



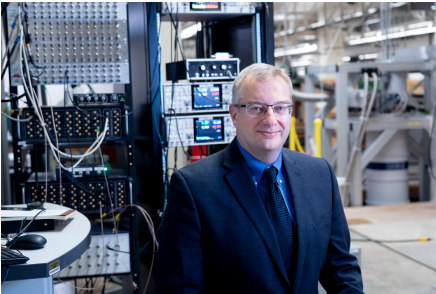
## Quantum Mechanics, Identical Particles, and the Strange Case of Anyons...

### Dr. Michael Manfra

*Bill and Dee O'Brien Distinguished Professor of Physics and Astronomy  
Professor of Materials Engineering  
Professor of Electrical and Computer Engineering  
Scientific Director, Microsoft Quantum Lab, West Lafayette*

**Wednesday, October 9th @ 2:00 pm in BRK 1001**  
*Coffee and snacks served before the seminar*

**Zoom Link:** <https://purdue-edu.zoom.us/j/95283400606>



### Abstract:

The fundamental particles of nature are indistinguishable - you cannot tell one electron from another by the color of its hair, or the shape of its ears, or the way it laughs. A basic tenet of quantum mechanics is that all elementary particles are either bosons or fermions, distinguished by their quantum statistics. Loosely speaking, bosons like to flock together while fermions are solitary creatures that tend to repel each other. Ensembles of bosons or fermions behave differently due to differences in their underlying quantum statistics. Starting in the late 1970s it was theoretically conjectured that excitations that are neither bosons nor fermions may exist under special conditions in two-dimensional interacting electron systems. These unusual excitations were dubbed “anyons.” Anyons possess fractional charges and fractional statistics. However, directly probing these properties presents experimental challenges. This lecture will focus on the development of electronic Fabry-Perot interferometers that resulted in the first direct observation of anyonic braiding in the fractional quantum Hall state at  $\nu=1/3$ . These experiments demonstrate that ensembles of fundamental particles confined to reduced dimensions may act in concert to form new particles with properties unlike anything previously observed in nature.

### Bio:

Michael Manfra is the Bill and Dee O'Brien Distinguished Professor of Physics and Astronomy, Professor of Materials Engineering, and Professor of Electrical and Computer Engineering at Purdue University. He also serves as Scientific Director of Microsoft Quantum Lab West Lafayette. Mike was born, raised, and educated in Boston Massachusetts where he received his A.B. degree from Harvard in 1992 and PhD from Boston University in 1999. Mike spent 2 years as a Postdoctoral Member of the Technical Staff at Bell Laboratories, Lucent Technologies from 1998 to 2000 and in 2001 became a member of the Technical Staff of Bell Laboratories where he conducted research in low dimensional electron systems. After 10 years at Bell Labs, Manfra moved to Purdue in 2009. Mike was a Keck Foundation awardee in 2013, was elected a Fellow of the American Physical Society in 2015, and in 2016 became the Scientific Director of Microsoft Quantum Lab West Lafayette. In 2020, his group reported interferometric measurement of anyon braiding, giving experimental evidence for a theoretical prediction made 40 years earlier.