Tuning of spin-lattice coupling in cobalt difluoride

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Recently, we have shown that the excited antiferromagnetic spins can mediate nonlinear coupling between THz light and a lattice [1]. High-intense THz pulse resonantly interacts with a coherent magnon state (38 cm^{-1} at T = 5 K) in CoF_2 and excites the Raman-active B_{1g} phonon (65 cm^{-1} at T = 5 K). The phonon amplitude scales quadratically with the THz field strength clearly evidencing the nonlinear excitation mechanism. Interestingly, that the phonon amplitude reaches maximum near a special temperature (T = 30 K) at which the magnon frequency matches half of the phonon frequency. Moreover, we have performed measurements combining high-intense THz pulses and high static magnetic fields. The B_{1g} phonon excitation shows resonance behaviour while tuning the frequency of the magnon with the help of external magnetic field [2]. Interestingly, the magnon frequency at this resonance (static field of ~ 4 T) is close to earlier mentioned frequency matching condition: the magnon frequency matches half of the phonon frequency. The results demonstrate that the magnon-phonon coupling mediates THz light-driven phonon excitation.

References

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