

## Condensed Matter Seminar

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### “Simulating the Dynamics of Braiding of Majorana Zero Modes on the IBM Quantum Computer“

Monday, February 8, 2021

4:00pm – 5:00pm

Virtual Meeting:

**Zoom Link:** <https://virginiatech.zoom.us/j/85251259643?pwd=bjFXMVR0OU9YcXBCQjQ5SGZOMVNFQT09>

Passcode: 372125

Topological quantum computing relies on braiding of non-abelian anyons like Majorana zero modes. While there has been considerable work on Majorana zero modes in engineered superconducting-semiconducting systems, thus far all attempts at observing braiding experimentally have failed. Being interested in quantum simulation and braiding, it was natural to attempt to simulate the dynamics of braiding on an IBM quantum computer. Our first attempt failed as we found that the native quantum gates introduce too much noise. In order to overcome this problem, we used Qiskit Pulse to develop scaled two-qubit quantum gates that better match the unitary time evolution operator and enable us to observe braiding. This work demonstrates that quantum computers can indeed be used for simulating non-trivial quantum dynamics and highlights the use of pulse-level control for programming quantum computers. Finally, we remark that as far as we know our work is the first demonstration of braiding in a quantum system.