The Leo Szilárd Physics Competition in Hungary

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Abstract. The Leo Szilárd Physics Competitions are being organized annually since 20 years. The competition originally was proposed and organized by George Marx, former president of GIREP, on the occasion of the Leo Szilárd centenary celebrations in Hungary in 1998. The topics of the competition include mainly atom- and molecule physics, nuclear physics and radiation protection etc., which are taught in secondary schools in Hungary. Besides the usual theoretical problem-solving the students have to do real hands-on experiments, and perform "complex" experiments using computer simulation software. Some selected examples will be presented.

1 Introduction and history

In 1998 Hungary was celebrating the 100th anniversary of the birth of the famous physicist of Hungarian origin, Leo Szilárd [1]. The main organizer of this centenary celebration was Prof. George Marx, who was also the president of GIREP earlier. Besides several scientific and political commemorating events he also suggested and organized a nationwide physics competition for Hungarian secondary school students in order to draw the attention of the physics teachers and that of their students on the important work and achievements of Leo Szilárd.

Originally the competition was thought to be a one and only event. However, the participants (teachers and students) were so enthusiastic that they strongly demanded the continuation also in the following years. That is why the competition is being organized annually since 1998. The leader of the Program Committee was Prof. George Marx until his death in 2002.

The topics of the competition are limited to the modern physics: atom- and molecule-physics, nuclear physics and radiation protection, history of modern physics etc.

2 The structure of the Leo Szilárd Competition

There are two categories of the participants: the 17-18 year old students form the first category, and the younger ones form the "Junior" category. There is no lower age-limit, but usually pupils below 14 don't have any chance to achieve good results. The competition consists of two rounds. The first round is organized in the schools, where the students have to work on 10 theoretical problems during 3 hours. Their work will be corrected by their teachers, and if they reach 60% (for the first category) or 40% (for the Junior category) then their work will be sent for "reevaluation" to the Program Committee. After reevaluating the works the Program Committee selects the best 20 students (for the first category) and 10 students (for the Juniors), who will be invited in the Final Round.

The two-and-half-day long Final Round is traditionally organized in a school in Paks, where Hungary has its only nuclear power plant.

In the first part of the Final Round the students have to solve again 10 theoretical problems in 3 hours. In the second half they should perform real hands-on experiments in 1,5 hours, and investigate the operation of some complex device using computer simulation software in another 1,5 hours.

Before starting the contest part the students and their teachers attend a visit at the Paks NPP.

3 Selected examples

3.1 A few selected theoretical problems to solve

Problem
How would our world look, if the mass of the neutrons was 1% less than it is now? (Assume that the masses of all other particles remain unchanged.)

Problem
Estimate the number of carbon atoms in an unsaturated carbon chain molecule, whose aqueous solution seems to be green in translucent light? (The distance between two carbon atoms in the unsaturated chain is 0.133 nm.)

Problem
A remote spaceship approaches the Earth at speed v/c=0.9999. The "space police station" on the Earth measures the speed of the spaceship using a laser device. What will be the energy of the reflected photons from the spaceship, if the laser emits ultraviolet photons with 3 eV energy? (Assume that the spaceship has such a big mass that the laser beam does not influence its speed!)

3.2 Few selected real experiments to perform

- Measuring the radioactivity of radon's daughter elements from the air (2015)
- Investigating the light emission of a fluorescent paint, determining the time dependence of the emitted light with Arduino (2017)

3.3 Few selected tasks using computer simulation software

- Operation of a cyclotron, preparing a proton beam of prescribed energy (2001)
- Construction and investigation of a reactor active core (2005)
- Operation of a research reactor (2015)

4 Conclusion

Students of the modern generations are more motivated about learning modern subjects than about learning classical physics. However, the knowledge of classical physics is necessary to solve problems in modern physics too. By challenging them with modern physics problems they learn the necessary classical physics laws and methods almost unnoticed. The competition about modern physics is an excellent way to discover and motivate the most talented students.

Acknowledgements

The valuable help of many colleagues in the organization is acknowledged.

References

[1] Gene Dannen, *Leo Szilard Centenary Budapest* http://www.dannen.com/98buda-2.html