Physics Colloquium

MONTANA STATE UNIVERSITY | College of Letters & Science

Friday, December 1, 2017
4:10 – 5:00 PM
Procrastinator Theater – Strand Union Building

Atomic-Scale Electronics for Quantum Computing

Dr. Michelle Y. Simmons, Scientia Professor of Physics
Centre Director & Work-Package Leader, Centre of Excellence for Quantum Computation & Communication Technology
School of Physics, The University of New South Wales, Sydney, Australia

Abstract:

Down-scaling has been the leading paradigm of the semiconductor industry since the invention of the first transistor in 1947. However, miniaturization will soon reach the ultimate limit, set by the discreteness of matter, leading to intensified research in alternative approaches for creating logic devices. This talk will discuss the development of a radical new technology for creating atomic-scale devices in silicon which is opening a new frontier of research in electronics globally. We will introduce single atom transistors where we can measure both the charge and spin of individual dopants with unique capabilities in controlling the quantum world. To this end, we will discuss how we are now demonstrating atom by atom the best way to build a quantum computer– a new type of computer that exploits the laws of physics at very small dimensions in order to provide an exponential speed up in computational processing power.

Why Quantum Computers Promise Computational Advantage

Dr. Mark B. Ritter
Distinguished Research Staff Member and Senior Manager, Physical Sciences
IBM T.J. Watson Research Center, Yorktown Heights, New York

Mark received his B. S. in Physics from MSU in 1981

Abstract:

Conventional computational power has increased roughly 18 orders of magnitude, or a billion-billion times in the last century, employing billions of transistors per processor chip. In this talk I will describe why quantum computers, even though they have a small number of quantum bits, or qubits, could have a computational advantage over any transistor-based computing technology. I'll review the status of IBM's superconducting qubit technology, describe the Quantum Experience, access to small (5 and 16 qubit) quantum computers on the web, and a quantum software development kit using Python Notebooks. I'll show computations we have already performed, and discuss key challenges, including the approximate number of qubits needed to achieve quantum advantage.

Hosts: Rufus Cone, MSU Department of Physics
George Keremedjiev, Director, American Computer & Robotics Museum

Part of the day-long celebration of the annual George R. Stibitz and E.O. Wilson Awards
http://www.compustory.com/
http://www.montana.edu/news/17275