# Accessing phonon polaritons in hyperbolic crystals by ARPES

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## Abstract

Hexagonal boron nitride (hBN) has received considerable attention in the context of the optical properties of 2D materials. Experimentally, it has been shown that Dirac plasmons in graphene couple strongly to the optical phonons of monolayer hBN [1]. Hybrid plasmon-phonon modes in hBN/graphene/hBN stacks have been investigated by scattering-type near-field optical spectroscopy [2]. Moreover, since hBN is a natural hyperbolic material [3], slabs of hBN support deep subwavelength phonon polaritons [4,5] and display standing Fabry-Pérot phonon-polariton modes [4].

In this work, we theoretically study the coupling of these standing phonon-polariton modes to the plasmons of a two-dimensional massless Dirac fermion liquid in a nearby graphene sheet. We show that a rich spectrum of dispersive plasmon-phonon polaritons emerges, some modes having group velocity as high as the graphene Fermi velocity. These couple strongly with graphene quasiparticles and substantially alter their decay rate and spectral function. Our predictions can be tested in near-field optical and angle-resolved photoemission spectroscopy.

## References

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