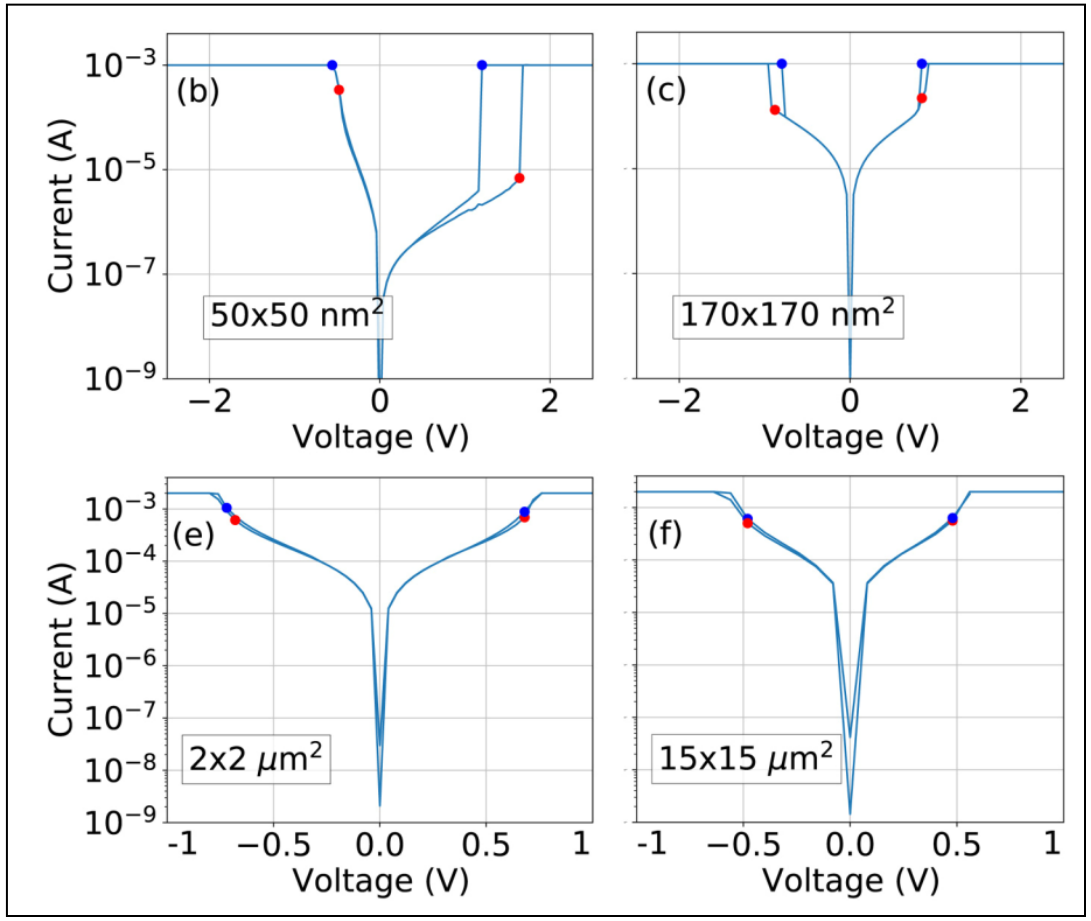
RUI: Structural and Compositional Modification of Niobium Oxide Films for Neuromorphic Computing Applications.

Matthew C. Sullivan, Ithaca College

We conducted electrical measurements on NbO2 devices. Our devices were either nanoscale devices (50x50 - 170x170 nm^2) or micro-scale cross-bar devices with active device areas between 2x2 and 20x20 um^2. The nanoscale devices were annealed in nitrogen to create crystalline NbO2, whereas the micro-scale devices were electroformed at large voltages to create NbO2 filaments of diameter ~100 nm.

Our results show that the large threshold voltages and large difference between threshold and hold voltages are attainable in annealed nanoscale devices, and that the more common electroformed filaments often show poor switching behavior, as shown in the figure on the right. As a result, the nanoscale devices are more promising for memristive applications.

Our full results are published here:
https://doi.org/10.1116/6.0002129



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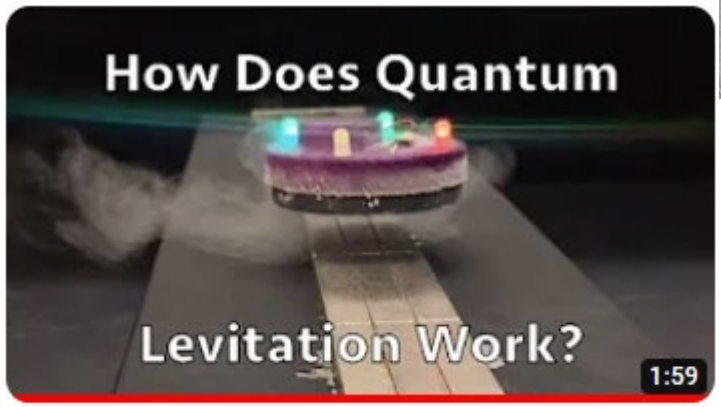
In 2022-2023 we trained three undergraduates and one high school student in various aspects of experimental condensed matter physics, including training in the Cornell Nanoscale Science and Technology Facility (photo attached).

We hired a High School junior to create outreach videos for YouTube. This student moved to Ithaca, NY and worked closely with the undergraduates in the lab and created a new demonstration for superconductors. She also created several videos and posted them to YouTube. This was the student's first experience with research in physics.



Quantum Levitation - Superconductor on a Magnetic Track

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