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Unified Description of the Optical Phonon Modes in N-Layer $MoTe_2$ GUILLAUME FROEHLICHER, ETIENNE LORCHAT, FRANÇOIS FERNIQUE, IPCMS (CNRS - Université de Strasbourg), CHAITANYA JOSHI, ALEJANDRO MOLINA-SÁNCHEZ, LUDGER WIRTZ, University of Luxembourg, STÉPHANE BERCIAUD, IPCMS (CNRS - Université de Strasbourg) — N-layer transition metal dichalcogenides (denoted MX_2) provide a unique platform to investigate the evolution of the physical properties between the bulk (3D) and monolayer (quasi-2D) limits. Here, we present a unified analysis of the optical phonon modes in N-layer $2H$-MX_2 [1]. The $2H$-phase (or hexagonal phase) is the most common polytype for semiconducting MX_2 (such as MoS_2). Using Raman spectroscopy, we have measured the manifold of low-frequency (rigid layer), mid-frequency (involving intralayer displacement of the chalcogen atoms only), and high-frequency (involving intralayer displacements of all atoms) Raman-active modes in $N = 1$ to 12 layer $2H$-molybdenenum ditelluride ($MoTe_2$). For each monolayer mode, the N-dependent phonon frequencies give rise to fan diagrams that are quantitatively fit to a force constant model. This analysis allows us to deduce the frequencies of *all* the bulk (including silent) optical phonon modes. [1] G. Froehlicher, E. Lorchat, F. Fernique, C. Joshi, A. Monlina-Sánchez, L. Wirtz, and S. Berciaud, Unified Description of the Optical Phonon Modes in N-Layer $MoTe_2$, Nano Letters, **15** (10), pp 6481-6489 (2015)

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