

MONDAY

COLLOQUIUM

Designing emergence with 2D atomic layers – From devices to black holes

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17 Feb 2025 (Monday) | 16:00 Hrs (Tea / Coffee 15:45 Hrs) | Venue: TIFRH Auditorium

Over the past two decades our understanding of two-dimensional (2D) atomic and molecular layers, especially graphene, has evolved progressively as the quality of the devices improved. Van der Waals epitaxy of combining multiple 2D layers from different chemical genre has played a key role in this development. While initial efforts were focused on creating high quality electronic channels, van der Waals epitaxy soon provided a versatile pathway to design devices for many applications ranging from electronic, optoelectronic, thermal to even neuromorphic architectures. Over the past few years though, van der Waals epitaxy has come a full circle and the outstanding quality of the devices obtained through this technique are becoming a key resource towards exploring new physical phenomena, for example the hydrodynamic electronic flow, when the scattering between electrons themselves become more frequent than the scattering between electrons and disorder. In this colloquium, I shall present a snapshot of this evolution and present some new experimental result on the electrical and thermal transport measurements in very high-quality graphene devices where electron-electron scattering dominates over the momentum relaxation rate. In this regime the gauge/gravity duality maps strongly correlated quantum condensed matter systems, in particular that at the Dirac point of graphene, onto holographic models of gravity and provides a non-perturbative approach towards predicting its transport properties.