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Engineering

EngineeRing

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A rendering of the Thirty Meter Telescope at night
Photo Credit: TMT Observatory Corporation

TMT: UVic Helps Build the Next Generation of Telescopes

IN THIS ISSUE

UVic's Adaptive Optics Laboratory continues to work with a US-Canada collaboration to build the next generation of telescopes, a Thirty Metre Telescope, known as the TMT.

The TMT will be the largest on earth, tripling the size of the largest current earth-based telescopes that have primary mirror diameters on the order of 8 to10 metres. The larger mirror diameter will increase the light gathering area of the TMT to eight times the size of the current class of large telescopes.

When operational, the TMT will be a crucial tool to help answer many fundamental questions about the universe. The major scientific goals of the TMT will be to explore the early universe; investigate dark matter and dark energy; determine the relationship between black hole and galaxy formation; study the formation of stars, planets, and galaxies; and identify extra solar planets. The TMT will carry out these investigations both independently and in combination with other cutting-edge facilities such as the James Webb Space Telescope, a space-based telescope currently being built to replace the Hubble.

The TMT project is in the detailed design phase, and construction is planned to commence in 2018. Much of the project's seed funding comes from the Moore Foundation. The TMT project managers have chosen candidate sites in Northern Chile, Northern Mexico and Hawaii. The Hawaii site, atop Mauna Kea, is already home to many observatories. Site testing has been underway at all locations for two years to provide information about clouds, water vapour, winds and atmospheric turbulence in order to determine which site will provide the best observing conditions.

One of the design challenges is to overcome atmospheric turbulence, a major limiting factor of telescope performance. Adaptive optics systems have been developed to remove the blurring and distortion of images caused by the turbulence. An adaptive optics system uses sophisticated optics, sensors and computer software to compensate for the turbulence in real-time. At the heart of an adaptive optics system are devices called deformable mirrors. A deformable mirror can alter the shape of its reflective surface under the control of the adaptive optics system. Depending on the scientific instrument in question, the diameter of the deformable mirror can range from several millimeters up to 20 cm.

UVic's Adaptive Optics Laboratory is involved in several projects related to adaptive optics systems. Laboratory members are designing deformable mirror systems, creating software for measuring the degree of atmospheric turbulence, and simulating the measurement of atmospheric turbulence using atmospheric laser probes.

-Dr. Colin Bradley
Professor, Mechanical Engineering

MESSAGE FROM THE DEAN

With spring arriving, the activity level on campus is dropping off as students head off for summer work, but the engineering program continues as usual, since as our alumni know, engineering classes continue year round.

Cooperative education is a core part of our commitment to experiential learning, but it's not the only one. The Faculty of Engineering continues to incorporate real-life learning into our undergraduate programs. This fall we will launch a new integrated design and communication course in first year, which will provide students with hands-on experience in engineering design. In this course students will work on their communication skills, and practice writing in the context of their design work.

Many engineering students are drawn early-on to experiential learning, and participate with student project teams that come together for purposes of competing in national or international design competitions. The EcoCar, H2Drive, Formula SAE, UVic AERO and the Autonomous Underwater Vehicle (AUVic) teams all continue to test students' practical engineering skills. These teams also inspire high school students to consider engineering as a path to solving some of the outstanding problems faced by society.

In the past ten years research funding at the University of Victoria has increased by a factor of three. In parallel with this, graduate student enrolment in the Faculty of Engineering has increased by about 50%. The graduates of our programs end up all over the world but their impact is particularly strongly felt on Vancouver Island. The technology industry is now the largest industry on the Island, and consists mainly of relatively small companies with a high proportion of computer science and engineering graduates from our faculty on their payrolls. We are proud to be part of this.

As Dean, I am committed to working with students, faculty and staff, to ensure that we continue to provide an outstanding educational experience for our students, and continue to create exciting career opportunities for our graduates.

- Tom Tiedje
PhD, FRSC, PEng

Steven Ness and Dr. George Tzanetakis in the lab
Photo Credit: K. Hollefreund

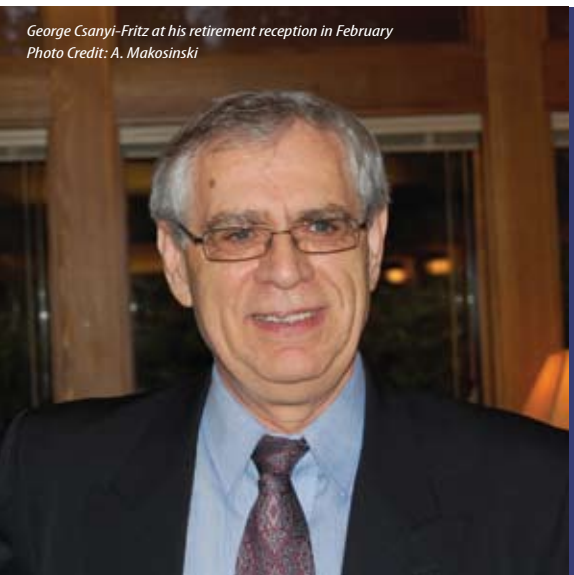
FACULTY NEWS

The Office of the Dean welcomed Mary-Anne Teo as the Faculty of Engineering Administrator in February '09.

