

# Report on Canada's participation in the 50<sup>th</sup> International Physics Olympiad in Tel Aviv, Israel

## Andrzej Kotlicki and Lior Silberman

The 50th International Physics Olympiad (IPhO) took place July 7<sup>th</sup> to 15<sup>th</sup>, 2019 in Tel Aviv, Israel. Again due to lack of funding we were unable to organize a Canadian Olympiad Finals. Instead, the five students scoring the highest in the Canadian Association of Physicists (CAP) High School exam were invited to represent Canada in the IPhO. This year the CAP exam attracted 762 students from 161 schools.

The generosity of our sponsors, the Trottier Family Foundation, the Toronto Olympiad School and the UBC Physics and Astronomy Department allowed us to organize the 4-day training camp for the team in Vancouver (this should be compared to training times of 6 weeks up to 2 years in other countries) and pay the team's participation fees and travel expenses.

The members of the Canadian team this year were:

Zhening Li (Sir John A. Macdonald Secondary School, Waterloo ON), student of David Vrolyk

Yuheng (Jack) Xu (Unionville High School, Markham ON), student of Elaine Howard

Roger Li (Marc Garneau Collegiate Institute, Toronto ON), student of Henri Van Bommel

Eric Shen (University of Toronto Schools, Toronto ON), student of Marisca Vanderkamp

Isaac Liao (Earl Haig Secondary School, Toronto ON), student of Adam Morin

Team leaders were Dr. Andrzej Kotlicki (UBC), Director for the Canadian Physics Olympiad Program, and Dr. Lior Silberman, associate professor of mathematics at UBC and past IPhO contestant (1994 Israeli team). Additionally Dr. Yadong Jiang from the Olympiads school in Toronto participated as an observer.

This year's IPhO was hosted by the Ministry of Education of Israel and Tel Aviv University.

This was the best academically prepared and organized IPhO in my (AK) memory. This success is, in large part, due to the leadership and input of Dr. Eli Raz, long time Israeli leader, who was not only chaired the organizing committee but also contributed two theoretical and one experimental problem and participated in preparation of all five problems. The IPhO International Board (consisting of all the team leaders) gave him a standing ovation at the end of the last meeting and the Israeli Government awarded him a special certificate of appreciation.

The opening ceremony took place at the main auditorium of Tel Aviv University. There were the usual (but unusually short and few) speeches by the organizers and the President of IPhO,

interspersed by great music and dance performances by various high school aged, but very professional, dance troops and bands. The teams paraded across the stage, while the images of their countries were flashing on the big screen.

Seventy-eight countries participated this year (nine less than last year), with Kosovo as the only new country.

All the problems (three theoretical, two experimental) were very well prepared and thus accepted by the International Board (the team leaders) with very minor corrections. All of them included parts requiring creative thinking, going beyond knowledge and technical problem-solving abilities. The first problem concerned kinematical analysis of a falling Slinky. Students were shown a drawing of consecutive phases of the fall of an initially stretched spring and had to calculate the time of collapse and the generated heat, among other quantities.

The second problem required students to estimate different operating parameters of a typical microwave oven's klystron and to describe quantitatively the process of microwave absorption in pure water and in salt water.

The third problem required calculating the efficiency and other parameters of thermo-acoustic engine.

The first experimental problem asked students to measure the refractive indices of the materials of a disc and a prism as well as the spacing of a diffraction grating. However, the contestants had to discover methods which are more accurate than the most obvious ones.

The second problem called for accurate measurements of the conductivity and thermal conductivity of three metals. The electrical conductivity was determined by measuring the time of fall of magnets in tubes made of these metals. The thermal conductivity was determined by measuring the temperature gradient along a rod heated at one end, with the other end kept in contact with a cold reservoir. The students had to take into account the corrections due to heat losses along the rod and the fact that the heat flow along the rod is not exactly in its steady state. Finally the students were expected to use the measured conductivities to calculate the constant in the Wiedemann-Franz Law (the "Lorenz number").

When additional information needed to solve the problems was not covered by the syllabus of the IPhO, it was very well presented and clearly explained.

The problems were difficult, with a best overall score of 87% and only 41 students out of 364 scoring more than 50%! 251 students were awarded medals or honorary mentions.

Our students did very well considering their very limited preparation:

Zhening Li, Isaac Liao and Jack Xu received Silver medals, Roger Li received Bronze and Eric Shen received the certificate of participation.

After each exam the students had a chance to meet with the leaders at dinner (Fig. 1), which allowed us to learn quickly about their progress and excitement.



Fig. 1. Our students having dinner in Jerusalem following the theoretical exam. From the left: Roger Li, Eric Shen, Isaac Liao, Zhening Li and Yuheng (Jack) Xu.

The organization of the whole event was perfect. For the first time in the history of the Olympiad, copies of the students' papers were delivered to the leaders on time. There was a lot of time (35 minutes per team per problem) for moderation – more than ever.

There was a great cultural and social program. Students had a chance to visit Jerusalem with its historical and holy places of three major religions, enjoyed Bedouin hospitality in Kfar Ha'Nokdim, checked their buoyancy in the Dead Sea, visited Old Acre, Haifa, and the Golan Heights, and rafted on the Jordan river. They even had a safe cracking competition won by British team. Leaders and observers also had a chance to visit some of the places mentioned but we missed the Dead Sea. The closing ceremony was held in the Charles Bronfman Auditorium (Concert Hall) in Tel Aviv with amazing music and dance performances and some (again short) speeches. Medals, honorary mentions and special prizes were awarded to the students (Fig. 2).



Fig. 2. Our team after the closing ceremony. From left: Dr. Yadong Jiang, Isaac Liao, Dr. Lior Silberman, Zhening Li, Yuheng (Jack) Xu, Eric Shen, Roger Li and Dr. Andrzej Kotlicki.

The Lithuanian Minister of Education announced that the 51<sup>st</sup> IPhO will be hosted in Vilnius, Lithuania from July 18<sup>th</sup> to July 26<sup>th</sup>, 2020.

The closing ceremony was followed by the farewell party with some teams' talent shows and a lot of dancing.