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Featured Story

Carbon Nanotubes Outperform Copper Nanowires as Interconnects



Saroj Nayak

Researchers at Rensselaer Polytechnic Institute have created a road map that brings academia and the semiconductor industry one step closer to realizing carbon nanotube interconnects, and alleviating the current bottleneck of information flow that is limiting the potential of computer chips in everything from personal computers to portable music players.

To better understand and more precisely measure the key characteristics of both copper nanowires and carbon nanotube bundles, the researchers used advanced quantum-mechanical computer modeling to run vast simulations on a high-powered supercomputer. It is the first such study to examine copper nanowire using quantum mechanics rather than empirical laws.

After crunching numbers for months with the help of Rensselaer's Computational Center for Nanotechnology Innovations, the research team concluded that the carbon nanotube bundles boasted a much smaller electrical resistance than the copper nanowires. This lower resistance suggests carbon nanotube bundles would therefore be better suited for interconnect applications.

"With this study, we have provided a road map for accurately comparing the performance of copper wire and carbon nanotube wire," said Saroj Nayak, an associate professor in Rensselaer's Department of Physics, Applied Physics, and Astronomy, who led the research team. "Given the data we collected, we believe that carbon nanotubes at 45 nanometers will outperform copper nanowire." The research results are featured in the March issue of the *Journal of Physics: Condensed Matter*.

Rensselaer graduate student Yu Zhou and postdoctoral research assistant Subbalakshmi Sreekala are co-authors of the paper. Materials science and engineering professor Pulickel Ajayan, who is now at Rice University, is also a co-author. Funding for this project was provided by the New York State Interconnect Focus Center.

[Read more.](#)

Honors and Awards

Faculty

- **Mohammed Zaki** (Associate Professor, Computer Science) was appointed Associate Editor of *ACM Transactions on Knowledge Discovery from Data*.

Students

- **Brian Schulkin** (Graduate Student, Physics) has been nominated for the 2008 TR35 list, which is *Technology Review* magazine's awards list honoring the world's top young innovators. Established in 1999, the TR35 list recognizes 35 outstanding innovators under the age of 35 each year. *Technology Review* is owned and published by MIT.
- The Undergraduate Research Forum and Awards Ceremony was held on March 28, 2008. Three students in the School of Science won awards as follows:
 - **Ashley Thomas** (Mathematics), First Place, Applied Category, "Inverse Problems in Sonoelastography: Recovering the Shear Wave Speed from Crawling Wave Data"

- **James Rajotte** (Biology), First Place, Theoretical Category, "Observation of Phosphoinositol Lipid-Septin Interactions Through GST Fusion Proteins"
- **Megan Salt** (Biochem/Biophysics) Third Place, Theoretical Category, "The role of Rho Family GTPases in microtubul organization during epithelial polarization (2)"

For more details, go to the [Undergraduate Research Forum website](#).

Research Accomplishments

- **Jim Ferris** (Research Professor, Center for the Origins of Life; Professor Emeritus, Chemistry) was an invited speaker at the International Workshop on Chemical Evolution and the Origins of Life at the Indian Institute of Technology Roorkee, Roorkee, India, March 14-16, 2008. In his presentation "Prebiotic Synthesis: The Possible Role of Mineral Catalysis in the Formation of RNA", he discussed his latest findings on the role of montmorillonite clay in catalyzing the formation of RNA oligomers from RNA monomers.
- **Jim Hendler** (Constellation Professor, Tetherless World Constellation; Professor, Computer Science) was interviewed by ZDNet on "AI lessons for the Semantic Web." The interview was published on March 20, 2008 and is available on the ZDNet website, [Read interview](#).
- **Jim Hendler** (Constellation Professor, Tetherless World Constellation; Professor, Computer Science) and **Deborah McGuinness** (Constellation Professor, Tetherless World Constellation; Professor, Computer Science) have received a \$2.5M, three-year subcontract from Lockheed Martin to be the research lead and ontology experts for a large (\$20M+) DAPRA effort. The subcontract is part of DARPA's "Integrated Learning" project, in which computers must show they can learn complex planning tasks from observing a single solution by an expert.
- **Jane Koretz** (Professor, Biology) received a Ruth L. Kirschstein National Research Service Award Senior Fellowship (F33) from the National Eye Institute of the National Institute of Health.
- **Deborah McGuinness** (Constellation Professor, Tetherless World Constellation; Professor, Computer Science) was the cochair of a symposium titled "Semantic Scientific Knowledge Integration" held at Stanford University in March, 2008. [View symposium website](#).
- **Evan Patton** (Junior, Computer Science, Accelerated B.S./Ph.D. Program) has developed an ontology browser as a web application for use on the iPhone and iPod Touch. This is the first Semantic Web application to be deployed on the iPhone/iPod Touch platform.
- **Bolek Szymanski** (Claire and Roland Schmitt Distinguished Professor, Computer Science) recently presented two talks in Los Angeles, CA. One was "Services for Sensor Networks," presented at UCLA and the second was "Malleability, Migration and Replication for Adaptive Distributed Computing Over Dynamic Environments," presented at the Information Science Institute of USC.
- **Mohammed Zaki** (Associate Professor, Computer Science) received a new grant from the National Science Foundation. The title of the grant is, "Mining and Remining Orthogonal Patterns and Models in Massive Graph Databases." The grant is \$150K for one year.

