

Search for Anyons in Quantum Materials

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Anyons, quasiparticles with fractional charge and exotic exchange statistics, have inspired decades of condensed matter research. Furthermore, it has been predicted that the exchange braiding of these particles, particularly non-abelian anyons, could produce topologically protected logic operations that may serve as the building blocks of fault-tolerant quantum computing. In this talk, I will discuss progress in researching two quantum materials platforms for realizing these exotic particles. In the first example, we will discuss anyon braiding arising in fractional quantum Hall (FQH) effects in graphene, using quantum Hall interferometers for direct observation of the anyon braiding phase around a confined cavity. In the second example, we will describe our recent experimental efforts to realize non-abelian anyons in proximitized topological insulator surfaces. Using a Corbino device geometry, we demonstrate the controlled manipulation of non-abelian anyons contained in magnetic vortices. We report tantalizing experimental observations to show the presence of non-abelian anyons in both systems.