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**Black phosphorous photodetectors for detecting light scattering properties in silicon waveguides** TIANJIAO WANG, SHUREN HU, Vanderbilt Univ, BHIM CHAMLAGAIN, Wayne State University, TU HONG, Vanderbilt Univ, ZHIXIAN ZHOU, Wayne State University, SHARON WEISS, YAQIONG XU, Vanderbilt Univ — By integrating a black phosphorus (BP) photodetector on top of a patterned silicon nanobeam waveguide, we investigate the light scattering properties of the waveguide through wavelength- and polarization-dependent scanning photocurrent measurements. The photocurrent distribution detected in the waveguide area exhibits similar pattern as the light intensity distribution calculated by the finite-difference time-domain simulation, indicating that the light scattering properties of the waveguide can be detected as photocurrent signals by the BP photodetector. Interestingly, we found that no photocurrent signals are observed when the incident photon energy goes below the bandgap of silicon, suggesting that the photo-excited electron-hole pairs in the silicon waveguide can be injected into the BP and then contribute to the photocurrent generation. From those results, we found that by utilizing photocurrent mapping, two-dimensional (2D) material based photodetectors can be an effective probe to learn the light-matter interactions of photonic structures. Those studies not only open avenues for understanding light manipulation properties of photonic structures but also provide further capacity for engineering high performance optoelectronics.

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