Dr. Afzal Suleman, the Faculty of Engineering's Associate Dean of Research, will be UVic's new Associate Vice-President of Research as of July 1.

The search is on for a new Associate Dean of Undergraduate Programs as Dr. Daniel Hoffman has completed his term.

The winner of our Alumni Newsletter naming contest is Dr. Jianping Pan, who came up with the title EngineeRing. Dr. Pan is an Assistant Professor in Computer Science. "It reminds us of our home, the Faculty of Engineering, UVic's Ring Road, the responsibility of being Engineers and Computer Scientists, the Iron Ring and most importantly, the news from them: ring the bell!"



George Csanyi-Fritz at his retirement reception in February
Photo Credit: A. Makosinski

George Csanyi-Fritz Retires

George Csanyi-Fritz arrived at UVic in June 1983 from the University of Calgary. As the Faculty Engineer, he helped start the Faculty of Engineering on July 1, 1983. This past February, George retired.

For over 25 years George oversaw much of the administration of the faculty, but he was always clear who his primary "clients" were – our students. Over the years George had an open-door policy for students, and he was a mentor and supporter of their efforts. After George retired, he continued to be involved, overseeing the 2009 Iron Ring Ceremony.

"All good things must come to an end," George says. "I will look back with fondness and gratitude at a 40-year career in the most amazing country, and now I will change focus and look forward to spending more time with my family and with the growing, not just by age, but also in numbers, of my grandchildren."

Passion for Orca Song
Brings Biochemist Back to School

I recently came back to do my masters in computer science at the University of Victoria in the lab of Dr. George Tzanetakis. As a mature student in my mid-thirties, I have spent about 20 years studying and working in the fields of macromolecular crystallography and genomics. While very exciting fields to work in, at some level they just didn't inspire true passion in me. One morning I heard Dr. Tzanetakis being interviewed about the Orchive project and his collaboration with Dr. Paul Spong and Dr. Helena Symonds of Orcalab, a research station on Hanson Island, near the north end of Vancouver Island. At Orcalab they had been recording Orca song for over 20 years, and had built a huge archive of over 20,000 hours of audio recordings on cassette tape.

As a musician from a musical family, I have always wanted to study whale song. Upon learning of the project I knew I needed to be part of it. In the following months we designed a website for the Orchive project, and in doing so, I learned more about the links to music information retrieval that was going on in Dr. Tzanetakis' lab.

We have made available the over 8,000 hours of Orca song that we have currently digitized, which takes up over 8 terabytes of disk space. Researchers from around the world can visit the Orchive website and listen to any of the recordings, with a rich web interface that we have been designing. This represents a huge advantage over the past when researchers had to drive up to Hanson Island, find the cassette tape they were interested in, and locate the desired section of audio.

We are also hard at work on doing the next phase of the project, which is to apply advanced machine learning tools to analyze the sounds in this archive. Using the Marsyas toolkit, we are developing algorithms to help us towards this goal. We use the techniques of audio feature extraction and support vector machines to analyze the audio and determine what parts of the tapes have Orca song on them. We continue to develop algorithms and to analyze the audio on this wonderful and rich archive.

You can find videos from the lab at **http://audioscapes.sness.net** and the Orchive at **http://orchive.cs.uvic.ca**.

-Steven Ness

Jerome Etwaroo
helps the UVic Community Develop Patents

Jerome Etwaroo, a recent graduate from the Department of Electrical and Computer Engineering, was attracted to UVic through its Engineering Bridge Program. Jerome had previously worked in Ontario where he held a diploma in Electronics Engineering. "I have always thought about pursuing a degree in Engineering. The turning point for me to return to College and University came when I realized that the work I was doing was very similar to the work of an Engineer. Getting an Engineering degree would provide me with the necessary credentials and open doors of opportunity."

Jerome started work at the Innovation and Development Corporation (IDC), University of Victoria's University-Industry Liaison Office in September. He was pleasantly surprised as it was the first application he submitted and his first interview following his graduation in August of 2008.

"IDC works with all Faculty, Staff and Students within the University," says Jerome. Working in the University-Industry Liaison Office allows him to assist everyone at UVic by managing Intellectual Property (IP) and facilitating its commercialization. As a Technology Transfer Officer, Jerome conducts IP assessments to determine if the invention is protectable and free from infringement, and conducts market analysis to identify if the invention is commercially viable. These are only some of the duties now assigned to Jerome. Following these checks and assessments, IDC assists members of the UVic community in IP protection and facilitates commercialization of IP by creating licensing opportunities, industrial collaborations or by creating spin-off companies.

Merging what he learned from the program at UVic and applying it to his work with IP is a highlight of Jerome's career. Understanding the research concepts and inventions from his coursework has been an asset in his work.

Jerome's experience studying at UVic had a positive impact on his decision to work on campus, "Overall it was a good experience; the courses were challenging and they were really worthwhile. The Faculty was encouraging and gave me good advice, not just about courses, but on jobs, work, life and even offered to serve as references."

