Regional

Ackad uses powerful computers to solve problems

Aldemaro Romero
College Talk

Progress in science has been aided by progress in technology, and among the most important tools propelling this change have been computers. No wonder why scientists today rely on these machines to solve ever more difficult scientific problems. Among the many scientists pushing this envelope is Eddie Ackad, an assistant professor in the department of physics at Southern Illinois University Edwardsville.

Born in Montreal, Canada, Ackad received his bachelor's degree in physics and computer science at Concordia University in Montreal, Canada, and his doctorate from York University in Toronto, Canada. Problems, it seems, is his life's passion.

"I love solving problems for one and I love being able to dig really deep into a problem and end up not just having solved it but having understood everything about it," said Ackad.

The specific area he works in is known as computational physics. It is a field known for its use of extremely precise and powerful computing to solve very complex problems. In fact the term High Performance Computing (HPC) was mentioned by President Obama during his 2011 State of the Union Address, when talking about the potential of using very large clusters of computers to get as much data and calculation ability as possible. Ackad explains the myriad of problems that this powerful computing can help solve.

"It is astonishing how much drug discovery is now simply done," Ackad said. "As far as I know it is almost unheard of nowadays to simply go out and try something in the lab without having some computation first. It has sort of narrowed down what you are going to do. So this is just everywhere and it is going to get better, eventually as systems grow and as computers become increasingly more powerful this will continue."

Advances in computing technology have come about so fast that even experts like Ackad are surprised by what is now possible. "Six months ago I would have told you that you really need the mainframes for just about every problem," Ackad explained. "But it turns out as of late, the new emerging phenomena is to do the computing on video cards because the processor that is on the video card is designed in such a way that you can get much much more data through."

What this means is that large mainframe computers can be replaced with fairly high-end graphic gaming cards – the same kind that are used to play games.

In fact, a lot of the new mainframes that are coming out are just large beds of video cards stacked together.

Some may be surprised that for his studies on the nature of molecules he uses data obtained through X-rays.

"X-rays are a fundamental tool and they are one of my primary research areas because what we are looking at is being able to look at matter at a very, very small scale," Ackad said. "And to look at it at a small scale we need high-energy light and that high-energy light is the X-ray. So what we try and do with these X-rays is really see into very important molecules inside that are relevant for human biology and for other animal biology."

Although X-ray technology was used as early as the 1950s to decipher the structure of DNA, today Ackad is using X-ray lasers in new areas of physics.

Currently he is looking into the idea for a cheap and efficient way of storing data as we do on hard drives.

"It is about writing the data with two lasers but at the nano (very small) scale so making very little size indentations – a billionth of a meter – in size in order to store huge amounts of data on a very small scale using a very cheap system," he said. "It won't be for a home device but there are plenty of things that need to be archived for long-term storage and this would be one way of doing it."

He said that he thinks that in the near future libraries won't need that much space since information will be able to be saved in the manner he describes. "Now we have chips that are small that can store 32 Gigs. The hope is to get chips that can store 32 billion Gigs," said Ackad.

He finds many of his students fascinated with his area of research not only because of the technology, but also because they are learning to be problem- solvers. "There are people who end up on Wall Street because it turns out modeling the stock market and modeling quantum mechanics is actually very similar," he said.

"And models are used in just about every industrial setting from drug development to engineering firms. It is about understanding and saying 'I know what to change.' "

Shan Lu/SIUE

Dr. Ackad at his office with his computer simulations.

Aldemaro Romero is the Dean of the College of Arts and Sciences at Southern Illinois University Edwardsville. His show, "Segue," can be heard every Sunday morning at 9 a.m. on WSIE, 88.7 FM. He can be reached at College_Arts_Sciences@siue.edu.