Open PhD and MSc positions in the *Quantum Materials Transport Lab*

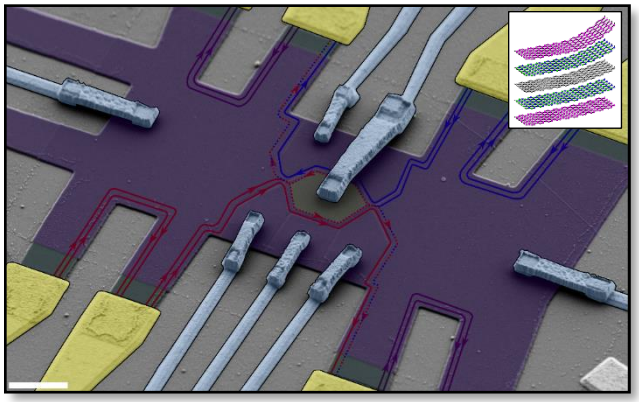
Our new group focuses on exploring physics beyond the conventional paradigms of quantum mechanics, where new many-body phases are realized. Many-body physics is the collective behavior of a large number of interacting particles, giving rise to phases such as topological superconductivity, the fractional quantum Hall effect, and a variety of other correlated phenomena. The ground states of these phases and their excitations (*i.e.* quasiparticles) are intriguing both from the perspective of fundamental physics, such as exotic exchange statistics as well as for application in the field of topological quantum computation.

This line of research is primarily realized in low-temperature studies of *quantum materials* whose reduced dimensionality enhances quantum effects. The group will focus on assembly, fabrication, and low-temperature transport measurements with various quantum materials. The main objective is to realize novel quantum phases and their excitations by utilizing van der Waals materials such as graphene and transition metal dichalcogenides (TMDs), as well as other low-dimensional systems such as two-dimensional electron gases (2DEGs) in GaAs-based heterostructures. We will fabricate mesoscopic devices (see images below) in state-of-the-art facilities specially designed for vdW materials nanofabrication.

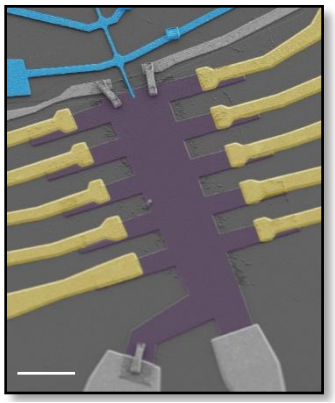
These devices will be measured with transport techniques including quantum Hall interferometry, Josephson interferometry, capacitance measurements, thermal transport, and shot noise measurements. These measurements require high magnetic fields and low temperatures, and our lab will be equipped with an 8mK wet dilution refrigerator with a 20T magnet, a 7mK dry dilution with a 3D vector magnet 9-1-1 T, as well as a dry 1.5K variable temperature cryostat (VTI).

While the initial lab set up is taking place, new students will have an internship at Harvard University for a few months.

- For more information, contact Yuval Ronen
  (yuval_ronen@g.harvard.edu)



Van der Waals based interferometry in the quantum Hall effect



Induced superconductivity in the fractional quantum Hall effect