

LOGISTICS, MANUFACTURING, DISTRIBUTION & TRANSPORTATION

Going beyond current nanotechnology could be profitable

By KRISTINE PORTER
Business Journal Staff

Kutztown University physics professor Dr. Kunal Das and co-scientist atomic physicist Seth Aubin at the College of William and Mary in Williamsburg, Va., are collaborating on a new technology, one that they hope will revolutionize the nanotechnology industry. Their goal is to improve circuits and reduce the heat generated in electronic devices.

"It's too early to tell how it will affect the costs of commercial products," Das said. "It's cutting edge technology, but it will be years before it starts generating money. It has the potential to generate."

Das calls the technology a quantum pump.

"We have become so spoiled to think that our computers are going to keep getting faster," Das said. "Heat means that the process is not efficient."

Aubin, who is an experimental physicist, will be conducting the tests.

"We are trying to build the electronic circuits of the future," Das said.

The two are hoping that their theory proves correct.

To explain what a quantum pump is, Das said that electronic devices use a technology for circuits that has

remained unchanged for 40 years. He explained that a group of electrons carry a charge. As these electrons move from one point to another in an electronic device, they complete a circuit. As the device gets smaller and the distance for the electrons to travel gets shorter, the electrons speed up. This increase in speed creates heat, he

"We are trying to build the electronic circuits of the future."

~ Dr. Kunal Das
Physics professor
Kutztown University

controlled manner, then they believe they can prove that the idea behind the quantum pump can work.

"We're taking an idea and implementing it into a totally different system," Das said. "You have to think about these things in a very different way."

Dr. Kunal Das explained that the pump can be

Academic basics

DR. KUNAL DAS
physics professor

- **Institution:** Kutztown University
- **Address:** P.O. Box 730, Kutztown, PA 19530
- **Telephone:** 610-683-4000
- **Web site:** www.kutztown.edu
- **E-mail:** das@kutztown.edu
- **Co-scientist:** Seth Aubin, atomic physicist and professor at the College of William and Mary in Williamsburg, Va.

single electron, quantum physics views electrons like a wave. Somewhere along that wave is the electron. Where the electron exists in the wave is known as the phase, Das said, and it is "kind of a fragile thing."

Since other scientists have not been able

to move a single electron in a predictable, controlled manner, Das said he and Aubin intend to start with atoms. The phase of electrons has been too unstable, he said. If they succeed in moving the atom in a

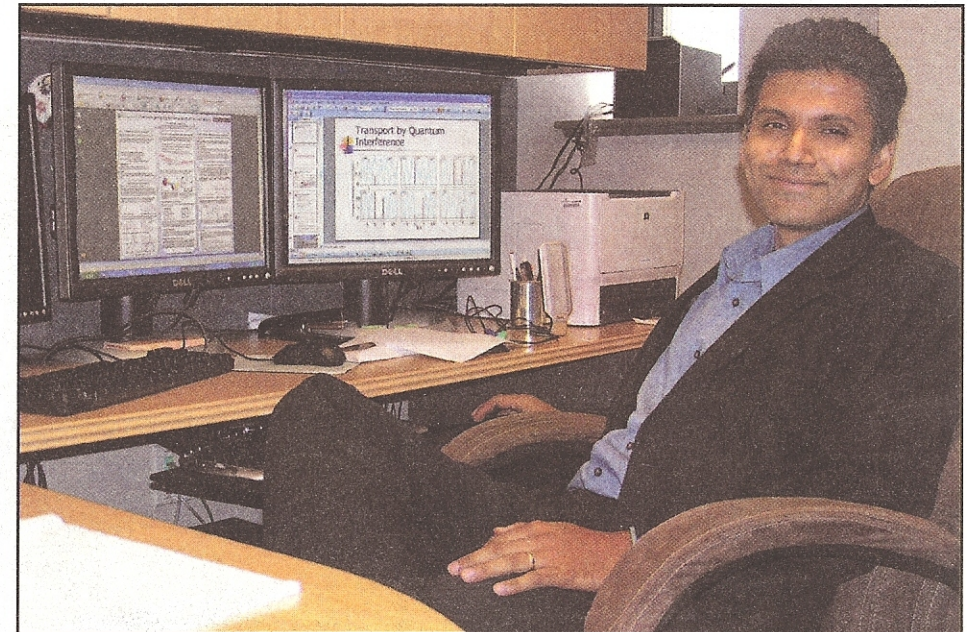


Photo by Kristine Porter

Physics professor Kunal Das shows slides he uses to explain the quantum pump.

said. These alternating voltage barriers are raised and lowered propelling the electron forward in a controlled, predictable manner.

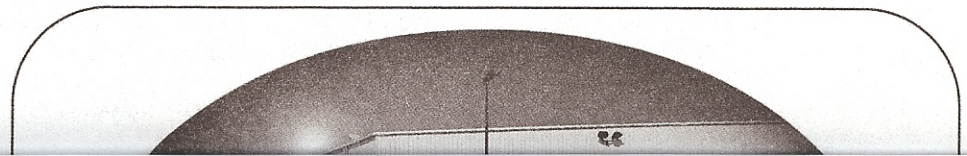
"If you have precise control, you have more efficiency and less heat in the system," Das said.

