Speaker: Daniele GUERCI (Flatiron Institute, USA)

Title: **Helical trilayer graphene and superconductivity in heterobilayer TMDs**

Abstract: In this talk I will present helical trilayer graphene (hTTG) which is characterized an emergent real-space Chern mosaic pattern resulting from the interface of two incommensurate moiré lattices [1]. This pattern shows macroscopic regions with finite Chern number separated by domain walls where the spectrum is gapless [2]. After introducing the Hamiltonian describing hTTG, I will focus on the macroscopic domains, that host isolated flat bands with intriguing properties. Upon investigating the chiral limit, where analytical expressions can be derived, we found that the flat bands zero energy manifold features a Chern -1 and a Chern 2 bands described by the superposition of two lowest Landau level [2,3]. The origin of the flat bands can be explained using a combination of geometrical relations and symmetry arguments [2,3]. The comparison with the recent experimental findings is discussed. In the latter part of the presentation, focus shifts to a mechanism for inducing superconductivity in heterobilayer transition metal dichalcogenides (TMDs) from a repulsive electron model [4]. Notably, the interplay of symmetries and geometrical properties leads to the emergence of a p-wave Z2 topological superconductivity. This phenomenon persists even at low doping levels, paving the way for exploring the long-sought p-wave BEC-BCS topological transition.

[1] Y.Mao, D.Guerci, C.Mora, PRB 107, 125423 (2023) [Editors' Suggestion]

[2] D.Guerci, Y.Mao, C.Mora, arXiv:2305.03702 (2023)

[3] D.Guerci, Y.Mao, C.Mora, arXiv:2308.02638 (2023)

[4] V.Crépel*, D. Guerci* et al., PRL 131, 056001 (2023) [Editors' Suggestion] [^* equally contributing authors]