I M B M **istanbul matematiksel bilimler merkezi**
istanbul center for mathematical sciences

Mathematical and Theoretical Physics Afternoons

Tuesday, March 27, 2018

13:30 - 14:30: İnanç Adagideli (Sabancı University, Istanbul)

Topologically protected Landau level in the vortex lattice of a Weyl superconductor

The question whether the mixed phase of a gapless superconductor can support a Landau level is a celebrated problem in the context of d-wave superconductivity, with a negative answer: The scattering of the subgap excitations (massless Dirac fermions) by the vortex lattice obscures the Landau level quantization. Here we show that the same question has a positive answer for a Weyl superconductor: The chirality of the Weyl fermions protects the zeroth Landau level by means of a topological index theorem. As a result, the heat conductance parallel to the magnetic field has the universal value $G = 1/2g0\phi/\phi0$, with ϕ the magnetic flux through the system, $\phi0$ the superconducting flux quantum, and $g0$ the thermal conductance quantum.

14:30 - 15:00: *Coffee Break*

15:00 - 16:00: Allessandra Gnecchi (Cern, Switzerland)

How interactions resolve state-dependence in a holographic toy model for black holes.

The black hole information paradox causes a breakdown of the effective description of light quanta in the black hole background, implying, in accordance to the firewall

proposal, that the inner region of the black hole horizon is de facto cut out from the physical universe. A consistent description of black hole interior that evades the firewall paradigm has been obtained through the dual CFT operators. However, the definition of such operators depends on the specific black hole microstate, thus introducing state-dependence, which does not enter the definition of conventional QFTs.

I will present the study of a quantum mechanical toy model given by a double well potential, motivated by holographic black holes solutions of N=8 supergravity. The model is numerically solvable, but in the limit where the barrier between the two minima is sufficiently high, one can study the low energy effective theory as the tensor product Hilbert space of two decoupled Harmonic oscillators. I will explain how this description presents analogous paradoxes to the black hole case. A rigorous definition of the effective field theory is possible but introduces a state-dependence on the microstates of the system, and in such construction state-dependence appears as a consequence of the perturbative nature of the states in the effective theory. I will explain how, taking into account the non-perturbative interactions due to the central barrier, one resolves state-dependence. Finally, I will summarize how this hints to an analogous construction for physical black holes.

Place: IMBM Seminar Room, Boğaziçi University South Campus