Plasmons in topological materials and hidden plasmon geometry

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Abstract:
The internal structure of quasiparticles (such as spin or valley quantum numbers), while conventionally obscured from view, can dramatically alter their behavior when they couple with kinematic degrees of freedom. Featuring prominently in topological materials, these can lead to new phenomena such as topological edge states, geometric phases, and Berry curvature, all of which dramatically enrich the dynamics of carriers.

I will discuss how unusual carrier dynamics in topological materials lead to a new range of plasmons, the collective modes of an electron liquid. Examples include anomalous Hall (Berry) plasmons that acquire a chirality even in the absence of an applied magnetic field in anomalous Hall metals, as well as collective oscillations of carriers in topological edge states that exhibit unusual spectral properties owing to their edge-state origin.

Further, I will also discuss the internal (hidden) structure of plasmon quasiparticles by themselves. I will demonstrate that plasmons in a simple 2DEG (2D metal) are not structureless objects, and can inherently possess a fine structure akin to a pseudo-spin-texture. This emergent non-trivial texture arises from the local current density configuration of plasmons and can take on an intricate pattern when a magnetic field is applied, exhibiting a non-trivial winding. As a result, plasmons pick up non-trivial geometric phases when they scatter displacing their trajectories. These unusual dynamics yield new means for directing plasmonic beams, as well as a window into the hidden lives of plasmon oscillations.

Host: Alexander Holleitner, WSI
There will be coffee, tea, and cookies in front of the lecture hall at 17.00 h