Coming full circle from being helped by his Professors at UVic, Jerome now looks forward to assisting them through his work at the IDC.

Farewell to Our Faculty Engineer

"Funnily enough, I was musing a few days ago about who the equivalent person to George would be at Carleton University, where I'm now doing my PhD in electrical engineering and I came up empty. I think there just is no equivalent to him. I considered George Csanyi-Fritz to be at the heart of the engineering program at UVic. When I was an executive on the Engineering Students' Society between 1998 and 2000, I remember that whenever we needed to get an event organized, somebody would say 'we'll just go talk to George about that'. It seemed that he was always there behind the scene, making the faculty run smoothly."

– Megan Holtzman (nee Howell Jones), Class of 2001, ESS President 1999 to 2000

"As the only individual who worked on the design of all three engineering buildings – and because of his many technical contributions over twenty-five years – George has made a tremendous contribution to the infrastructure that will support teaching and research in engineering for many years to come."

– Dr. Michael Miller, former Dean of Engineering from 1993 to 2008, and Professor, Department of Computer Science

"George is the guy who gets stuff done. His cool confidence was the first thing I noticed and, in hindsight, it was a bit scary to see. It didn't take long for me to overcome my fear and learn to appreciate his honesty and competency. He is a pleasure to work with."

– Logan Volkers, Current ESS Stream B President

Single Crystal Semiconductors

Hold Promise for Reliable, Cheaper, Greener Detectors and Devices

Demands for better health, increased security, and greener energy are on the rise. The first demand is due to our desire for a healthier and longer life, and the second is due to the recent security concerns in transportation and other applications. The need for greener energy sources such as solar is to address our concerns of climate change.

These strategic applications require devices and detectors that are mostly based on single crystal materials. Among these materials, Cadmium Zinc Telluride (CZT), Cadmium Telluride (CdTe) and Gallium Indium Antimonide (GaInSb) have the potential for the development of efficient, portable, inexpensive, reliable, and room-temperature operation detectors and devices. The availability of such detectors and devices is essential in meeting the above-mentioned demands. CdTe and CZT detectors are also seen as the enabling technology that will allow the development of next-generation x-ray inspection and imaging systems that are required for a number of industrial applications, including non-destructive inspection and testing of manufactured goods, liquid level and thickness gauging, as well as x-ray food inspection and x-ray fluorescence.

In this direction, Dr. Sadik Dost's current research programs have focused on the growth of these single crystal materials. Presently, Canada is one of the world leaders in both research and industrial production in this field.

> *"From watches and cell phones to supercomputers and solar panels, almost all electronic devices rely on the semi-conducting properties of single crystal materials."*

These materials are produced by a solidification process called crystal growth. Today, most bulk semiconductors are made through crystal growth processes known as melt/solution techniques. These growth techniques have evolved from artisanship, relying on experience and intuition. Even today, this is the case in most techniques, if not all. The production of the same crystal twice is still a challenge, and not even possible by most techniques.

Dr. Dost is working on a more scientific approach so that high-quality crystals can be grown reproducibly. Dr. Dost is a Mechanical Engineering Professor, the Director of the Crystal Growth Laboratory and the Canada Research Chair in Semiconductor Crystal Growth. He is taking both an experimental and a theoretical approach, focusing on crystal growth of semiconducting bulk single crystals from the liquid phase.

More specifically, Dr. Dost studies the transport phenomena (fluid flow, heat and mass transfer in the liquid phase, and heat and mass transfer in the solid phase) occurring during the solidification and dissolution (or melting) of semiconductors. In his experimental research he is developing models and numerical simulations for these transport phenomena. His experimental research program includes the crystal growth techniques of Liquid Phase Electroepitaxy (LPEE), the Traveling Heater Method (THM), and Liquid Phase Diffusion (LPD), Vapour Phase Growth (VPG), and Zone Refining.

Trevor Thompson, Marija Kopac and Tessa Quinn at an Alumni and Co-op event in Vancouver this Spring. Photo credit: K. Hollefreund

Co-Op Student Profile:

Tessa Quinn Works to Integrate Wind Power

Tessa Quinn, a fourth year electrical engineering student, is currently completing her third co-op term in Vancouver at BC Transmission Corporation. Previous terms at MDA Corporation and Advanced Lithium Power prepared her for her current work-term at BCTC. Quinn feels that "BCTC is a good company where I could see myself working in the future."

Her co-op position involves working on a dispatcher-training simulator, a tool that simulates BC's real-time energy management system. Her focus is studying the effects wind farms will have on the transmission system as the province currently relies mostly on hydroelectric power. BCTC is looking at the future of power generation and delivery, a topic which resonates with the B.C. raised Quinn.

"I'm from Ladysmith, so coming to UVic was a natural choice. It turned out that I've really liked co-op and the program at UVic. It's rewarding right now to be working on the future of power in B.C. There are real-world applications to what I've been studying and through my co-op term, I can see how what I'm working on will impact the lives of British Columbians."

Tessa Quinn was also a 2008 recipient of the BCTC Scholarships. BCTC established these scholarships to promote electrical energy systems within the Department of Electrical and Computer Engineering at UVic.

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