Computing breakthrough could elevate security to unprecedented levels

August 16 2007

By using pulses of light to dramatically accelerate quantum computers, University of Michigan researchers have made strides in technology that could foil national and personal security threats.

It's a leap, they say, that could lead to tougher protections of information and quicker deciphering of hackers' encryption codes.

A new paper on the results of this research, "Coherent Optical Spectroscopy of a Strongly Driven Quantum Dot," appears in the Aug. 17 issue of *Science*. Duncan Steel, the Robert J. Hiller Professor at Michigan Engineering's Department of Electrical Engineering and Computer Science and the Department of Physics, is one of the lead authors of the paper. Faculty from the University of California-San Diego and the Naval Research Laboratory in Washington, D.C., also contributed.

The researchers used short, coherent pulses of light to create light-matter interactions in quantum dots---particles so small that the addition or deletion of electrons changes their properties. They found they could control the frequency and phase shifts in the optical network, which is crucial in powering an optically driven quantum computer, Steel said.

Optically driven quantum computers can crack highly encrypted codes in seconds. The fastest of today's desktop computers would require 20 years.

Part of what makes quantum computers so fast is that they are multitask masters.

"Quantum computers are capable of massive parallel computations," Steel said. "That's why these machines are so fast."

And the technology the researchers used to power them in this study is relatively cheap.

"We're particularly excited about our findings because they show that we can achieve these results by using quantum dots and readily available, relatively inexpensive optical telecommunications technology to drive quantum computers," Steel said. "Quantum dots replace transistors in these computers, and our results show that it only takes a few billionths of a watt to drive it."

U-M researchers are using quantum dot systems to pave the way for numerous quantum level applications, such as quantum dot dressed state lasers, optical modulators and quantum logic devices.

This discovery in quantum dot spectroscopy is an important stepping stone to building a quantum computer for the future. Spectroscopy is the study of the interaction between light and matter.

Source: University of Michigan