

**Prize Talk**

PRV V Thu 13:00 HSZ/0002

**Observation of Floquet states in graphene** — ●MARCEL REUTZEL — Philipps-Universität Marburg, Fachbereich Physik and mar.quest, Germany — Georg-August-Universität Göttingen, I. Physikalisches Institut, Germany — Laureate of the Walter-Schottky-Prize 2026

Material phases are traditionally controlled by parameters such as temperature or doping. Newer efforts employ ultrashort light pulses and correlated - but incoherent - interactions of the electron-lattice-spin systems to create non-thermal phases. While such on-demand material engineering has been established in the last years, more recent efforts strive for the coherent counterpart: By using time-periodic light fields (a.k.a Floquet engineering), new electronic band structures and

correlated or even topological phases can be created. Importantly, these phases can then be coherently controlled by the properties of the light field. Therefore, fundamental research on Floquet engineering promises the realization of emergent material phases without any counterpart in thermal equilibrium.

Here, we will outline how the development of time-resolved momentum microscopy - a new variant of time- and angle-resolved photoelectron spectroscopy - has enabled the direct observation of Floquet states in monolayer graphene [1]. These proof-of-principle experiments on semi-metallic graphene open up a new pathway for testing the many theoretical proposals of light-induced phase transitions that have so far remained elusive.

[1] Merboldt *et al.*, Nature Physics 21, 1093 (2025).