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Raman spectroscopy of the magneto-elasticity in 2D magnets

We present a comprehensive Raman investigation of single-crystal rare-earth i-MAX phases, $(Mo2/3RE1/3)_2AlC$ with RE = Gd, Yb, Dy. Low-temperature (4 K) spectra collected on a Horiba LabRAM system equipped with a cryostat reveal pronounced changes across the antiferromagnetic transition of Gd-i-MAX at TN =26 K. Antiferromagnetic ordering suppresses the electronic continuum, consistent with the opening of an order-parameter gap, and induces sizeable renormalization of phonon frequencies, evidencing strong magneto-elastic coupling. By modelling the temperature evolution of the Raman-active modes, we extract a spin–phonon coupling constant λ ~ 0.1 cm−1 for all observed phonons, comparable to canonical antiferromagnets such as MnF_2 and FeF_2 despite the markedly different two-dimensional crystal structure. Our results establish i-MAX magnets as a versatile platform for exploring tunable spin–lattice interactions in layered quantum materials.