Title：Discrete scale invariance and Log-B periodic quantum oscillation in topological semimetals

Abstract：The quasi-particle in Dirac materials obeys the relativistic equation, and the value of fine structure constant in Dirac materials is much larger than that in the vacuum. Owing to the large value of fine structure constant, the Coulomb attraction gives rise to supercritical atomic collapse in analogy to the phenomena proposed to exist in super-heavy atoms. Moreover, the massless Dirac equation with Coulomb attraction also preserve the scale invariance, which in combination with the quantization effect, gives rise to a novel feature—the discrete scale invariance. Up to now, the discrete scale invariant quantum systems only exist in the Efimov trimers that has generated immediate interest throughout the related fields.

In this talk, I will discuss that the two-body Weyl Hamiltonian with supercritical Coulomb attraction can give rise to Efimovian quasi-bound states with discrete scale invariance. Moreover, the magnetic field introduces a new length scale. The resonant scattering between the mobile carrier and the Efimovian bound states around the Fermi energy gives rise to a novel type of log-B periodic magneto-resistance oscillations in Dirac materials, beyond the Landau level scenario.