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New Tools to Study Forest Fires, Traffic Jams, & Other Problems

14.07.2004

The control of forest fires has developed into a complex science costing millions of dollars internationally. In the U.S. more than 10 million acres of forest burn annually while, in Canada, over 8,000 fires last year claimed more than 1.5 million hectares. Experts around the world are continuing to research new and innovative ways of battling forest fires.

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At Carleton University in Ottawa, Canada, Systems and Computer Engineering Professor Gabriel Wainer has created a software toolkit that can be used to define very complex physical systems. One of the applications is intended to predict the spread of forest fires. Dr. Wainer points out that his simulation research can also be used for other purposes such as predicting traffic flow. "We could use the toolkit to reprogram traffic lights that would move the traffic differently and prevent traffic jams." Another use is the examination of wireless communication patterns e.g. predicting ad hoc communication networks. "We can look at coverage and the

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shortest pathways to get from point A to point B."



"What we've done with the fire spread models is to build on other researchers' work and design a computer simulation model considering various factors such as wind speed and direction, terrain, slope, and firefighter participation, in order to study how these factors will affect the spread of a forest fire. You could use this toolkit to predict whether a town is endangered or where to place a forest fire team in order to combat a fire most effectively."



Dr. Wainer says the toolkit is now ready to be used in different applications in collaboration with industry and government agencies. "Of course, we will then have to make more adjustments and changes as we continue to upgrade our product."



Dr. Wainer notes that the fire spread application implemented in his toolkit is a continuation of work that has been conducted for decades. He said it began in 1972 when an American researcher at the USDA Forest Service, R.C. Rothermel developed a mathematical model to predict the spread of forest fires. "He is now viewed as the godfather of this research." Researchers used this model to devise various theories about the best way to examine fire spread. "Researchers at the University of Arizona developed a discrete event fire spread model and we then took their research and condensed about 50 pages of their computer codes into a simple one-page model using higher level language that allows the user to focus more on the actual problem than issues related to computer programming." Dr. Wainer continued: "This toolkit is easier to use as it is simpler to make changes and modify. Practically, someone could add a couple of lines that introduces different factors such as 'What if it is raining?' or 'What if a firefighter is placed here at this point and time?'"



Last year, Carleton University signed an historic Memorandum of Understanding with the University of Arizona to signify an ongoing relationship that would lead to an important exchange of research, faculty, and students in all disciplines. This partnership is the largest Canada-U.S. alliance for both schools. "I already had some dealings with faculty at the U of A before we struck this agreement," points out Dr. Wainer, "but this collaboration is really helping us to move forward in this field of research."



Dr. Wainer recently returned from a European Simulation Symposium that allowed him to compare notes with colleagues in France and Germany. He was hired by Carleton University in 2000 as an Assistant Professor of Systems and Computer Engineering. He completed his Ph.D. at the University of Aix-Marseilles in France and his M.A. at the University of Buenos Aires in Argentina. He is the author of two books "Methodologies and tools for discrete-event simulation" (in Spanish, 2003) and "Real-Time Systems: concepts and applications" (in Spanish, 1997) along with several journal articles.



Dr. Wainer's research project is just one of a number of amazing research projects now underway at Carleton University in Canada. A major new international facility for underground science called SNOLAB, which will feature the deepest underground laboratory in the world, is now being constructed. It will transform the already renowned Sudbury Neutrino Observatory (SNO) experiment into a permanent, world-class research facility. Carleton is the administrator of this project that will help people better understand the basic nature of our universe and its evolution. As Carleton's David Sinclair, director and principal investigator of SNOLAB points out: "We can only imagine where the results of this research will take us." Construction is expected to be completed by 2007. The project is a collaborative effort among six Canadian universities and several international partners.



Carleton University, Canada's Capital University, has seen its sponsored research grow fourfold in the past four years to the tune of \$100 million. Earlier this year, Carleton's Sprott School of Business won the Institutional Best Overall Research Performance Award from the Administrative Sciences Association of Canada. In October 2002, Alcatel selected Carleton as its first Canadian Alcatel Global Research Partner. A list of Canada's top 50 research universities published November 4, 2003 in the National Post puts Carleton third among comprehensive universities in Canada in research funding.



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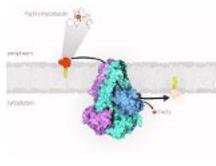
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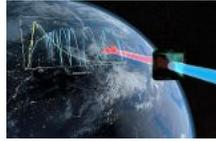
Im Focus: Blocking the Iron Transport Could Stop Tuberculosis



The bacteria that cause tuberculosis need iron to survive. Researchers at the University of Zurich have now solved the first detailed structure of the transport protein responsible for the iron supply. When the iron transport into the bacteria is inhibited, the pathogen can no longer grow. This opens novel ways to develop targeted tuberculosis drugs.

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An international team with the participation of Prof. Dr. Michael Kues from the Cluster of Excellence PhoenixD at Leibniz University Hannover has developed a new method for generating quantum-entangled photons in a spectral range of light that was previously inaccessible. The discovery can make the encryption of satellite-based communications much more secure in the future.

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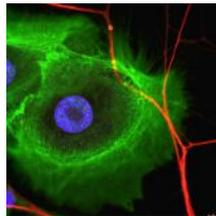
Im Focus: Junior scientists at the University of Rostock invent a funnel for light



Together with their colleagues from the University of Würzburg, physicists from the group of Professor Alexander Szameit at the University of Rostock have devised a "funnel" for photons. Their discovery was recently published in the renowned journal Science and holds great promise for novel ultra-sensitive detectors as well as innovative applications in telecommunications and information processing.

The quantum-optical properties of light and its interaction with matter has fascinated the Rostock professor Alexander Szameit since College.

Im Focus: Stem Cells and Nerves Interact in Tissue Regeneration and Cancer Progression



Researchers at the University of Zurich show that different stem cell populations are innervated in distinct ways. Innervation may therefore be crucial for proper tissue regeneration. They also demonstrate that cancer stem cells likewise establish contacts with nerves. Targeting tumour innervation could thus lead to new cancer therapies.

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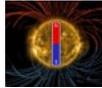
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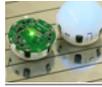
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