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Agricultural and Forestry Science
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Automotive Engineering
Business and Finance
Communications Media
Earth Sciences
Ecology, The Environment and Conservation
Health and Medicine
Information Technology
Interdisciplinary Research
Life Sciences
Machine Engineering
Material Sciences
Medical Engineering
Physics and Astronomy
Power and Electrical Engineering
Process Engineering
Social Sciences
Studies and Analyses
Transportation and Logistics

Home → Science Reports → Reports and News → Information Technology

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.

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 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 forestfighter 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.

| newswise

Further information:
http://www.carleton.ca

Event News

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07.04.2020 | Event News

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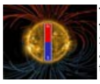
longstanding fascination, but UA astrophysicists are using cutting-edge technology to go one better.


NASA's Swift Mission Observes Mega Flares from a Mini Star
NASA's Swift satellite detected the strongest, hottest, and longest-lasting sequence of stellar flares ever seen from a nearby red dwarf star.


NASA | Global Hawks Soar into Storms
NASA's airborne Hurricane and Severe Storm Sentinel or HS3 mission, will revisit the Atlantic Ocean for the third year in a row.


Baffin Island - Disappearing ice caps
Giff Miller, geologist and paleoclimatologist, is walking the margins of melting glaciers on Baffin Island, Nunavut, Canada.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Something big is about to happen on the sun.


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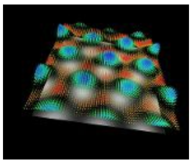
Im Focus: Researchers watch the dynamics of plasmonic skyrmions made from light on ultra-smooth gold platelets for the first time



The destructive force of a tornado occurs due to the extremely high rotational speeds in its center, which is called "vortex". Surprisingly, similar effects as in such storms are predicted for light that travels along an atomically smooth gold surface. This light can exhibit angular momentum and vortices. Researchers at the Universities of Stuttgart and Duisburg-Essen and the University of Melbourne (Australia) have now succeeded for the first time in filming these vortex patterns on the nanometer scale, which are named "skyrmions" after their discoverer Tony Skyrme. The journal Science reports this groundbreaking work in its issue of April 24, 2020.

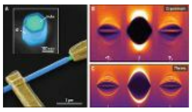
When a figure skater starts to perform a pirouette and raises her arms, she turns around her own axis increasingly faster due to the conservation of angular...

Im Focus: Protective ventilation: computational lung model could significantly reduce the number of deaths from Covid-19 and ARDS

The use of mechanical ventilation can save lives – and not just for COVID-19 patients who develop severe respiratory problems. But at the same time, the ventilation pressure puts immense stress on delicate lung tissue. Especially for patients with preexisting lung damage, the use of ventilators can prove deadly. A computational lung model that's been developed by the Technical University of Munich (TUM) can be used to reduce damage caused by mechanical ventilation – and could increase survival rates for patients significantly.

For patients suffering from acute lung failure (Acute Respiratory Distress Syndrome, ARDS), mechanical ventilation is a lifesaving treatment.

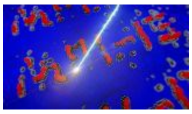
Im Focus: Quantum research unifies two ideas offering an alternative route to topological superconductivity



Researchers from University of Copenhagen have discovered a new way of developing topological superconductivity that may provide a useful route toward the use of Majorana zero modes as the foundation of qubits for quantum information.

A pencil shaped semiconductor, measuring only a few hundred nanometers in diameter, is what researches from the Center for Quantum Devices, Niels Bohr...

Im Focus: Serendipity in the research field of magnetism



Scientists discover new light-matter interaction with which they can write nanometer-sized magnetic structures

A German-Chinese research team has discovered a new effect that for the first time enables the creation of extremely small magnetic structures, known as...

Im Focus: Scientists at TU Bergakademie Freiberg develop new ways of emergency ventilation

Scientists at TU Bergakademie Freiberg are currently testing a prototype of a pressure-controlled emergency ventilator. The device, which can be built with simple tools and is easy to maintain, could be used primarily in developing countries for the ventilation of emergency patients suffering from lung diseases.

To this end, the mine rescue team of TU Bergakademie Freiberg and the Institute for Machine Elements, Design and Production have combined their expertise.

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