All-Optical Reconfiguration of Single Solid-State Defects in Diamond

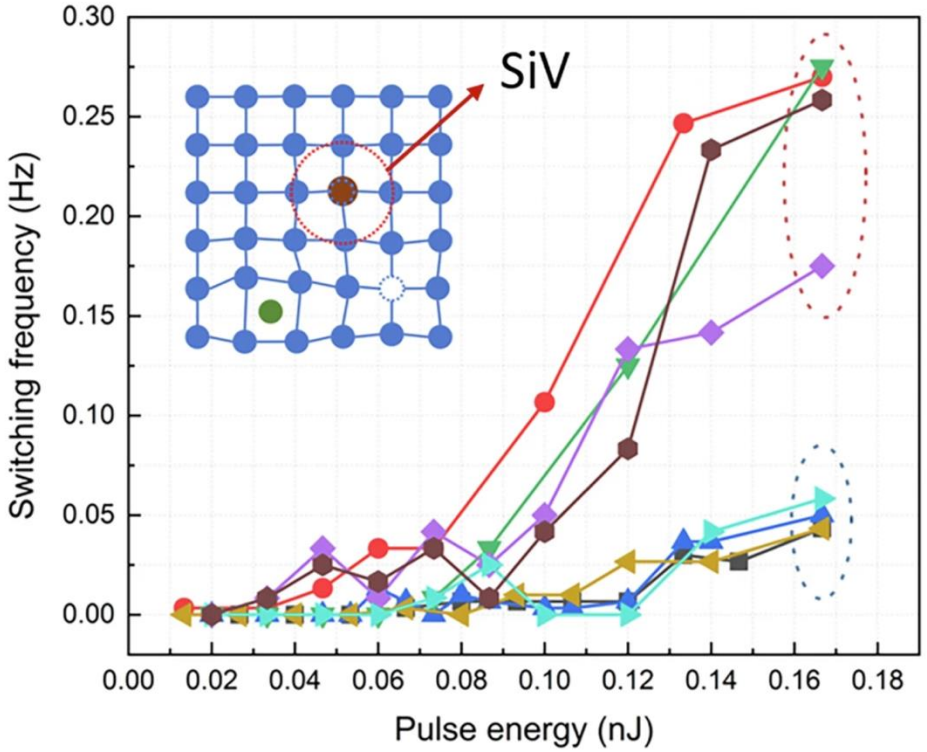

Figure: Time-dependent PL spectra of relevant SiV transition. Application of the high-energy pulsed laser results in a persistent shift of the SiV emission wavelength, showing deterministic manipulation of the SiV into a specific strain state with high fidelity.

Scientific Achievement

The ground state splitting of single silicon-vacancy centers (SiVs) in diamonds were engineered using high-energy laser pulses, allowing for SiVs to operate as reconfigurable non-volatile optical memories.

Significance and Impact

The team enabled local strain engineering in SiVs as optical memories at nanoscale without delicate nanostructures, complicated fabrication, or continuously applied external fields.

Research Details

- High-power pulsed laser irradiation was used to manipulate defects in the diamond lattice caused by SiV implantation.
- Modified the local diamond strain near the SiV, which is read out optically as a non-volatile shift in the SiV emission wavelength through photoluminescence (PL) spectra.

This work was performed, in part, at the Center for Integrated Nanotechnologies.

Xue, Y.; Ni, X.; Titze, M.; Su, S. S.; Wu, B.; Zhang, L.; Cui, C.; Guha, S.; Eichenfield, M.; Fan, L. All-Optical Reconfiguration of Single Silicon-Vacancy Centers in Diamond for Non-Volatile Memories. *Nature Communications.* 2025.