Identifying and characterizing correlated phases in twisted bilayer graphene using thermoelectricity

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Thermoelectricity is an unconventional but extremely sensitive probe to the effects of electronic interactions in solids. It has been used to invesitgate several many-body phases and phenomena such as the Kondo effect, breakdown of Fermi liquid theory, and so on. Thermoelectric measurement often complement standard electrical transport, and detects electronic correlations through departure from the well-established Mott semiclassical framework. In this talk I shall present the results of measurement of thermoelectric power in twisted bilayer graphene (TBLG) over a wide range of mis-orientation angles [1,2,3]. TBLG is a new and versatile platform to realize effects of strong electron-electron interaction as the misorientation angle between the graphene lattices profoundly affects the electronic structure of the combined system. While the layers behave independently at large angles (> 5 degrees), new electronic bands emerge when the angle is decreased, including nearly flat dispersion at the magic angle of 1.1 degree that has been shown the harbor superconductivity, magnetism and other many-body phases. I shall identtify new phases in TBL that arise from number of sources ranging from van Hove singularities, strong electron-electron interaction, and proximity-induced spin-orbit interaction [4,5,6].

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