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Optical patterning of trapped charge in nitrogen-doped diamond[1] SIDDHARTH DHOMKAR, HARISHANKAR JAYAKUMAR, DANIELA PAGLIERO, ABDELGHANI LARAOUI, REMUS ALBU, City College of New York-CUNY, NEIL MANSON, MARCUS DOHERTY, Australian National University, JACOB HENSHAW, CARLOS MERILES, City College of New York-CUNY, Graduate Center-CUNY — The nitrogen-vacancy (NV) center in diamond is emerging as a promising platform for solid-state quantum information processing and nanoscale metrology. Of interest in these applications is the manipulation of the NV charge state, which can be attained by optical illumination. Here we use two-color optical microscopy to investigate the dynamics of NV photo-ionization, charge diffusion, and trapping in type-1b diamond. We combine fixed-point laser excitation and scanning fluorescence imaging to locally alter the concentration of negatively charged NVs and to subsequently probe the corresponding redistribution of charge. We uncover the formation of various spatial patterns of trapped charge, which we semi-quantitatively reproduce via a model of the interplay between photo-excited carriers and atomic defects in the diamond lattice. Further, by using the NV as a local probe, we map the relative fraction of positively charged nitrogen upon localized optical excitation. These observations may prove important to various technologies, including the transport of quantum information between remote NVs and the development of three-dimensional, charge-based memories.

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