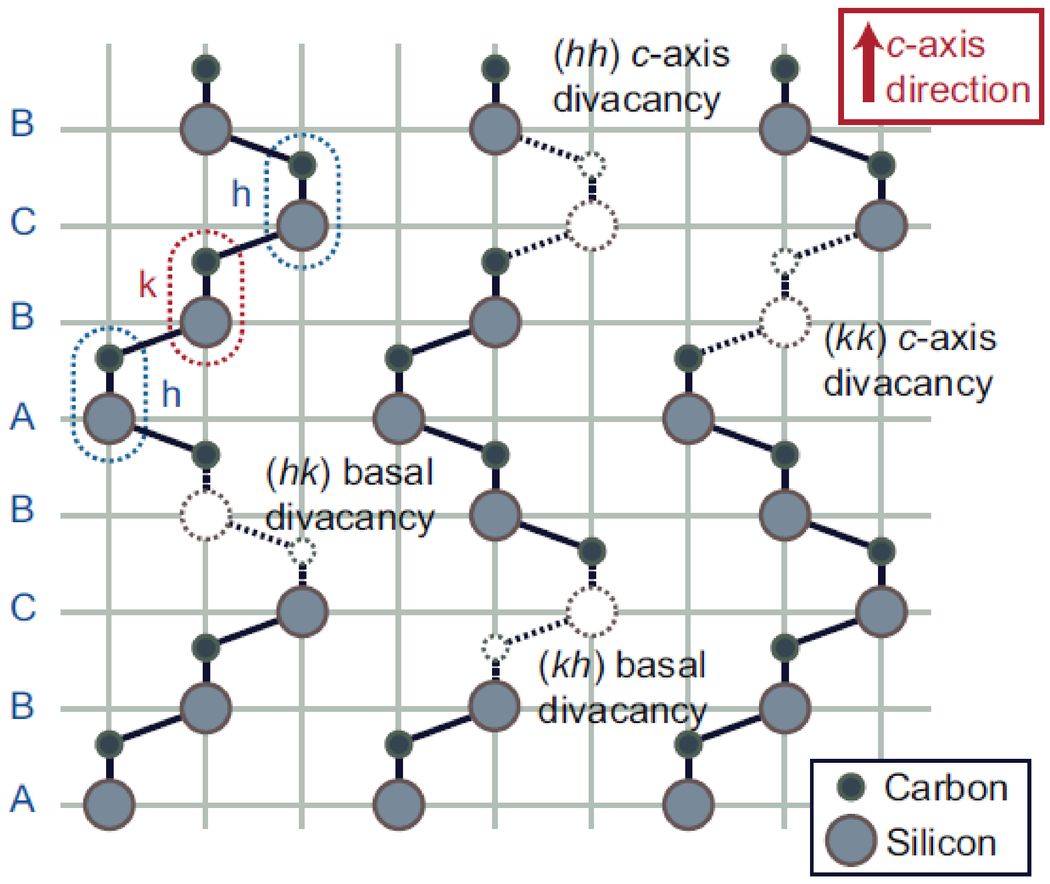
Christopher Morris
(301) 394-0950
christopher.j.morris58.civ@mail.mil

Research Objective

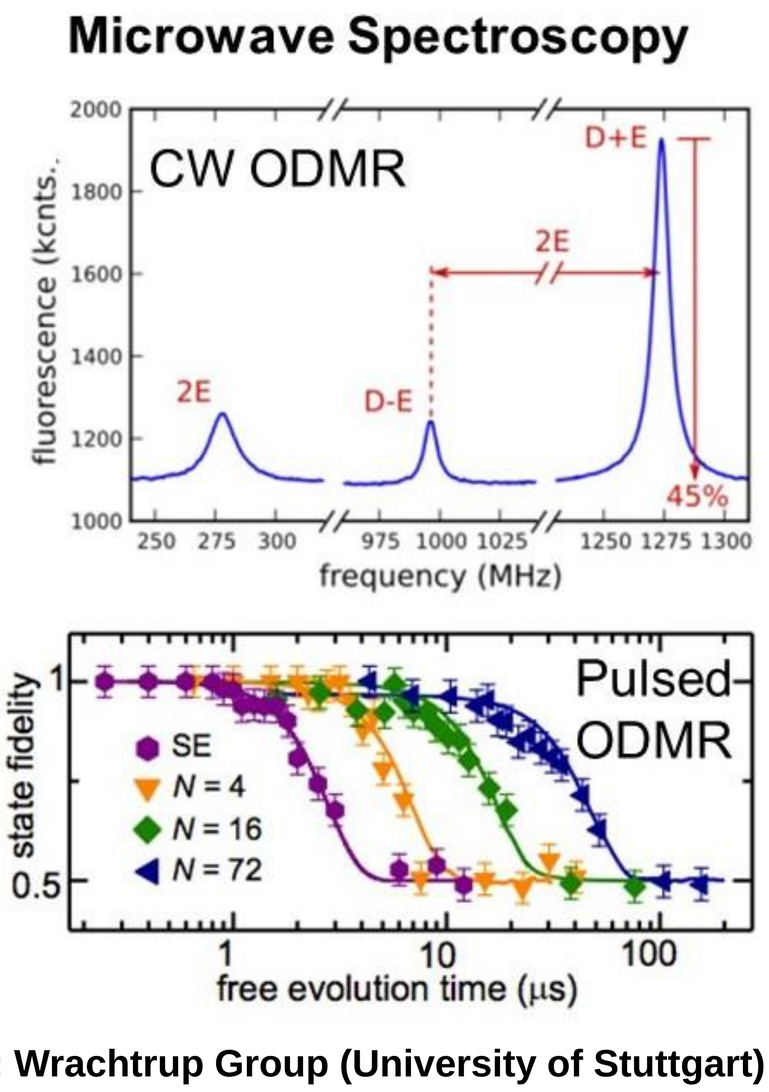
- **Establishment of in-house capability for solid-state quantum systems based on defects in technologically relevant materials such as 4H-SiC.**
- **Development of common characterization tools including continuous-wave (CW) and pulsed optically detected magnetic resonance (ODMR). These tools provide optical access of the chemical signature of point defects in solids that also provide 'quantum memory'.**

