The Electronic Phase Diagram of Moiré Superlattices

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Moiré superlattice systems such as transition metal dichalcogenide heterobilayers have garnered significant recent interest due to their promising utility as tunable solid-state simulators. Recent experiments on a WSe_2/WS_2 heterobilayer detected charge ordered states at commensurate fillings (electron counts).

Members of **PARADIM's in-house research team** have used Monte Carlo simulations to study intermediate phases occurring at fractional electron counts between the charge-ordered states in the strong coupling limit. The team found two distinct stripe solid states to be each preceded by distinct types of nematic states and describes a microscopic mechanism that stabilizes each of the nematic states.

The results provide a testable experimental electronic phase diagram of Moiré materials, including predictions of where both types of nematic order occur and elucidate the microscopic mechanism driving their formation.

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Monte Carlo Data: 10.5281/zenodo.7120826.

Software Codes: 10.5281/zenodo.7120887.

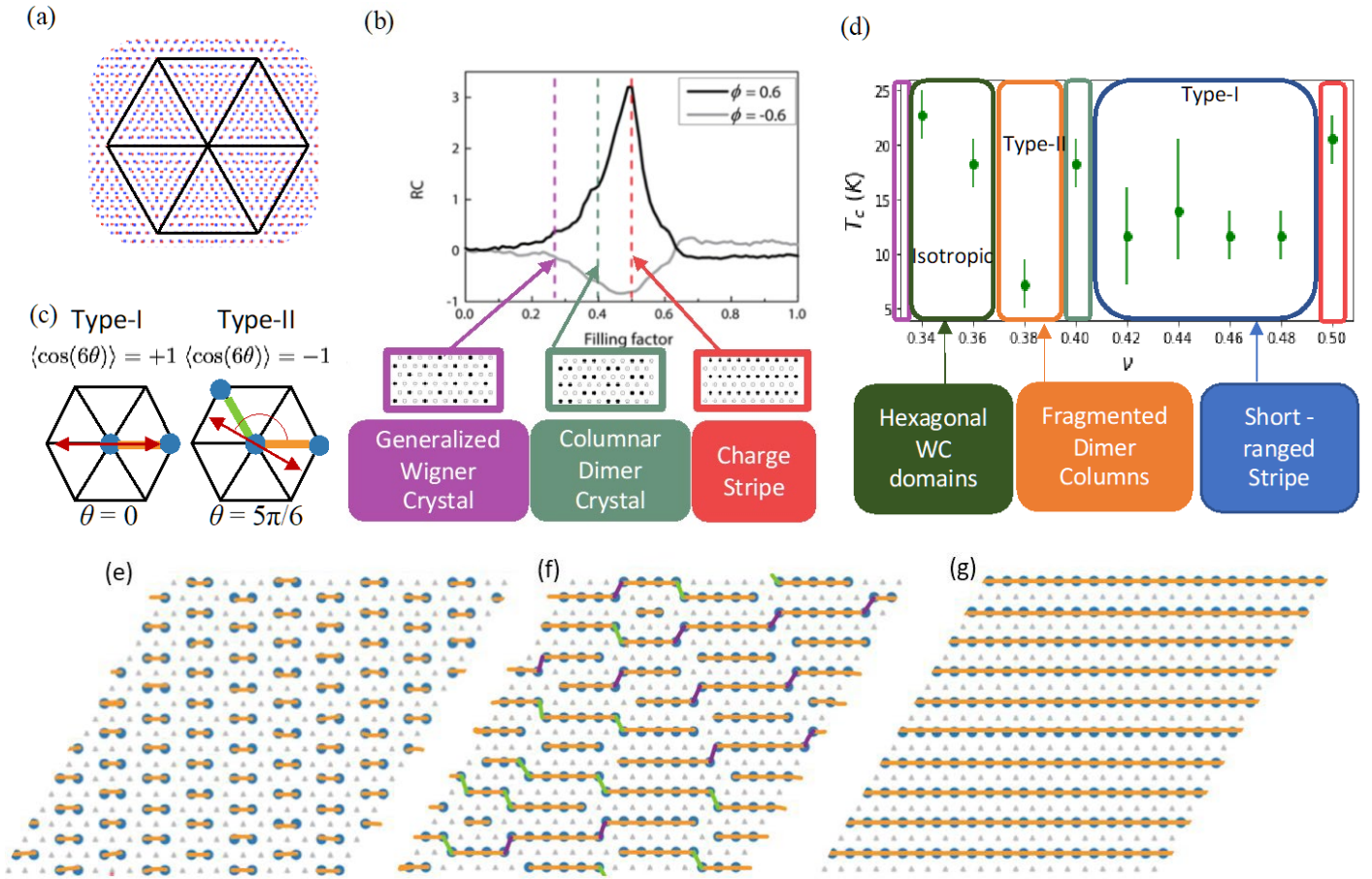

Figure: a-d) TMD Moiré system, crystalline (b), two types of nematic (c) and the intermediate phases (d). **e-g**) Electronic liquid crystalline phase (f) in between two electronic crystal phases (e and g).