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Near Infrared Emission from Defects in Few-Layer Phosphorene SHAHRIAR AGHAEIMEIBODI, JE-HYUNG KIM, EDO WAKS, Univ of Maryland-College Park — Atomically thin films of black phosphorus have recently received significant attention as low dimensional optical materials with a direct exciton emission whose wavelength is tunable by controlling the number of layers. In addition to this excitonic emission, recent work has revealed emission from defect states and reported new methods to manipulate them. Monolayer phosphorene exhibits emission from localized defect states at wavelengths near 920 nm. Increasing the number of layers should shift defect emission to longer wavelengths, enabling the material to span a broader spectral range. But defect emission from few-layer phosphorene has not yet been reported. Here, we demonstrate a new class of near infrared defects in few layer phosphorene. Photoluminescence measurement shows a bright emission around 1240 nm with a sublinear growth of emission intensity with linear increase of excitation intensity, confirming the defect nature of this emission. From time-resolved lifetime measurements we determine an emission lifetime of 1.2 ns, in contrast to exciton and trion lifetimes from few layer phosphorene previously reported to be in the range of a few hundred picoseconds. This work highlights the potential of bright defects of phosphorene for near infrared optoelectronic applications.

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