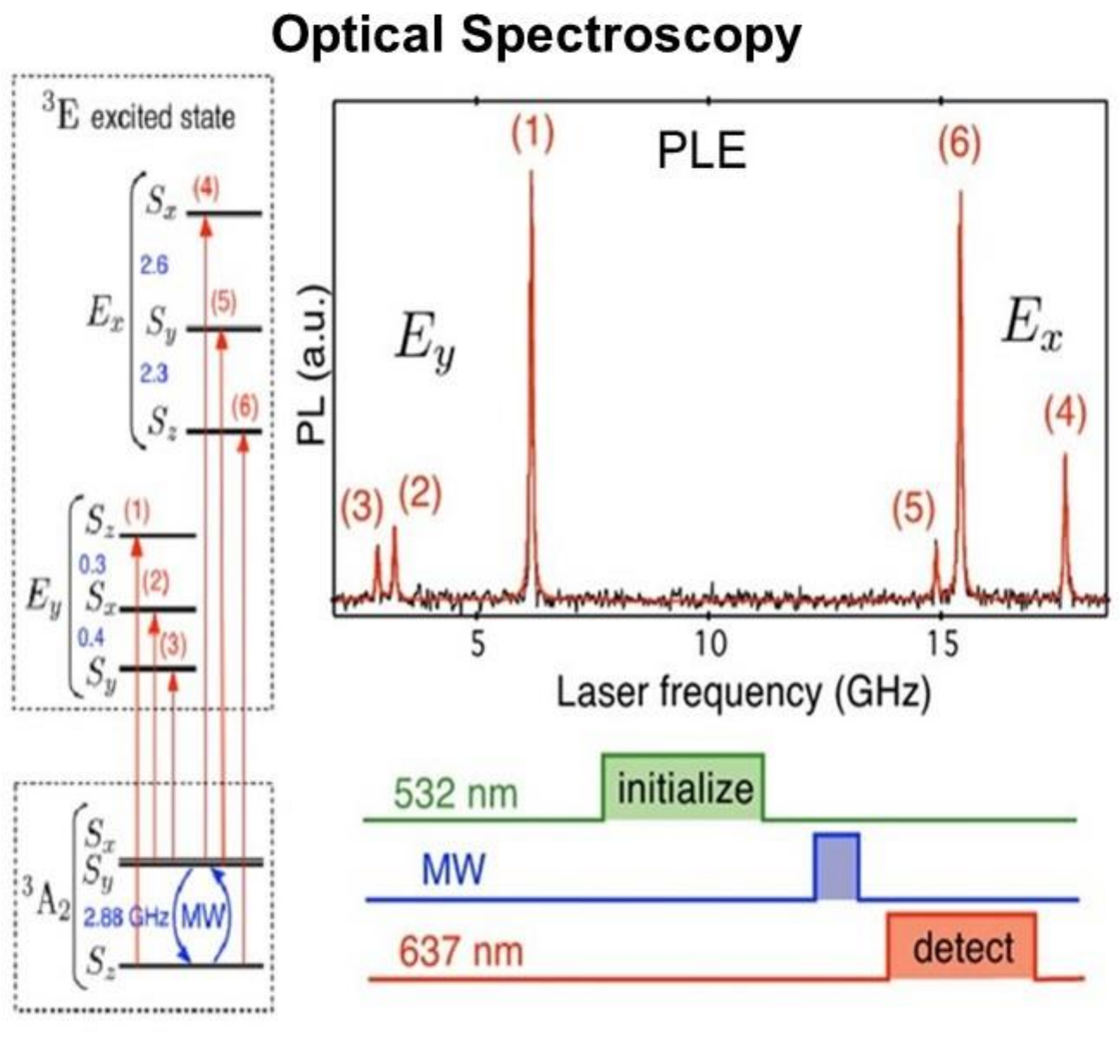
Challenges

Qubit (spin, photon) coherence properties of defects such as 4H-SiC divacancy are known to degrade near surfaces, where the majority of acoustic, electronic and optical engineering may occur in 4H-SiC.



Di-vacancy color centers in 4H- polytype silicon carbide.
Reference: Awschalom Group, IME.





References: Wrachtrup Group (University of Stuttgart) and Hanson Group (Delft University).

ARL Facilities and Capabilities Available to Support Collaborative Research

Dedicated silicon carbide metal organic chemical vapor deposition (MOCVD) reactor for 'gentle' doping and precision crystalline control of silicon carbide material used for quantum devices.

Complementary Expertise / Facilities / Capabilities Sought in Collaboration

Research groups with experimental and theoretical backgrounds in solid-state and materials physics, nano- and quantum photonics and electronics, and nanofabrication.