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Engineering Dirac points with ultracold fermions in a tunable-geometry optical lattice DANIEL GREIF, THOMAS UEHLINGER, GREGOR JOTZU, LETICIA TARRUELL, TILMAN ESSLINGER, ETH Zurich — Dirac points lie at the heart of many fascinating phenomena in condensed matter physics, ranging from massless electrons in graphene to the emergence of conducting edge states in topological insulators. At a Dirac point, two energy bands intersect linearly and the particles behave as relativistic Dirac fermions. A highly flexible approach to studying Dirac points is to create model systems using ultracold fermionic atoms trapped in the periodic potential of interfering laser beams. In our setup we have realized an optical lattice of tunable geometry, ranging from square, triangular, honeycomb, dimer and different one-dimensional structures. For the case of the honeycomb lattice, we probe the band structure using momentum resolved interband transitions and observe the appearance of Dirac points with tunable properties. Furthermore, recent progress on the interplay between geometry and interactions will be presented.

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