Abstract Submitted
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Creating, moving and merging Dirac points with a Fermi gas in a tunable honeycomb lattice GREGOR JOTZU, LETICIA TARRUELL, DANIEL GREIF, THOMAS UEHLINGER, TILMAN ESSLINGER, Institute for Quantum Electronics, ETH Zurich, 8093 Zurich, Switzerland — We report on the creation of Dirac points with adjustable properties in a tunable honeycomb optical lattice. Using momentum-resolved inter-band transitions, we observe a minimum band gap inside the Brillouin zone at the position of the Dirac points. We exploit the unique tunability of our lattice potential to adjust the effective mass of the Dirac fermions by breaking the inversion symmetry of the lattice. Moreover, changing the lattice anisotropy allows us to move the position of the Dirac points inside the Brillouin zone. When increasing the anisotropy beyond a critical limit, the two Dirac points merge and annihilate each other. We map out this topological transition in lattice parameter space and fin dexcellen tagreemen twit ha biniti ocalculations .Our results pave the way to model materials where Berry phases and the topology of the band structure play a crucial role. Furthermore, they provide the possibility to explore many-body phases resulting from the interplay of complex lattice geometries with interactions.

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