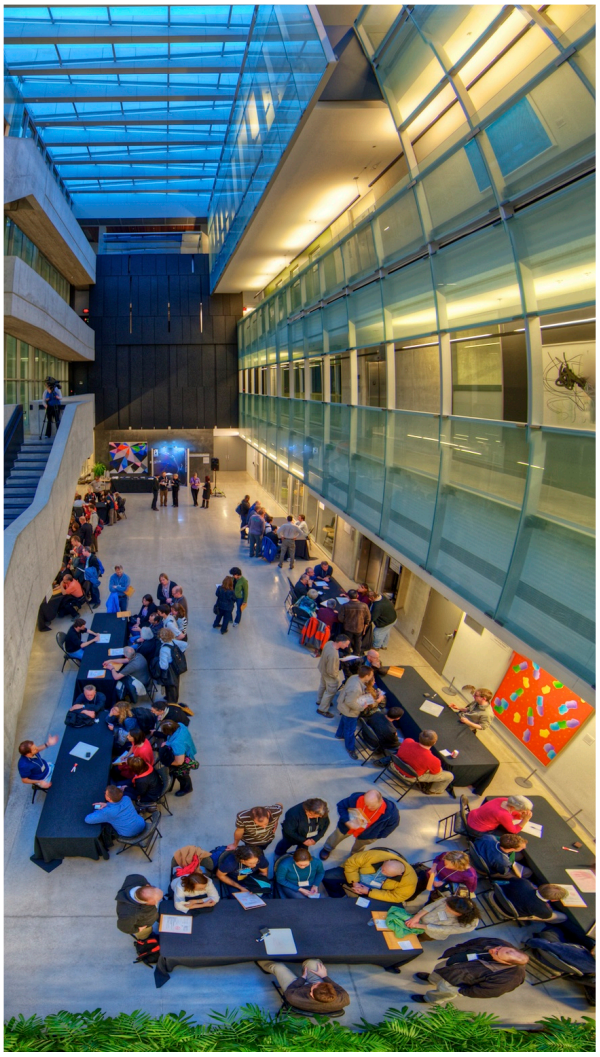


Spring 2014

OAPT Newsletter

Spring 2014

The OAPT was formed to advance the teaching of physics in the secondary schools, colleges, and universities of Ontario. For more information on the OAPT, visit our website at **www.oapt.ca**.

The OAPT newsletter is published four times a year. Back issues and submission guidelines can be found at **www.oapt.ca/newsletter/**.

Ontario Association of Physics Teachers

Register NOW and save up to $40

(Offer ends April 19)

In this issue we preview some of the sessions for this year's conference. While we did not have space here to preview all of the sessions, abstracts can be found on the website: **http://www.oapt.ca/conference/2014/program.html**. There is an amazing range of session topics, from subject knowledge (see Session 1: Negative Refraction, Super-Resolution Imaging and Invisibility with Metamaterials) to pedagogical knowledge (see Session 15: STEM Problem Solving) to the contextual importance of STEM (see Session 9: STEM, STSE and Relevance). All sessions promise to be, as has come to be the norm at our conference, participatory and activity-based.

We are pleased to have Bonnie Schmidt of Let's Talk Science to give a keynote address that will give us context for the sessions. Bonnie's special guest is actor, stunt coordinator, world champion martial artist and producer of the hit series *Lost Girl* Paul Rapovski. Paul is a savvy advocate for the innovative, entrepreneurial potential of STEM education.

Your full registration gets you wine & cheese and dinner on Thursday evening and lunch and snacks on Friday. We are once again offering a northern travel subsidy. And don't forget we have substantially reduced rates for new teachers! In the words of Dave Doucette, "Yagottaloveit!"

