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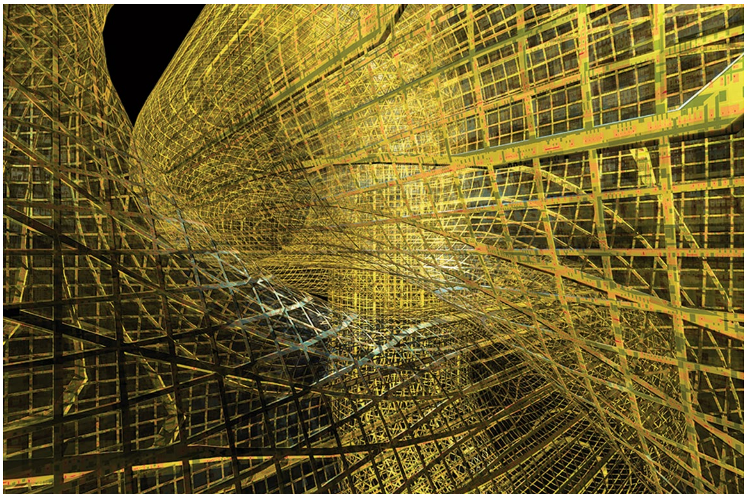

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TOPOLOGICAL INSULATORS

Fantastic beasts

More than a decade after the discovery of topological insulators there is an entire zoo of topological phases of matter and new exotic beasts are still being discovered. Writing in *Physical Review Letters*, Moon Jip Park and colleagues and Thomas Schuster and colleagues predict new types of topological insulators that could be observed in twisted bilayer graphene or periodically driven systems.

In higher-order topological insulators, the band topology of the insulator manifests in lower dimensions as interesting boundary states, for example, localized modes at the corner of 2D materials, known as corner states. But 2D higher-order topological insulators are yet to be observed in experiment. Park et al. suggest that bilayer graphene with large twist angles between the two sheets is a generic higher-order topological insulator that hosts corner states. Furthermore, the emergence of corner states is independent of the twist angle as long as the underlying superlattice symmetries are preserved. The physical mechanism leading to the emergence of the non-trivial band topology is due to intervalley scattering, that is, electrons bouncing around, which becomes important at sufficiently large twist angles.

Periodically driven systems, such as ultracold atoms, engineered photonic or solid-state devices, can host topological phases of matter known as Floquet topological insulators. Despite the fundamental difference between driven and non-driven systems, Floquet phases tend to be classified using an analogy with the properties of static topological insulators. Schuster and co-workers predict a new type of Floquet topological insulator — called a Floquet Hopf insulator — that is characterized by two distinct topological invariants, quantities that do not change under continuous deformation, and which transcends the conventional classification. The two invariants are a static invariant, well-known to mathematicians as the Hopf invariant, and a Floquet invariant reminiscent of the topology of an anomaly in SU(2) gauge theory, the Witten anomaly.

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ORIGINAL ARTICLES Schuster, T. et al. Floquet Hopf insulators. *Phys. Rev. Lett.* preprint at: https://arxiv.org/abs/1903.02558 (2019) | Park, M. J. et al. Higher-order topological insulator in twisted bilayer graphene. *Phys. Rev. Lett.* preprint at: https://arxiv.org/abs/1907.02868 (2019)