

# PHYSICS & ASTRONOMY

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Welcome to the second issue of **UBC Physics & Astronomy Outreach Program News**! As we approach the end of 2008, we would like to celebrate with a Free Public Event! The **UBC 5th Annual Faraday Show** is for anyone who is excited about scientific discoveries (and fun!). Also in this issue are several **free physics education resources and opportunities** for teachers and students. Want to bring "sustainable energy" into your classroom? Read about "**Wind Power**" in this issue. We will also give an update on **Physics Olympiad 2008** in a report in this issue.

If you would like to continue receiving this newsletter in the future through email, please sign up at <http://www.phas.ubc.ca/outreach/web/emailList.php>. For more information, or to download the most recent version of this newsletter, please visit our website: <http://www.phas.ubc.ca/outreach>.

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## Free Public Event!

### December 7th, 2008 - UBC 5th Annual Faraday Show

#### "Planes, Trains, Automobiles and Rockets: Physics of Transportation"

In 1826, physicist Michael Faraday founded the Children's Christmas Lectures at London's Royal Institution. His goal was to communicate to children the excitement of scientific discovery. In keeping with the spirit of those lectures, faculty members of the Department of Physics and Astronomy at UBC will present a physics demonstration and lecture show for **children - between the ages of 5 and 120 years!**

Our theme for this year is **Planes, Trains, Automobiles and Rockets: Physics of Transportation**. Together we will **learn the science of rockets, explore the physics of flying, and talk about the transfer of energy in transportation**. There will also be a demo of our **magnetic levitating train!!!**

**WHEN: 2 - 3:30pm on Sunday December 7, 2008**

**COST: FREE!** Bring your Family and Friends! Seating is limited so come early!

**WHERE:** UBC Hebb Theatre - 2045 East Mall at the UBC campus

To download/print a map, visit <http://www.maps.ubc.ca>

For parking information please visit <http://www.parking.ubc.ca/visitor.html>

For more information, visit <http://www.physics.ubc.ca/outreach/web/faraday/faraday.php>,

or contact us at [outreach@phas.ubc.ca](mailto:outreach@phas.ubc.ca)



**Sign up for this newsletter: [www.phas.ubc.ca/outreach](http://www.phas.ubc.ca/outreach)**

# Academic Programs

## Engineering Physics at UBC

*...Turn Ideas into Reality...*



Engineering Physics at UBC is a **challenging interdisciplinary degree** designed to train those who wish to work at the **leading edge of scientific and technological innovation**. By applying the fundamentals of physics with the practicality of engineering, our students are given the skills to become tomorrow's inventors, technology leaders, discoverers of new science, and developers of new medical techniques.

The Engineering Physics program combines an **Honours Physics degree with an Engineering degree in Electrical, Mechanical, Computer, or Mechatronic options**.

For more information, please visit: [www.engphys.ubc.ca](http://www.engphys.ubc.ca)

Or, contact the UBC Engineering Physics Program

Tel: 604-822-6451; Fax: 604-822-5324

Email: [andre@physics.ubc.ca](mailto:andre@physics.ubc.ca) (Director Andre Marziali)

# Physics Education Resource

## Physics Education Technology Project (PhET)

*Free Teaching & Learning Resource for Physics Teachers and Students*

Carl Wieman, who joined the UBC physics department last year, developed the Physics Education Technology project (PhET). This is an ongoing effort to advance science education by producing high-quality interactive simulations and teaching materials and by making them available for FREE online. ([phet.colorado.edu](http://phet.colorado.edu)). These 80+ simulations can be run through a regular web browser.

Simulations like [Energy Skate Park](#), [Circuit Construction Kit](#), and [Magnets and Electromagnets](#) create animated, interactive, game-like environments in which students learn through exploration. They emphasize the connections between real life phenomena and the underlying science, make the invisible visible (e.g. electrons, photons, field vectors), and include the mental, visual models that experts use to aid their thinking – design features which help students build their own understanding and skills. Using [research studies](#) the PhET team of scientists, software engineers, and science educators optimize the simulations for student engagement and educational effectiveness. These simulations can be run online or downloaded so students and teachers can run local copies that are installed on their personal or school computers. The website also includes an extensive set of activities that teachers have developed for using the PhET simulations to teach a variety of physics and other science topics at different grade levels.



The PhET website has won a number of awards. A 5 minute interview with the co-director of the project describing the site and showing some of the simulations in action can be seen at [http://taste.merlot.org/Videos/Phet\\_Flash8.html](http://taste.merlot.org/Videos/Phet_Flash8.html).