Speaking of Big Dave, he has the following instructions for accommodations at the conference:

OAPT 2014 Conference Accommodation Procedure

The Edward S. Rogers Sr. Department of Electrical and Computer Engineering at the University of Toronto has graciously offered to manage room reservations and payments through their Engineering Welcome Centre. Call their main reception at 416-978-3872 and mention OAPT conference rooms, or email them at **engineering@ecf.utoronto.ca**, subject line: **OAPT Room Booking**. Give those great folks at ECE a shout and take advantage of our crazy $19.99/night (with full breakfast) special offer.

- **http://www.oapt.ca/conference/2014/register.html**

Don't procrastinate! Register **now**!

Session 2: What Good is a STEM Education?

Friday, 10:15

Damian Pope

Secondary school students face great pressure and uncertainty. How can they best deal with this reality and prepare themselves optimally for the future? Some of the most important skills they can learn are general ones like critical thinking, communication, adaptability, perseverance and teamwork. These broad skills are applicable to any job. But where are the best places for students to acquire these skills? While there are many options, one good avenue is through science, technology, engineering and math (STEM) courses. Take physics as an example. All of the skills mentioned can be learned in a physics classroom through activities such as solving problems, doing labs and discussing content with fellow students. In fact, by some measures physics is one of the best subjects through which to acquire these skills. In this session we will explore the wider benefits of taking STEM courses beyond learning a set of technical skills. We will also discuss a range of global trends that are shaping our lives today and that will dramatically affect the lives of today's youth. Finally, we will consider the link between STEM subjects and the bold thinking and actions of entrepreneurs across all fields.

Session 3: Girls in Science

Friday, 10:15

Shohini Ghose, Dawn Britton and Chandra Boon

Shohini Ghose is the Director of the Centre for Women in Science at Wilfrid Laurier University. Dr. Ghose says, "Our mission is to create a strong and vibrant community for women in science, and our motto is 'Explore, Engage and Connect'." Ghose continues, "We want to support research and exploration of science by women, but also we want to explore… the issues that women face in science and how can we address them."

Dawn Britton is Associate Director for Engineering Outreach at the University of Toronto.

Chandra Boon is a physics teacher at Branksome Hall. Boon says, "There are two basic mindsets: the fixed mindset and the growth mindset. People with a fixed mindset often have a helpless response to challenge, and research has shown that bright girls are particularly prone to this response. I have incorporated teaching students to take a growth-minded approach to their physics learning as an integral part of my pedagogy. In interviews, students have told me that when they consciously use a growth mindset they understand the value of practice and they feel less anxious, even in the face of difficulty. I will share strategies I have developed through action research for teaching the growth mindset in physics, and I will show that the beliefs embodied in this mindset are compatible with how the brain learns."

Session 4: The ability of our students to think scientifically: probably not as great as we think

Friday, 10:15

David M. Harrison

Thinking about the world in a "scientific" way turns out to involve some ways of thinking that only develop with age and experience. Until a young person develops the capability to "think like that" the STEM disciplines are an occult set of magical spells. In this session we will explore what thought processes are necessary for thinking scientifically, and how to test for whether our students are capable of those ways of thinking. We will discuss some data on how students perform on the tests, and how this performance correlates with other measures of student learning. Finally, we will talk about what, if anything, we can do about the fact that the data show that many of our students cannot think scientifically. The work of developmental psychologist Jean Piaget will be a guide to the way we think about these issues, and the methods and materials of Physics Education Research will be part of the story.

Session 6: Outreach Opportunities from McMaster and Western

Friday, 11:15

Sara Cormier and Patrick Whippey

"What would happen if humans could travel at the speed of light?"

"What's next for the Standard Model now that the Higgs boson has been confirmed?"

"Why is time so different than the other three spatial dimensions?"

These are just some of the questions discussed in the Physics Inquiry Workshop, an outreach initiative offered by the Department of Physics & Astronomy at McMaster University. Sara Cormier will discuss this workshop along with a slew of other fun outreach events McMaster offers to high school students. Many of these allow off-campus participation, for example, the Physics@Mac Online Contest and the Physics@Mac Video Contest. Come and learn what each of these activities is all about and how your class can participate.

