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## Strong Inter-valley Electron-Phonon Coupling in Magic-Angle Twisted Bilayer Graphene

*Tuesday 6 January 2026 09:05 (35 minutes)*

The unusual properties of superconductivity in magic-angle twisted bilayer graphene (MATBG) have sparked enormous research interest. However, despite the dedication of intensive experimental efforts and the proposal of several possible pairing mechanisms, the origin of its superconductivity remains elusive. In this talk, using angle-resolved photoemission spectroscopy with micrometer spatial resolution, we show our observation on the replicas of the flat bands in superconducting MATBG unaligned with its hexagonal boron nitride (hBN) substrate, which are absent in non-superconducting MATBG aligned with the hBN substrate[1]. Remarkably, the replicas are evenly spaced in energy, separated by  $150 \pm 15$  meV, signaling the strong coupling of electrons in MATBG to a bosonic mode of this energy. By comparing our observations to simulations, the formation of replicas is attributed to the presence of strong inter-valley electron-phonon coupling to a K-point phonon mode[1,2]. In total, the observation of these replica flat bands and the corresponding phonon mode in MATBG could provide important information for understanding the origin and the unusual properties of its superconducting phase.

1. C. Chen, et. al., Nature 636, 342 (2024)
2. C.X. Liu, et. al., Phys. Rev. B 110, 045133 (2024)

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