

# Materials Science Seminars

Spring 2021



Department of  
Materials Science  
and Engineering

UC San Diego  
Jacobs School of Engineering



Samueli  
Materials Science & Engineering

**Fri, 15 January 2021**

**Title:** Towards topological quantum computing  
with magnetic insulators

**Presenter:** Dr. Jason Alicea  
Professor of Theoretical Physics, California Institute of  
Technology

**Time:**

10:00 AM – 11:00 AM (Pacific time)

**Connection:**

Zoom meeting ID: 842 506 6501

Password: 587901

Recent experiments on the Mott insulator  $\text{RuCl}_3$  support the emergence of a magnetic-field-induced “spin liquid” phase featuring non-Abelian anyons, which underlie intrinsically fault-tolerant topological quantum computation schemes. This talk will explore two classes of measurements that probe anyons born in such a spin liquid. The first class utilizes low-voltage electrical probes – despite the fact that  $\text{RuCl}_3$  realizes a good Mott insulator! To this end I will introduce circuits that interface electrically active systems with  $\text{RuCl}_3$  to perfectly convert electrons in the former into anyons in the latter, enabling analogues of transport probes for topological superconductors. The second class of measurements utilizes ancilla spins to implement a time-domain analog of anyon interferometry developed for quantum Hall systems. Together, these results illuminate a partial pathway towards exploiting magnetic insulators for topological quantum computation.

Jason Alicea earned a physics PhD from UC Santa Barbara in 2007 and then moved onto a postdoc fellowship at Caltech. In 2010 he became an assistant professor at UC Irvine before returning to Caltech as a professor in 2012. His research explores novel quantum phases of matter, often motivated by fault-tolerant quantum computing applications.

## Organizers

**William J. Bowman, Ph.D.**

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