- **http://www.science.mcmaster.ca/outreach/outreach/physics-astronomy.html**

Patrick Whippey will give a brief overview of Smarter Science, an open-source framework for developing the skills of inquiry, creativity and innovation in a meaningful and engaging manner. As a culminating experience, students can present their work as a poster, present it to the class, and celebrate their success. Take it a small step further and present it at the Regional Science Fair. The skills students learn will be of enormous help in post–secondary learning. Patrick will describe the opportunities at the regional, national and international levels.

- **http://smarterscience.youthscience.ca**

In the London District Science Olympics 700 students compete in 23 events including Compound Boggle, Fermi Questions and Dante's Peek. One school this year is driving 850 km each way! Patrick will describe the program that generates the same enthusiasm as a Stanley Cup Final. Just ask Dave Doucette.

- **http://www.ldstf.ca/olympics/**

Session 10: Engineering Contests and STEM

Friday, 10:15

Roberta Tevlin

STEM is not primarily about content; it is more about developing skills such as critical thinking, collaboration, and creativity needed to solve real world problems. Engineering contests provide a great vehicle to motivate students while providing opportunities for them to use math and physics to solve concrete problems in a group setting.

I have been teaching a two-year Engineering Design Program for 15 years. The project-based courses — IDC 3O and IDC 4U — require only a principal's permission to run. Students build hovercrafts, hot air balloons, gliders, elastic-powered cars, robots, roller coasters, trebuchets and much more. I explicitly teach group dynamics, individual accountability and leadership skills. The courses are extremely popular with students, parents and the administration. The students enjoy competing and the opportunity to work with others and to build things. Many of them find their greatest academic success in these courses. The parents are amazed that their child talks enthusiastically about something school-related. The administration uses the contests to promote the school and its commitment to STEM education.

The contests are selected to maximize learning for the students and minimize cost and set-up time for the teacher. They can be inserted into courses ranging from grade 9 Science to Grade 12 Calculus and Vectors. In this session you will try out some of these contests. You will be provided with worksheets and helpful hints on my website under Engineering Contests

- **http://roberta.tevlin.ca/Engineering%20Contests/Engineering%20Contests.htm**

If you are interested in introducing the Engineering Design course at your school I am happy to provide continued support after the conference.

Session 12: Knowledge Building in Modern Physics: A 21st Century Approach

Friday, 1:30

Glenn Wagner

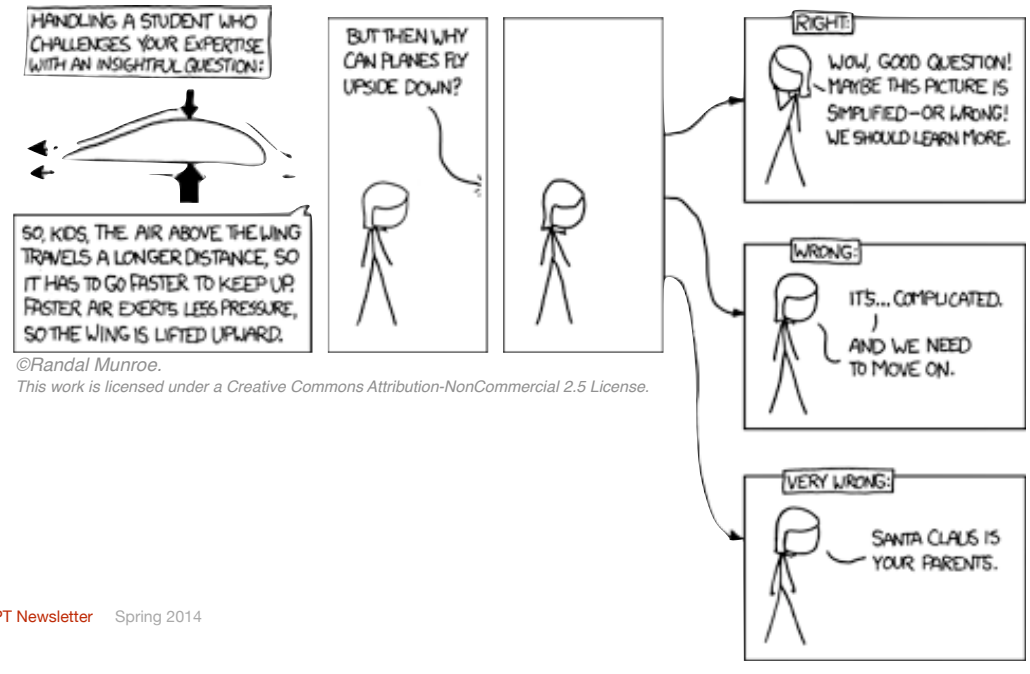
How do you grow a galaxy? Where did all the matter in the universe come from? How do we know how old the universe is? Student-generated questions like these ones can form the basis for inquiry in a knowledge-building environment where students assume the role of collaborative researchers in their own research institute. Students share ideas, post research, and ask further questions, all within an on-line database. As students build upon each other's work in the database, the growth and spread of knowledge becomes the property of the community, to be examined, modified and improved. The theory of knowledge building asserts that when students are given the opportunity to ask questions and work with ideas within a like-minded community deep learning can take place. This workshop will show how a knowledge-building community works in modern physics and how you can create one in your classroom. **Please bring an internet-ready device to maximize participation.**

