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Near-field optical microscopy and spectroscopy of few-layer black phosphorous A. J. FRENZEL, Department of Physics, University of California, San Diego, S. TRAN, Department of Physics Astronomy, University of California, Riverside, J. P. HINTON, A. J. STERNBACH, Department of Physics, University of California, San Diego, J. YANG, N. GILLGREN, C. N. LAU, Department of Physics Astronomy, University of California, Riverside, D. N. BASOV, Department of Physics, University of California, San Diego — Few-layer black phosphorous is a recent addition to the family of two-dimensional (2D) materials which exhibits strongly anisotropic transport and optical properties due to its puckered honeycomb structure. It was recently predicted that this intrinsic anisotropy should manifest in the plasmon dispersion. Additionally, tuning layer number and carrier density can control the dispersion of these collective modes. Scanning near-field optical microscopy (SNOM) has been demonstrated as a powerful method to probe electronic properties, including propagating collective modes, in layered 2D materials. We used SNOM to investigate anisotropic carrier response in few-layer black phosphorous encapsulated by hexagonal boron nitride. In addition to exploring gate-voltage tunability of the electronic response, we demonstrate effective modulation of the near-field signal by ultrafast photoexcitation.

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