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Cathodoluminescence Imaging Using Nanodiamond Color Centers DAVID GLENN, HUILIANG ZHANG, Harvard-Smithsonian Center for Astrophysics, NARAYANAN KASTHURI, Harvard Center for Brain Science, ALEXEI TRIFONOV, Harvard Physics Department, RICHARD SCHALEK, Harvard Center for Brain Science, JEFF LICHTMAN, Harvard Department of Molecular and Cell Biology, RONALD WALSWORTH, Harvard-Smithsonian Center for Astrophysics — We demonstrate a nanoscale imaging technique based on cathodoluminescence (CL) emitted by color centers in nanodiamonds (NDs) under excitation by an electron beam in a scanning electron microscope (SEM). We have identified several classes of color centers that are spectrally distinct at room temperature and can be obtained with high reliability in NDs with diameters on the order of 50 nm or smaller. Compared to standard CL markers, ND color centers are bright and highly stable under SEM excitation. In conjunction with appropriate functionalization of the ND surfaces, ND-CL will provide nanoscale information about molecular function to augment the structural information obtained with standard SEM techniques. We discuss an exciting application of this approach to neuroscience, specifically in the generation of high-resolution maps of the connections between neurons ("Connectomics").

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