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Electronic dispersion from long-range atomic ordering and periodic potentials in two overlapping graphene sheets[1] TAISUKE OHTA, Sandia National Laboratories, JEREMY ROBINSON, Naval Research Laboratory, PETER FEIBELMAN, THOMAS BEECHEM, BOGDAN DIACONESCU, Sandia National Laboratories, AARON BOSTWICK, ELI ROTENBERG, Advanced Light Source, Lawrence Berkeley National Laboratory, GARY KELLOGG, Sandia National Laboratories — A worldwide effort is underway to learn how to build devices that take advantage of the remarkable electronic properties of graphene and other two-dimensional crystals. An outstanding question is how stacking two or a few such crystals affects their joint electronic behavior. Our talk concerns "twisted bilayer graphene (TBG)," that is, two graphene layers azimuthally misoriented. Applying angle-resolved photoemission spectroscopy and density functional theory, we have found van Hove singularities (vHs) and associated mini-gaps in the TBG electronic spectrum, which represent unambiguous proof that the layers interact. Of particular interest is that the measured and calculated electronic dispersion manifests the periodicity of the moiré superlattice formed by the twist. Thus, there are vHs not just where the Dirac cones of the two layers overlap, but also at the boundaries of the moiré superlattice Brillouin zone. Moirés, ubiquitous in hybrid solids based on two-dimensional crystals, accordingly present themselves as tools for manipulating the electronic behavior.

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