# Photoionization of double negatively charged silicon vacancy in diamond

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The study of optically active point defects in wide bandgap semiconductors is of primary interest for the development of solid-state quantum technologies. However, not all defects are accessible by optical means, which hinders the ability to study them. Here we demonstrate the imaging of the point defects attributed to the double negative charge state of silicon-vacancy (SiV) centers in diamond [1], which are not accessible by either optical methods or electron paramagnetic resonance measurements. We used a technique based on the recently developed photoelectric detection of nitrogen vacancy centers [2]. We show that the SiV center can be photoionized and recharged in a closed loop under constant laser illumination. Under applied electrical potential, the emission from a small ensemble of SiV centers can be switched on demand to a single photon level by charge state switching of the defects. Taking advantage of photoelectric imaging, we show that charge conversion and generation occur locally on the SiV with charge separation into conduction and valence bands.

[1] A. Gali and J. R. Maze, "Ab initio study of the split silicon-vacancy defect in diamond: Electronic structure and related properties", Phys. Rev. B 88, 235205 (2013)
[2] E. Bourgeois, A. Jarmola, P. Siyushev, M. Gulka, J. Hruby, F. Jelezko, D. Budker, and M. Nesladek, "Photoelectric detection of electron spin resonance of nitrogen-vacancy centres in diamond", Nat. Commun. 6, 8577 (2015).