Contribution ID: **55** Type: **Poster**

Chiral orbital order without higher bands

Monday, 11 September 2023 22:40 (20 minutes)

Ultracold atoms loaded into higher Bloch bands provide an elegant setting for realizing many-body quantum states that spontaneously break time-reversal symmetry through the formation of chiral orbital order. The applicability of this strategy remains nonetheless limited due to the finite lifetime of atoms in high-energy bands. Here we introduce an alternative framework, suitable for bosonic gases, which builds on assembling square plaquettes pierced by a
pi-flux (half a magnetic-flux quantum). This setting is shown to be formally equivalent to an interacting bosonic gas loaded into
p orbitals, and we explore the consequences of the resulting chiral orbital order, both for weak and strong on-site interactions. We demonstrate the emergence of a chiral superfluid vortex lattice, exhibiting a long-lived gapped collective mode that is characterized by local chiral currents. This chiral superfluid phase is shown to undergo a phase transition to a chiral Mott insulator for sufficiently strong interactions. Our work establishes coupled
pi-flux plaquettes as a practical route for the emergence of orbital order and chiral phases of matter.

Primary author: DI LIBERTO, Marco (University of Padua)

Co-author: GOLDMAN, Nathan (Université Libre de Bruxelles)

Presenter: DI LIBERTO, Marco (University of Padua)

Session Classification: Poster Session II

Track Classification: Synthetic Gauge Fields and Topology