# Physics Outreach Opportunity



**TRIUMF**

Canada's National Laboratory for Particle & Nuclear Physics  
4004 Wesbrook Mall, Vancouver, BC V6T 2A3

## Outreach & Education Programs Fall 2008



**BC Teachers are invited to a professional enrichment opportunity not to be missed!**

### Teacher Internship Program

- Stay 3-7 days at TRIUMF assisting a live experiment
- Paid travel plus meal costs from our travel grant
- Subsidized room at nearby TRIUMF House
- NEW: substitute teacher subsidy for locals
- Contact: [outreach@triumf.ca](mailto:outreach@triumf.ca) for details

## Saturday Morning Physics Lectures

TRIUMF and the UBC Dept. of Physics and Astronomy present a series of public lectures on current issues in physics and astronomy. The lectures are aimed at the level of high school students. Free parking available. Refreshments served.

<http://www.triumf.info/public/students/lectures.php>



## Physics in Action

TRIUMF is releasing a new educational DVD this season which will use the cutting-edge science and the world's largest cyclotron to teach basic concepts in physics. Pre-order your copy today!

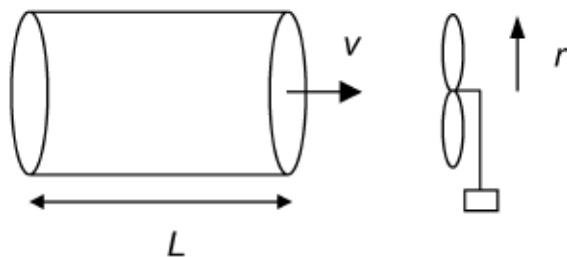
<http://www.triumf.info/public/students/videos/>

# Physics in Your Classroom

## Quick Physics: Wind Power - Chris Waltham

About 2% of the solar energy absorbed by the earth goes into moving air around. This we call wind, and the kinetic energy resident in the moving air can be captured and turned into electrical energy by means of a wind turbine that turns a generator. Here we consider the broad energetics of wind turbines, which are quite accessible to a high school or first-year university physics class.

Consider the propellor blades of a wind turbine that each have length  $r$  and sweep out an area  $A = \pi r^2$ . Now let a cylinder of air, radius  $r$ , and length  $L$ , approach the turbine head-on at speed  $v$ .



The mass of the cylinder of air is given by  $m = \rho AL$ , where  $\rho$  is the density of air, about  $1.2 \text{ kg/m}^3$ . The kinetic energy of the cylinder,  $E$ , is:

$$E = \frac{1}{2}mv^2 = \frac{1}{2}\rho ALv^2$$

The time  $\Delta t$  taken for this cylinder to pass through the turbine blades is just  $L/v$ . Therefore the power  $P_{in}$  incident on the turbine is:

$$P_{in} = \frac{E}{\Delta t} = \frac{1}{2}\rho ALv^2 \cdot \frac{v}{L} = \frac{1}{2}\rho Av^3$$

This is continuous if the air continues to flow. Clearly the turbine cannot extract all this power out of the wind, or the air would have to stop dead after passing the blades. The maximum fraction that can be extracted is known as the Betz limit<sup>1</sup>, which is about 60%. Losses in the generator and transmission lines further reduce the available power.

The  $v^3$  term emphasizes the need for high, continuous wind. Germany, Spain and the USA each have about 20GW of installed wind power capacity (10x Canada's wind capacity). Have your class design a set of turbines of reasonable size that could produce 1GW of electrical power under common wind conditions at a site they can choose in BC<sup>2</sup> or Alberta<sup>3</sup>.

For more on making physics teaching relevant to major issues of the 21<sup>st</sup> century, see <http://www.phas.ubc.ca/outreach/c21/>

*Chris Waltham* is a professor in the Department of Physics and Astronomy at UBC. His teaching interests include the physics of energy and climate issues.

1. <http://www.windpower.org/en/stat/betzpro.htm>
2. <http://www.geog.ubc.ca/courses/geog376/students/class05/cskwan/intro.html>
3. [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/sag6451?opendocument](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sag6451?opendocument)



# Physics Olympiad Report 2008

## International Physics Olympiad – Andrzej Kotlicki, Natalia Krasnopolskaia

The 38<sup>th</sup> International Physics Olympiad (IPhO) was held in **Hanoi, Vietnam** from 20<sup>th</sup> to 19<sup>th</sup> of July, 2008. A total of 82 countries participated in the competition this year. Chile participated for the first time and Syria sent an observer, planning to participate next year. The team from Puerto Rico participated unofficially as it does not represent an independent country.

Similarly to the competitions in Korea, Indonesia and Singapore the Olympiad was quite clearly an event of primary importance to the Vietnamese government and educational authorities. The president of Vietnam, his Excellency Mr. Nguyen Phu Trong, and the Deputy Prime Minister Prof Nguyen Thien Nhan participated in the opening ceremony and stressed in their opening addresses the paramount importance of science, technology and education for the development of Vietnam.

