

Quantitative Measurements of Moiré Electric Potential on Twisted Hexagonal Boron Nitride Multilayers by Kelvin Probe Force Microscopy

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Moiré superlattices have been attracting significant attention because they can host a rich variety of correlated electronic phases. The periodic electric potential on the surface of a twisted hexagonal Boron Nitride (t-hBN) bilayer or a multilayer (moiré potential) can be used to impose a moiré potential on an adjacent functional layer and modulate its electronic band structure [1-3]. This moiré potential originates from spatially alternating electric polarization at the interface of twisted hBN layers and the depth and period of the potential can be tuned by the twist angle and the top hBN layer thickness [1]. We confirmed these theoretical predictions by measuring the moiré potential by Kelvin probe force microscopy (KPFM) [2]. We also performed the finite element modeling of the KPFM measurements which includes the effect of the tip and the substrate. I will present the comparison between the experimental and finite-element simulation results and discuss the effect of the thickness of the top and bottom hBN layer and the effect of the substrate on the measured contact potential difference.

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References

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Bio

Yoichi Miyahara joined the Department of Physics at Texas State University in 2019 as an Assistant Professor, following positions at École Polytechnique Fédérale de Lausanne and McGill University as a Research Associate. He earned his Ph.D. in Electrical Engineering from Waseda University. Dr. Miyahara is the recipient of an NSF-CAREER award and has served as the principal investigator on an NSF-MRI development grant, as well as a co-principal investigator on an NSF-PREM grant. His research group is dedicated to creating unique instrumentation for investigating quantum materials and quantum electronic devices at ultra-low temperatures. Specializing in advanced scanning probe microscopy techniques for nanoscale material property characterization, his work focuses on the development and application of these techniques.