

## Emergent collective behaviours in twisted graphene devices

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**Abstract:** We discuss the observation of collective modes of electrons and lattice, revealed by transport experiments on CVD-grown twisted graphene layers serving as solid-state quantum simulators.

Stacks of two-dimensional materials can be leveraged to engineer artificial Hamiltonians based on the layer number and their relative orientation. We report recent results on two twisted systems built from CVD-grown graphene, where collective electronic and lattice behaviours are observed.

The first one is gapped bilayer graphene in proximity to a twist-decoupled monolayer [1]. This configuration grants access to a flat region in the bilayer valence band, where spontaneous isospin polarization of the charge carriers is detected by means of quantum oscillations experiments.

The second one is twisted bilayer graphene at minimal twist angle [2], where collective modes of the moiré lattice arise. Specifically, we reveal dominant carrier scattering by phasons – corresponding to the relative sliding motion of the two layers – via temperature-dependent electrical transport.

These findings highlight the potential of our platform for the realization and control of emergent quantum phenomena.

### References

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