WISCONSIN
UNIVERSITY OF WISCONSIN–MADISON

Department of Physics
Distinguished Mack Lectures

Friday November 30, 2018

2241Chamberlin Hall
3:30 PM- 4:30 PM

Quantum Information and Computation

Quantum systems such as atoms can be used to store information. For example, we can store a binary bit of information in two energy levels of an atom, labeling the state with lower energy a “0" and the state with higher energy a “1.” However, quantum systems can also exist in superposition states, thereby storing both states of the bit simultaneously, a situation that makes no sense in our ordinary-day experience. This property of quantum bits or “qubits” potentially leads to an exponential increase in memory and processing capacity. It would enable a quantum computer to efficiently solve certain problems such as factorizing large numbers, a capability that could compromise the security of current encryption systems. It could also be used to simulate the action of other important quantum systems in cases where such a simulation would be intractable on a conventional computer. A quantum computer could also realize an analog of "Schrödinger's Cat," a bizarre situation where a cat could be simultaneously dead and alive. Experiments whose goal is to realize a quantum computer based on laser manipulations of atomic ions will be described, but this is only one of several possible platforms for such a machine.

Prof. David J. Wineland,
The **Nobel Prize** in Physics 2012
https://www.nobelprize.org/prizes/physics/2012/wineland/auto-biography/