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Dimerized Mott insulators in hexagonal optical lattices DIRK-SOEREN LUEHMANN, OLE JUERGENSEN, KLAUS SENGSTOCK, University of Hamburg — We numerically study driven optical honeycomb lattices and find dimerized insulator phases with fractional filling. These incompressible insulating phases are characterized by an interaction-driven localization of particles on individual dimers and a coherent superposition within the dimers. We calculate the ground-state phase diagrams and the excitation spectra using an accurate cluster mean-field method as well as perturbation theory employing an effective model. Probing the fundamental excitations of the dimerized Mott insulator allows the distinction from normal Mott insulating phases. By computing finite lattices with large diameters the influence of the experimental confinement is discussed in detail.

Klaus Sengstock
University of Hamburg

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