QPhysics
AT QUEENS COLLEGE

Colloquium Notice

Christopher Wilson

Institute for Quantum Computing, University of Waterloo

Quantum Simulation and Computation with Microwave Photons

Optical quantum computing (OQC) is a major paradigm of quantum information. In standard OQC, quantum information is processed by laser light traveling on a large table top. Over the last several years, we have worked to develop an alternative approach using microwave photons traveling on-chip in a superconducting circuit. Using superconducting parametric cavities, we have already demonstrated much of the toolbox of linear quantum optics, but also extended it by taking advantage of the strong nonlinearities of superconducting circuits. In this talk, we present a series of experiments demonstrating the capability of this system. In a first, we show that we can create genuine tripartite entanglement of propagating microwave photons. The approach used is easily scalable to more modes. In a second set of experiments, we use the parametric cavities as a platform for analog quantum simulation of lattice field theories. Preliminary results already show the promise of the platform for this application. For instance, a single device can simulate a number of different models, including topological and chiral models, in a flexible and programmable way. Finally, we look at experimental progress towards generating a type of “magic state” for OQC called the cubic-phase state, which has remained elusive to experimenters in traditional quantum optics. The cubic-phase state and its relatives would allow universal quantum computation using linear quantum optics. We have successfully generated non-Gaussian generalized squeezed states across one, two and three modes, which are an important experimental step towards these magic states.

About the Presenter

Christopher Wilson received his B.S. in Physics from MIT in 1996. There he performed undergraduate research on the role of nonlinear dynamics in the nervous system using analog circuit simulators. He received his Ph.D. in Physics from Yale University in 2002. His dissertation focused on the development of single-photon optical spectrometers using superconducting tunnel junctions. He then worked at Yale as the W.M. Keck postdoctoral fellow where he started work on quantum computation and information processing using superconducting single-electronics. In 2004, he moved to Chalmers University of Technology in Sweden, later becoming an assistant professor in 2007 and an associate professor in 2011. In 2011/2012, he spent a sabbatical year working at a biomedical startup company in Pasadena, where we worked on signal processing and machine learning for medical diagnostics. Starting in 2012, he became an associate professor at the University of Waterloo, where he holds appointments in the Department of Electrical & Computer Engineering and the Institute for Quantum Computing. He was appointed professor in 2017 and has served as the Director of the Graduate Program at IQC since 2018. His research focuses on applications of superconducting quantum electronics to quantum information, computing and sensing and the foundations of quantum mechanics. His work has been recognized internationally, receiving the 2012 Wallmark prize from the Royal Swedish Academy and being named one of the top 5 breakthroughs of 2011 by Physics World magazine.

Attending this Meeting
Mohammad Miri is inviting you to a scheduled Zoom meeting.

Topic: Colloquium : Christopher Wilson
Time: Sep 21, 2020 12:15 PM Eastern Time (US and Canada)

Join Zoom Meeting
https://zoom.us/j/99617446833?pwd=eTAyYUtQcnZONXJXamZBTHgxTnFIUT09

Meeting ID: 996 1744 6833
Passcode: 545570
One tap mobile
+16468769923,,99617446833# US (New York)
+13126266799,,99617446833# US (Chicago)

Dial by your location
+1 646 876 9923 US (New York)
+1 312 626 6799 US (Chicago)
+1 301 715 8592 US (Germantown)
+1 669 900 6833 US (San Jose)
+1 253 215 8782 US (Tacoma)
+1 346 248 7799 US (Houston)
+1 408 638 0968 US (San Jose)
Meeting ID: 996 1744 6833
Find your local number: https://zoom.us/u/adXqg6uU1B

Monday
September 21, 2020
Starts at **12:15 pm**
Online at zoom.us