

# REPORT ON CANADA'S PARTICIPATION IN THE 43RD INTERNATIONAL PHYSICS OLYMPIAD, TALLINN, ESTONIA

BY JEAN-FRANÇOIS CARON AND ANDRZEJ KOTLICKI



The 43rd International Physics Olympiad (IPhO) was held from 15 to 24 July in Tallinn and Tartu, Estonia. A total of 378 students from 80 countries took part in the competition, with 45 receiving gold medals, 71 receiving silver medals and 92 receiving bronze medals. A further 63 students completed the Olympiad with honorary mentions. For the first time in the history of the Olympiad the International Committee and most of the organizers were staying in Tallinn and were separated by 200 km from the students who were in the old Estonian University Town Tartu.

The members of the Canadian team this year (Figure 1) were: Tristan Downing from Semiahmoo High School (BC), Sepher Ebadi from Langstaff Secondary School (ON), Yun Jia (Melody) Guan from University of Toronto Schools (ON), Henry Wu from University of Toronto Schools (ON), and Simon Blouin from Collège Bois-de-Boulogne (QC). The leaders were Dr Andrzej Kotlicki (UBC) and Jean-Francois Caron (UBC)

Again for the first time the Estonian Olympiad was preceded by an on line theoretical problem competition open on line for all students. Interestingly the winner of this competition was also an absolute winner of the Olympiad. The organization of the Olympiad was very good with some new features like leaders submitting the translated problems on line (problems are prepared and discussed in English and the team leaders translate then for their teams in their native languages) rather than printing them and submitting all the marks on line. Some of these were the result of the separation of students and leaders.

Jean-François Caron is a PhD student in particle physics at the University of British Columbia

Dr. Andrzej Kotlicki <kotlicki@phas.ubc.ca> is from the Department of Physics and Astronomy at the University of British Columbia

## SUMMARY

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Fig. 1 Members of the Canadian team.

The problems comprising the competition challenged the students' knowledge of physics at a level exceeding most introductory physics courses in universities. As usual, there were three theoretical problems, while the experimental part of the competition consisted of two separate experiments. These were the most difficult problems in the history of the Olympiad. They were very well prepared and most challenging. The absolute winner of the Olympiad got 46 point out of 50 and one needed only 24 points for silver medal and 17 for bronze!

The first theoretical problem consisted of three independent parts. Part one was an optimization of a ball trajectory to reach a top of a spherical building, the second part was a flow around a wing problem and in the third part student were expected to find a magnetic field around the superconducting tubes with the trapped flux and the interaction between two tubes like it. The interaction is equivalent to the interaction of four magnetic monopoles and it seems that finding this equivalence far exceeds what one can expect from a best high school student.

The second theoretical problem was about the Kelvin water dropper – an electrostatic voltage generator.

The third theoretical problem asked the students for number of (mainly thermodynamical) calculations modeling a Protostar formation.



Fig. 2 Our team did well in the competition: Henry Wu got a silver medal and all the other team members received bronze medals.

In the first experimental problem students were expected to measure the magnetic permeability of water. It was a beautifully designed experiment, which allowed to obtain the value  $\mu_{-1} = -7.8 \times 10^{-6}$  to within 30%.

The second experimental problem was an electrical black box problem with the tunnel diode inside a “black box.”

As indicated by the IPhO Statutes, a moderation of the grading was held where the local markers and the delegation leaders discussed the students’ scores to ensure fairness and consistency in the marking. The moderation went very smoothly, with disagreements resolved in a friendly and speedy manner.

Our team did well in the competition: Henry Wu got a silver medal and all the other team members received bronze medals.

When the students were not busy solving problems, they experienced the rich social and scientific program. They visited Tartu Adventure Park and were able to try various obstacle courses and Zip Line rides, visited the Rakvere medieval Castle, listened to the lecture by Sir Harold Kroto (the 1996 Nobel Prize in Chemistry), participated in a soccer tournament... Direct interaction with students from all over the world, sharing the passion for physics and science is probably the most valuable experience for the students.

Next year, the IPhO will be held in Copenhagen, Denmark from 7<sup>th</sup> to 15<sup>th</sup> of July 2013. The chair of the organizing committee, Dr. Niels Hartling, invited all countries present to participate in next year’s competition.