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Graphene by light –how nonlinear optics creates artificial topological matter

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Graphene with its hexagonal band structure of the energy spectrum has been celebrated in the past years as an ultrathin wonder material due to its intriguing features. Thus, it is a long-standing dream of solid-state physics to vary this lattice structure beyond graphene in order to extend the features of two-dimensional (2d) materials for example to topological insulation.

While condensed matter systems are difficult to adapt, optically- created artificial dielectric photonic matter represent an ideal testbed for these 2d materials. This has led to the field of topological photonics, an emerging field in which geometrical and topological concepts are implemented to mold the flow of light.

In our contribution, we introduce into this field of nonlinear optics, explaining how to fabricate those 2d photonic materials and demonstrate new 2d photonic materials as twisted bilayer graphene or photonic borophene, the optical equivalent of the new rising star of solid-state physics. We also showcase fascinating topological effects including nonlinear light localization in higher-order topologies.

Category

Solid State (Experiment)

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