

Detecting low energy optical responses of twisted bilayer graphene via millikelvin far-infrared spectroscopy

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Quantum materials associated with correlated energy gaps show unusual electronic, magnetic and optical properties, whose careful examinations can help reveal the nature of the underlying phases. The optical responses in the far infrared (FIR) regime of interesting moiré materials, remain largely unexplored due to experimental challenges in performing FIR spectroscopy on small samples and low temperatures. In this talk, we will present the characterization of low energy optical excitations in magic angle twisted bilayer graphene (MATBG), using our recently developed milli-kelvin FIR spectroscopy instrument¹. Our measurements, performed at temperature below the superconducting transition temperatures of these systems, reveal the optical excitations associated with different band fillings tuned by the carrier densities. These results reveal optical resonances of correlated electrons attributed to the flat bands of MATBG. We will discuss their connection to theoretical model of MATBG²⁻⁴.

References

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Figures

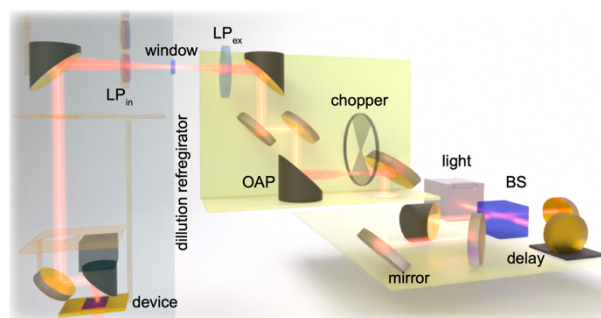


Figure 1: Schematic description of millikelvin FIR optical detection platform based on Fourier transform infrared spectroscopy.