Floquet engineering, which involves controlling systems through time-periodic driving, provides a powerful method for coherently manipulating quantum materials and realizing dynamical states with novel functionalities. This presentation reports our recent experimental and theoretical findings on the dynamical states realized in Dirac electrons under various fields.

1. **Circularly Polarized Laser [1]:**
   Nonlinear optical response experiments suggest the generation of chiral gauge fields and the creation of emergent Weyl points.
2. **AC-Magnetic Fields [2]:**
   We demonstrate the emergence of π-Landau levels (Fig.1) and the chiral anomaly-induced homodyne effect when Dirac electrons are subjected to a time-oscillating magnetic field $B\cos(\Omega t)$.
3. **Propagating Fields [3]:**
   Dirac electrons in a propagating wave $V\cos(Qx-\Omega t)$ exhibit sensitivity to the field speed $v=\Omega/Q$. We classify these states and explore the associated topological phase transitions.

References:

[1] N. Yoshikawa et al., arXiv:2209.11932; Y. Hirai et al., arXiv:2301.06072

[2] S. Kitamura and T. Oka, arXiv:2407.08115

[3] T. Oka, *in preparation*

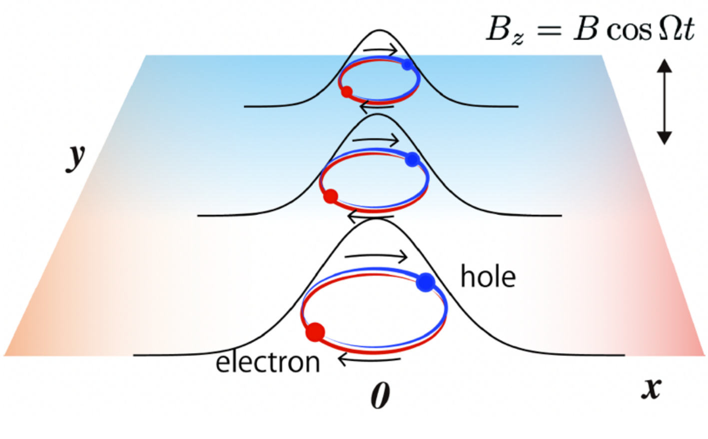

Fig 1. Schematic representation of the electronic states of the π-Landau levels in an AC-magnetic field. The states coherently oscillate between electron-like and hole-like natures under the influence of a time-oscillating magnetic field $B\cos(\Omega t)$.