Ultra cold atoms are much easier to control, he said. For this reason, Das thinks that the atoms will help him and Aubin prove the workability of the quantum pump. The physicists intend to create a device using a laser and magnets to create

a channel trap for the atom. They will use the atom's own magnetic quality to control its movement.

Machine technology continues to move toward smaller circuits and faster devices. These devices are used in everything with a computer component. Reducing the number of electrons from a mob to one allows circuits to get small and fast.

"Both of them rely on being able to move fewer electrons faster," Das said. "In a sense, it underlies everything."



The two are hoping that their theory proves correct.

To explain what a quantum pump is, Das said that electronic devices use a technology for circuits that has

remained unchanged for 40 years. He explained that a group of electrons carry a charge. As these electrons move from one point to another in an electronic device, they complete a circuit. As the device gets smaller and the distance for the electrons to travel gets shorter, the electrons speed up. This increase in speed creates heat, he said. Present devices move about 20 to 30 electrons at a time. With increasingly smaller technology, the goal is to move electrons individually.

"Begin to think of each separate electron as its own entity," Das said. "You can predict the behavior of a mob, lots of electrons, but not so much with one."

In classical physics, Das explained, electrons are thought of as particles. Their behavior as a group is predictable, but the behavior of a single electron isn't as precise.

In order to understand the behavior of a

"We are trying to build the electronic circuits of the future."

*~ Dr. Kunal Das
Physics professor
Kutztown University*

controlled manner, then they believe they can prove that the idea behind the quantum pump can work.

"We're taking an idea and implementing it into a totally different system," Das said. "You have to think about these things in a very different way."

Das explained that the pump can be compared to a canal. A boat enters the canal, and the lock closes behind it. Water is pumped in, and the boat rises with the water level. The lock in the front is opened and the boat can move forward.

With electronic devices, "you move electrons by applying a voltage," Das said. "The quantum pump takes advantage of the quantum mechanics of the electrons."

In the quantum pump, a voltage barrier (a canal lock) interferes with the electron wave (the boat). A second voltage barrier is enacted creating a voltage well where the electron is trapped or contained, he

to move a single electron in a predictable, controlled manner, Das said he and Aubin intend to start with atoms. The phase of electrons has been too unstable, he said. If they succeed in moving the atom in a

controlled manner, then they believe they can prove that the idea behind the quantum pump can work.

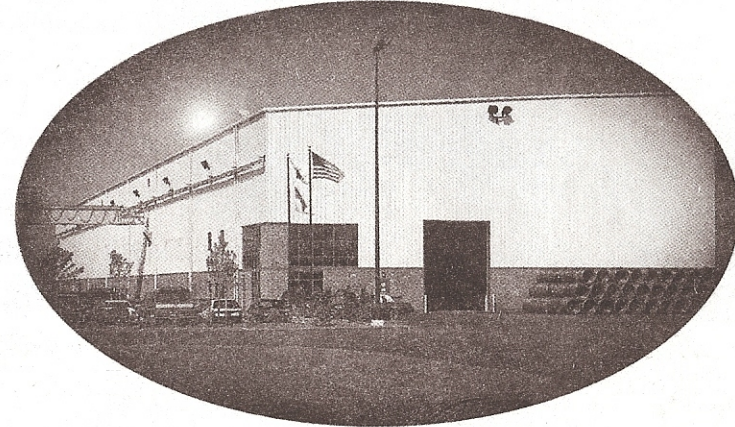
"If you have precise control, you have more efficiency and less heat in the system," Das said.

Ultra cold atoms are much easier to control, he said. For this reason, Das thinks that the atoms will help him and Aubin prove the workability of the quantum pump. The physicists intend to create a device using a laser and magnets to create

control its movement.

Machine technology continues to move toward smaller circuits and faster devices. These devices are used in everything with a computer component. Reducing the number of electrons from a mob to one allows circuits to get small and fast.

"Both of them rely on being able to move fewer electrons faster," Das said. "In a sense, it underlies everything."



SOME GROWING MANUFACTURERS SEEK A BRIGHTER APPROACH TO CONSTRUCTION.

THEY FIND NORTH STAR.

Insightful planning and design through our experience managing the construction of dozens of manufacturing plants and distribution centers. The unique ability to guarantee pricing before the design is begun. Single source responsibility for the entire project. Look to North Star to bring it all together.

When it's time to grow, North Star is the bright place to start.

PROFESSIONALISM. EXPERIENCE. DEPENDABILITY. VALUE.



NORTH STAR
Construction Management Inc.

SUITE 100 • 7562 PENN DRIVE • ALLENTOWN, PA 18106 • 610.395.7005 • FAX 610.395.8570

North Star proudly uses **NUCOR** pre-engineered products
BUILDING SYSTEMS

Go With MOYER AVIATION!

It's your time... your plane... you're there!



- Executive charter flights to all points in the U.S. & Canada
- Personal travel
- High priority delivery
- Pick up at all area Airports

Personal Transportation on your schedule

MOYER AVIATION INC.



BRADEN AIRPARK

3800 Sullivan Trail, Easton, PA 18040

610-258-0473 • 800-321-5890

www.moyeraviation.com