The Quantum Twisting Microscope

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Recently, we developed a fundamentally new type of scanning probe microscope, the Quantum Twisting Microscope, capable of performing local quantum interference experiments at a twistable interface between two quantum materials[1]. This microscope is based on a unique tip, made of an atomically-thin two-dimensional material. This tip allows electrons to coherently tunnel into a sample at many locations, and the quantum interference between these tunneling paths makes it a scanning electronic interferometer. With the addition of a continuously-scanned twist angle between the tip and the sample, this microscope allows probing electrons in momentum space like a scanning tunnelling microscope probes electrons in real space. This provides powerful new ways to study the energy dispersions of interacting electrons. Last year, we constructed the first generation QTM that operates at room temperature. We demonstrated quantum interference at its tip and the imaging of energy bands through momentum resolved tunneling experiments. In this talk I will present the first results from a new generation QTM, working at cryogenic temperatures, and show the new scientific horizons that this cryogenic-QTM now opens.

[1] A. Inbar, J. Birkbeck, J. Xiao, T. Taniguchi, K. Watanabe, B. Yan, Y. Oreg, Ady Stern, E. Berg and Shahal Ilani, **Nature** 614, 682-687 (2023).