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Raman modes of exfoliated black phosphorus down to the monolayer ANNE-LAURENCE PHANEUF-L'HEUREUX, Polytechnique Montreal, ALEXANDRE FAVRON, ETIENNE GAUFRES, RICHARD MARTEL, Universite de Montreal, SEBASTIEN FRANCOEUR, Polytechnique Montreal — Exfoliated black phosphorus layers, or 2D-phosphane, are a lamellar direct-gap semiconductor providing high mobilities and enabling a thickness-controlled band gap tunability ranging from 0.3 up to about 2 eV. Using Raman spectroscopy, we have studied vibrational modes of pristine and non-oxidized 2D-phosphane as a function of the number of layers involved (n), and also as a function of temperature, polarization, and excitation wavelength. The evolution of the width and of the frequency of A_g^2 as a function of n presents a clear non-monotonic dependence. This can be explained by the presence of new nearly-degenerate Raman-allowed modes that are symmetry-forbidden in both bulk and monolayer samples. We also present Raman spectra of few-layer samples for excitation wavelengths in the viscinity of the expected band gap.

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