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Gauge Fields and Topological Confinement in Synthetic Nanomaterials Assembled via Atomic Manipulation DOMINIK RASTAWICKI, ERIC CHATTERJEE, YAN SUN, ALEX CONTRYMAN, DYLAN RUETER, HARI MANOHARAN, Stanford Univ — The assembly of molecular graphene and related nanostructures demonstrated that atomic manipulation can be used to build functional quantum nanomaterials site by site and bond by bond. This level of precise control lets one tune the potential of each site, the hopping strength of each bond, and—by adjusting lattice size—the Fermi energy and relative interaction strength inside and between sites. Here we present examples of new molecular materials assembled and characterized by STM/STS exploiting these techniques. We show that lattices with varying site potential across six sites of a unit cell show signatures of non-abelian gauge fields. We will contrast observed behavior with conventional abelian gauge fields built into the same structures. We will also show that boundaries between patterned mass domains can induce topological edge states and topological charge confinement. We will also discuss the engineering of flat bands into more complex materials, and show effects of the resulting quenching of kinetic energy.

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