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Backfolded acoustic phonons as ultrasonic probes in metal-oxide superlattices

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For thin-film structures, ultrasound spectroscopy is in general difficult because the signal is dominated by the substrate. Here, we use confocal Raman spectromicroscopy to that multiple reflection of sound waves at internal interfaces in metal-oxide superlattices generates standing waves that are insensitive to the normally strong substrate in thin film structures [1]. These Raman-active modes, which arise from a backfolded c-axis acoustic branch, are highly sensitive to atomic-scale thickness variations of the superlattice and can hence serve as a powerful characterization tool of thin-film structures. In addition, these results of tunable phonon modes in superlattices can have implications on important physical properties such as thermal transport, and shape future quantum acoustic devices.

[1] F. Lyzwa, A. Chan, J. Khmaladze, K. Fürsich, B. Keimer, C. Bernhard, M. Minola, B. P. P. Mallett, *Phys. Rev. Mater.* 2020, 4, 043606.