IST AUSTRIA
Institute of Science and Technology

Physical Sciences Seminar

Non-equilibrium Quantum Simulation with Superconducting Circuits

Mattias Fitzpatrick (Princeton University, USA)

Host: Andrew Higginbotham

In recent years, superconducting circuits have emerged as a promising platform for quantum computation and quantum simulation. One of the main driving forces behind this progress has been the ability to fabricate relatively low-disorder, low-loss circuits with a high-degree of control over many of the circuit parameters, both in fabrication and in-situ. This coupled with advances in cryogenics and microwave control electronics have significantly improved the rate of progress. The field, which is broadly called circuit quantum electrodynamics (cQED) has become one of the cleanest and most flexible platforms for studying strong interactions between light and matter.

In this talk we will describe the study of non-Euclidean lattices which can be made from coplanar waveguide (CPW) lattices. This work relies on the fact that the frequency of the resonators in the lattice is dependent only on the total length of the cavities, not the length between the ends of the cavity. This means that we can form lattices from CPW cavities where the edge distance is not the same. The first result in this direction is the fabrication and measurement of a finite piece of a hyperbolic graph, formed from a regular tiling of heptagons. This lattice had an effective curvature which is quite large and in principle exhibited a gapped flat band.

Following up on the hyperbolic lattice work, we will describe the study of exotic new lattices which have band structures that exhibit exotic features such as gapped flat bands and Dirac cones. This work involves looking at the spectra of graphs and their corresponding line-graphs, which are the graphs which are pertinent to the tight-binding Hamiltonian in CPW lattice devices. In this work, we derive the mathematical relationship between the spectrum of a graph and its line graph as well as what is known as the split graph. These operations allow us to exactly maximize the gap between the flat band and the rest of the spectrum for certain line graph lattices.

Tuesday, March 31, 2020 11:00am - 12:00pm

IST Austria Campus Heinzel Seminar Room / Office Bldg West (I21.EG.101)

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