Other News

- Rensselaer is among 25 universities participating in the ExxonMobil Bernard Harris Summer Science Camp. The program is run by former U.S. astronaut Bernard Harris and the ExxonMobil Foundation. It will take place at Rensselaer from June 15-27. "The ExxonMobil Bernard Harris Summer Science Camp will give 50 underserved Capital Region middle school students in fifth through seventh grades the opportunity to engage in an innovative pre-college science program," says Cynthia Smith, assistant dean of students, director of pipeline initiatives and partnerships, and the director of the program at Rensselaer. "The program is a perfect fit for Rensselaer and its other pipeline initiatives, the goals of which are to ignite young peoples' interest and to inspire them to pursue careers in the STEM fields."
- **Joe Bao**, who received his Ph.D. working with Vasant Hanovar at Iowa State University, has joined the Tetherless World Constellation as a post doctoral researcher. Dr. Bao's thesis focused on developing modular ontologies for the Semantic Web.

- A confocal-Raman/AFM instrument was recently installed in the Proximal Probe Laboratory of NSEC. The instrument was purchased with funds from a NSF Major Research Instrumentation grant with PI **Chang Ryu** (Associate Professor, Chemistry) and Co-PIs **Richard Siegel** (Center Director, Nanotechnology Center; Professor, Materials Science & Engineering), **Robert Lindardt** (Ann and John H. Broadbent, Jr. '59 Senior Constellation Professor, Biocatalysis and Metabolic Engineering; Professor, Chemistry and Chemical Biology), and **Toh-Ming Lu** (R.P. Baker Distinguished Professor, Physics, Applied Physics, and Astronomy). The facility will be managed by **Hoichang Yang** (Laboratory Manager, Nanotechnology Center).

Upcoming Events

- School of Science Faculty Research Luncheon, April 9, 2008, 12:00 - 1:30, 2C25 Science Center, speakers: Mohammed Zaki and Bulent Yener (all faculty are encouraged to attend).
- Presidential Colloquy: "A Global REACH in a Shrinking World," April 11, 2008, 1:30 - 3:00, Biotech Auditorium (all are encouraged to attend).
- Undergraduate Accepted Student Celebration, April 12, 2008 (all departments participate).
- School of Science Graduate Student Council Poster-Palooza, April 17, 2008, 3:00 - 5:00, Empire State Hall (Polymer Center) (all are encouraged to attend).
- School of Science Workshop on Guidelines for DARPA Proposal Development and General Proposal Writing, presented by Jim Hendler, April 24, 2008, 5:30 - 7:00, 2C25 Science Center (all faculty are encouraged to attend).
- School of Science Recognition Reception, 3:30 - 5:00, May 1, 2008, Atrium (Level 2) Biotech Center (all are encouraged to attend).

This newsletter is prepared monthly and distributed to faculty, staff and students in the School of Science to keep everyone informed of accomplishments and events within the school. Corrections and items for the next newsletter should be sent to spoon@rpi.edu.

