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Optical magnetic detection of single-neuron action potentials using NV-diamond MATTHEW TURNER, JOHN BARRY, Harvard University, JENNIFER SCHLOSS, MIT, DAVID GLENN, RON WALSWORTH, Harvard University — A key challenge for neuroscience is noninvasive, label-free sensing of action potential dynamics in whole organisms with single-neuron resolution. Here, we report a new approach to this problem: using nitrogen-vacancy (NV) color centers in diamond to measure the time-dependent magnetic fields produced by single-neuron action potentials. We demonstrate our method using excised single neurons from two invertebrate species, marine worm and squid; and then by single-neuron action potential magnetic sensing exterior to whole, live, opaque marine worms for extended periods with no adverse effect. The results lay the groundwork for real-time, noninvasive 3D magnetic mapping of functional mammalian neuronal networks.

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