A Nobel Prize Laureate Prof. Jerome Friedman participated in the Olympiad activities, gave lecture to the participants and socialized with them.

The social program was very entertaining and interesting with visits to monuments, temples and historical sites, an excursion to the spectacular Halong Bay and continues “flow” of excellent Vietnamese food.

The academic part of the competition was organized by the faculty members from the Hanoi National University of Education and Institute of Physics and Electronics, Vietnamese Academy of Science and Technology

The problems were very interesting and well prepared. One of the theoretical problems involved a modeling of the ancient water-powered rice-pounding mortar. The other one involved modeling the air flow in the atmosphere and air pollution. In the experimental problem students had to measure the efficiency of a solar cell. So 3 out of 4 problems (the third theoretical problem was about Cherenkov radiation) had something to do with “a green life style”

Marking by the academic committee was very thorough and fair and in most cases agreed closely with the marking of the leaders. The marking moderations (the process of establishing the final mark acceptable by both leaders and the local marking team) were performed in a good collegial atmosphere with very few real controversies.

Canada was represented by the following students:

Bo Cheng Cui (Bob) from BC  
Jingyuan Zhang (Lynda) from Alberta  
Jixuan Wang from Ontario  
Keith Kaichung Ng from Ontario  
Junjiajia Long (Bill) from Ontario

The team leaders were: Dr Andrzej Kotlicki from the Department of Physics and Astronomy, University of British Columbia and Dr Natalia Krasnopolskaia from the Department of Physics, University of Toronto.

The following 82 countries were present at the 39<sup>th</sup> International Olympiad:

*Albania, Argentina, Armenia, Australia, Austria, Azerbaijan, Belarus, Belgium, Bosnia & Herzegovina, Brazil, Brunei, Bulgaria, Cambodia, Canada, Chile (\*), China, Colombia, Croatia, Cuba, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Great Britain, Greece, Hong Kong, Hungary, Iceland, India, Indonesia, Iran, Ireland, Israel, Italy, Japan, Kazakhstan, Kuwait, Kyrgyzstan, Latvia, Liechtenstein, Lithuania, Macau, Macedonia, Malaysia, Mexico, Moldova, Mongolia, Nepal, The Netherlands, Nigeria, Norway, Pakistan, The Philippines, Poland, Portugal, Puerto Rico (\*\*), Romania, Russia, Saudi Arabia, Serbia, Singapore, Slovakia, Slovenia, South Korea, Spain, Sri Lanka, Suriname, Sweden, Switzerland, Syria (\*), Taiwan (Chinese Taipei), Tajikistan, Thailand, Turkey, Turkmenistan, Ukraine, USA, Vietnam.*

(\*) - new countries invited by the Organizing Committee to the Olympiad this year,

(\*\*) - invited by the Organizing Committee as a guest team.

# Physics Olympiad Report 2008 (con't)

The best score (44.6 points) was achieved by **Longzhi Tan** from **China** (Absolute winner of the 39<sup>th</sup> IPhO). The following limits for awarding the medals and the honorable mentions were established according to the Statutes: Gold Medal - 33 points (out of 50, Silver Medal - 26 points, Bronze Medal - 21 points and Honourable Mention - 14 points. According to the limits, 46 Gold Medals, 47 Silver Medals, 78 Bronze Medals and 87 Honorable Mentions were awarded. The list of the scores of the winners and the students awarded with honorable mentions were distributed among all the delegations.

In addition to the regular prizes, the following special prizes were awarded:

for the best score (Absolute winner): Longzhi Tan (China); for the best score in the theoretical part of the competition: Longzhi Tan (China); for the best score in the experimental part of the competition; Yi-Shu Wei (Taiwan); for the best score among female participants: Andrada Ianus (Romania); Gorzkowski Prize (for the best participant among the countries that joined IPhO first in 2008): Efraín Alfonso Pérez Argandoña (Chile); for the best Vietnamese competitor: Huynh Minh Toan

The Canadian team performed very well, winning one gold medal (Junjiajia Long) who was 6<sup>th</sup> in the world, two silver medals (Jingyuan Zhang and Bo Cheng Cui) and two bronze medals (Keith Kaichung Ng and Jixuan Wang). It was for the first time in the Canadian participation in the IPhO that all the Canadian team members got medals.

At the meeting of the International Board the presidential election was carried out according to a secret ballot. Dr. Hans Jordens (The Netherlands) was elected a new president.

At the end of the Olympiad, acting on behalf of the organizers of the next International Physics Olympiad, Dr. **José Luis Morán López**, announced that the 40<sup>th</sup> International Physics Olympiad will be organized in Mérida, Mexico on July 11<sup>th</sup> – 19<sup>th</sup> 2009 and cordially invited all the participating countries to attend the competition.