Moiré Energy Dissipation Driven by Nonlinear Dynamics

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The moiré superlattice in twisted van der Waals heterostructures is of central importance for the modulation of the electronic and optical properties of the system, yet the mechanical dissipation of such moiré systems remains largely unexplored. Here, we report the experimental observations of energy dissipation across both vertical and lateral directions along the moiré superstructures, revealing a significant increase in dissipation at moiré ridges compared to flat domains. Comparison of the measurements with a theoretical phononic dissipation model suggests that the local increase in energy dissipation originates from nonlinear instability dynamics of the moiré superstructure. Criteria for such moiré energy dissipation are established, which are expected to be broadly applicable to other van der Waals heterostructures. Our results extend the understanding of mechanical energy loss in moiré systems and support the rational design of slidtronic and twisttronic devices and nanoelectromechanical systems in general.

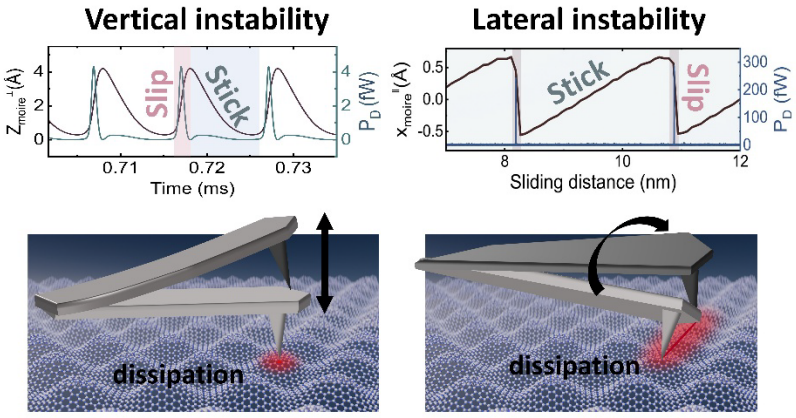

Figure 1. Moiré energy dissipation originates from vertical and lateral instability.