Session 13: New Pedagogies for Teaching Physics

Friday, 1:30

John Caranci

Would you present a problem to a class that you cannot solve yourself? How many times have you worked through a lesson that you thought was perfect, but then three people in the class begin to nod off? Engaging the class so that every single person is focused on the problem at hand is what we're going to deal with. "Those who do the work do the learning." (That's an original Caranci quote, by the way, but you can use it if you like!) If you're at the board doing a lecture or a Socratic interaction you are doing the work therefore…



Session 21: Perimeter Institute's New Cosmology Resource

Friday, 3:15

Damian Pope and Kevin Donkers

Last year a team of cosmologists working with data from the Planck satellite released an image that was the culmination of a decade of planning, observation and hard work. The image was of the cosmic microwave background (CMB) radiation, the faint afterglow of the Big Bang that continually bathes Earth from all directions. It was significantly more accurate than any previous observation and showed a number of fine-grained details beyond the resolution of earlier telescopes. The release of this image led to a flurry of scientific activity and to improved calculations of the proportions of the three fundamental constituents of the universe: ordinary matter, dark matter and dark energy. It also deepened scientists' understanding of the universe's evolution. While the CMB is an exciting topic it is also very complicated. How can high school students learn about it in any significant detail? More generally, what could we teach students about all aspects of cosmology? In this session we will discuss a forthcoming resource by Perimeter Institute that includes an activity explaining the CMB and its structure using content taught in the Waves & Sound unit of the Grade 11 physics course. In a similarly high-school-friendly fashion the resource deals with cosmological topics like the Big Bang theory, the expanding universe, black holes and nucleosynthesis.

Session 25: Teaching Physics by Coding

Saturday, 9:00

Richard Taylor

The survival of Physics teaching is at stake! Dish out revenge on the Bad Piggies (and Birds) who stole the Physics students' attention! Use the unique constructive powers of software coding to lay waste to the pigs' defences! Richard's website, "Physics by Simulation," features hours of game development, challenging physics-based coding, and lots of replay value. Use logic, skill, and brute force to crush the enemy!

Get ready for as many levels as you can handle: when you've finished one level code another! The Java-based language, dubbed "Processing," makes it easy for students to get things moving on the screen. They can introduce gravity, friction, springs, electrostatic forces and magnetism. For added fun, apply the Lorentz transformations at higher speeds.

Richard Taylor will describe his students' experiences learning Physics by coding simulations. You, too, can learn how to make this happen.

