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Interfacial electron-phonon coupling in 2D materials

Tuesday 6 January 2026 08:30 (35 minutes)

Hexagonal boron nitride (hBN), a polar wide gap insulator, is the gate dielectric of choice in the field of 2D materials. However, surprisingly little is known about how hBN affects the electronic properties of 2D materials of interest. Here, we use nano-ARPES to study the prototypical systems of monolayer transition metal dichalcogenide semiconductors on hBN. Our data show two replica bands of the semiconductor valley at energies close to hBN phonon modes. This is the fingerprint of long-range electron-phonon interaction across the interface. Our data is well reproduced by a generic model describing the propagation of a charged particle above a polar substrate, suggesting that interfacial electron-phonon coupling is universal for 2D materials encapsulated in hBN. Consistent with this interpretation, control experiments on non-polar graphite substrates do not show the replica bands observed on hBN.

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