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Interlayer breathing and shear modes in NbSe2 atomic layers[1]
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Atomically thin NbSe2 is a metallic layered transition metal dichalcogenide (TMD) with novel charge-density-wave (CDW) and superconductive phases. Properties of NbSe2 atomic layers are sensitive to interlayer coupling. We investigate the interlayer phonons of few-layer NbSe2 by ultralow-frequency Raman spectroscopy. We observe both the interlayer breathing modes and shear modes at frequencies below 40 cm-1 for samples of 2 to 15 layers. Their frequency, Raman activity, and environmental instability depend systematically on the layer number. In addition, the interlayer phonon modes evolve smoothly from T = 300 K to 8 K, with no observable response to the CDW formation in NbSe2. This finding indicates that the atomic registry between adjacent NbSe2 layers is well preserved in the CDW transition.

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