Session 27: Particles Smarticles

Saturday, 10:45

James Ball and Sara Naudts

A Higgs boson walks into a cathedral. The priest says, 'What are you doing in here?' The Higgs boson replies, 'You can't have mass without me!'

The Higgs boson (really the Higgs field) is at the heart of what we call mass. According to the Standard Model it is the interaction between the Higgs field and any elementary particle that gives that particle its mass. Without the Higgs field all fundamental particles would be massless! It turns out that most of your mass (i.e., all the protons and neutrons that form your body) comes from E = mc2. If you find the mass of all quarks that make up your protons and neutrons it will only account for 1.2 % of your mass! We need to stop thinking about mass as how much matter an object is made of and start thinking of it as a property, much like electrical charge.

In this workshop we will examine and discuss the results from the CERN experiments and show how to model the collisions that resulted in the creation of the Higgs boson using student role play. In addition, we will examine data from the Tevatron collider to demonstrate conservation of energy and momentum in two-dimensional collisions. Participants will use simple objects to model the Higgs interaction and get a "feel" (pun intended) for the Higgs field interactions. Time permitting, participants will use an online simulation that helps students understand the importance of statistics in the announcement of the Higgs discovery.

Session 29: Redefining Science in a School

Saturday, 10:45

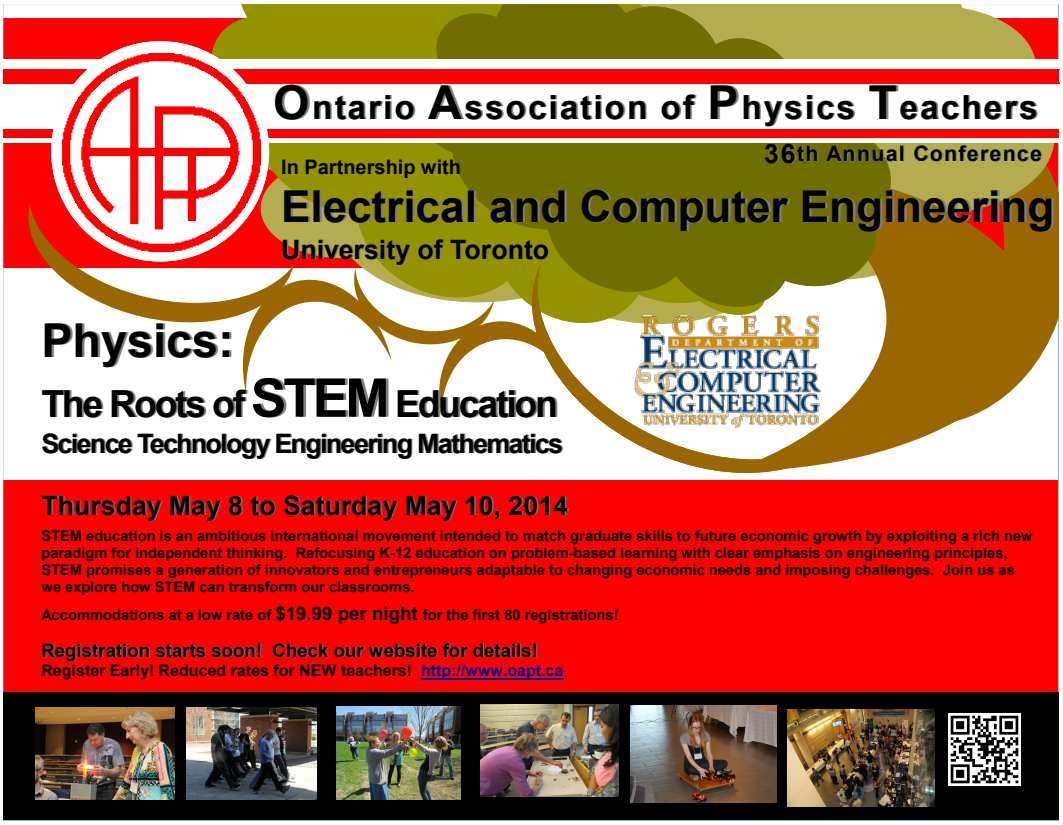
Lisa Lim-Cole and Margaret Scora

Science is…?? We often begin intermediate science courses by asking our students to define what science is. As science educators why not ask ourselves, "What is science education?" With the support of the Durham District School Board, the Ministry of Education and the Ontario Teachers' Federation, Lisa Lim-Cole (physics), Angela Davis (chemistry), and Stephanie Hale (biology) at Uxbridge Secondary School were able to explore questions about their own teaching practices and how they impact student learning. They evaluated methods of inquiry learning, cooperative group problem solving, and the development of 21st century skills such as collaboration, organization, leadership, and time management. On this journey they encountered obstacles that forced them to reflect on their own practice. The project is ongoing. Through professional development, departmental meetings, co-planning and co-teaching they have been working on "redefining science" for both the science teachers and the students at their school. In this session Lisa will share their journey. She and Margaret will provide opportunities to explore some of the activities that were developed. Let's think about science! Let's play!

2014 OAPT Conference Theme:

STEM Education

(Science – Technology – Engineering – Mathematics)



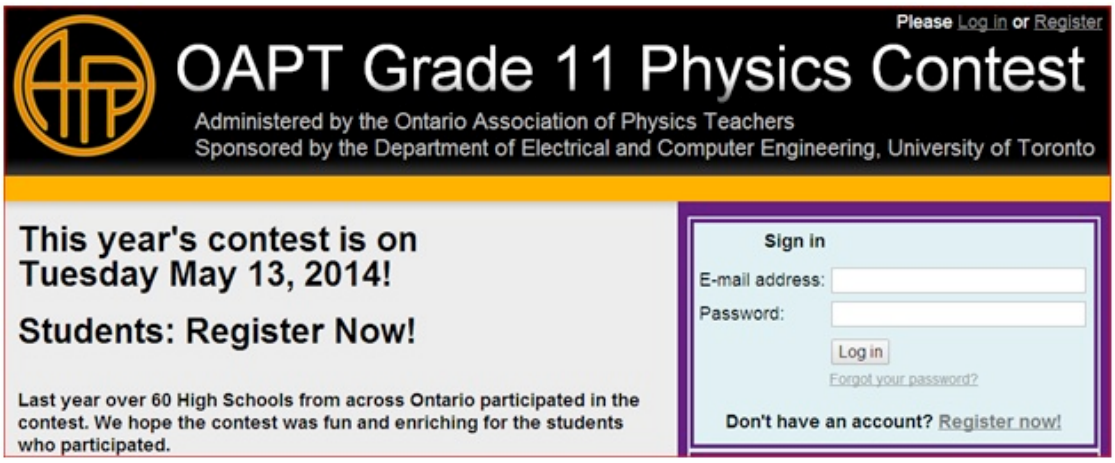
Registration starts Feb. 1

Register Early!
Accommodation only $19.99/night for the first 80 registrants!

Reduced rates for NEW teachers!

http://www.oapt.ca/conference/2014/register.html

OAPT Grade 11 Physics Contest



The OAPT Grade 11 Physics Contest is for students taking SPH3U this year who are looking for a challenge. It is also a great way for students to review for their final exam.

To reduce administrative overhead take advantage of the browser-based version of the contest at **http://oapt.ece.utoronto.ca/**. A paper-based version of the contest is also available. Students can write the contest at any time during the day of Tuesday, May 13th.

The contest is completely **free of charge**, thanks to our sponsors:

- The Edward S. Rogers Sr. Department of Electrical and Computer Engineering at the University of Toronto
- York University
- The Perimeter Institute

Visit the **contest website** for archived contests, with solutions.

For more information about the contest visit the OAPT site:
http://oapt.ca/grade_11_contest/index.html