INTERNATIONAL PARTICLE PHYSICS OUTREACH GROUP

Particles4U

EPS Activity Project Showcasing Particle Physics in Everyday Lives

The Project

The International Particle Physics Outreach Group (IPPOG) [1] held a competition this past fall, challenging young students, teachers and classrooms to develop projects describing to the public the relevance of particle physics in everyday life. The competition was based on a proposal selected by the EPS Council in 2017, as part of its campaign seeking new projects focusing on “scientific excellence, education, communication and outreach, publication, diversity, etc.” IPPOG was awarded 3000 EUR for implementation of the project, which we call Particles4U.

The primary goal of Particles4U is to inspire primary and secondary students to develop an understanding of the field of particle physics, with an emphasis on comprehending its connection to our everyday world. Students were encouraged to work with their teachers and their classmates to develop the project, but were given a very wide latitude on the exact

implementation. This opened up the competition to a socially and culturally diverse audience that included future artists, musicians, and poets, as well as scientists and engineers.

Implementation

The project was officially launched on 21 November 2017 through announcements on the official IPPOG Facebook [2] and Twitter [3] sites. IPPOG is a global network of scientists, researchers, science educators, and communication specialists, and the IPPOG members used their local networks to forward the invitation to teachers and education departments in their own countries. There are 27 countries, spanning 5 continents, who are official IPPOG members, as well as several others on the path to membership, so the global reach of the announcement was significant.

The project web site [4] and the application forms were translated into 18 different languages, with the IPPOG members offering their assistance to respond to questions in the local language. Applicants were asked to specify their age group as either primary (age 12 and under) or secondary (age 13 and up), name and describe their projects, and to upload any pertinent material, such as images, audio, or video files, to the web site.

The awards offered include a visit from a particle physicist, who will come to their classroom to talk (in their own language, when possible) and to answer student questions about particle physics and research. They are also offered a special gift (to be determined based on the age and type of classroom) and an official certificate acknowledging their achievement. For the secondary classroom winners, two Cosmic Pi detectors[5][1] for measuring cosmic ray muons, allowing to measure and further discuss the pertinence of particles in daily life directly in their classroom.

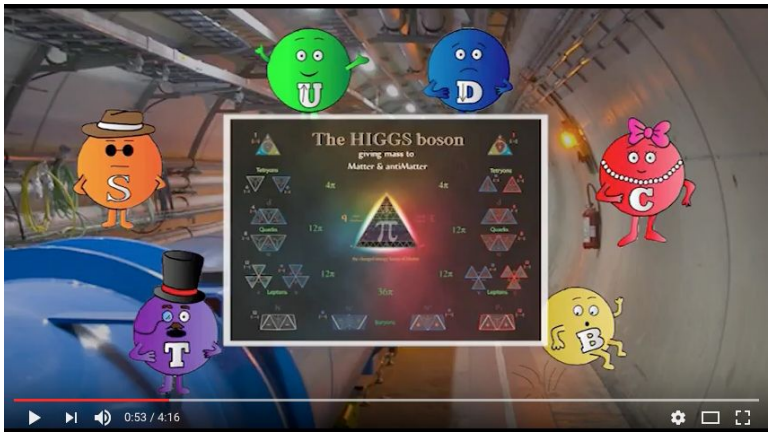
Response

We received a total of 89 responses, 77 of which were considered legitimate, substantive projects, to be reviewed by an appropriate national representative. Entries came in from Austria, Brazil, Bulgaria, Colombia, France, Greece, Iran, Italy, Japan, Philippines, Poland, Slovakia, South Africa, Spain, and the United States, all in their local language. These entries were then rated by the participating IPPOG members and associates according to originality, feasibility, physics content, and potential impact. For every language, the best entries were summarized in English for the final assessment of the winning teams.

Winning Entries

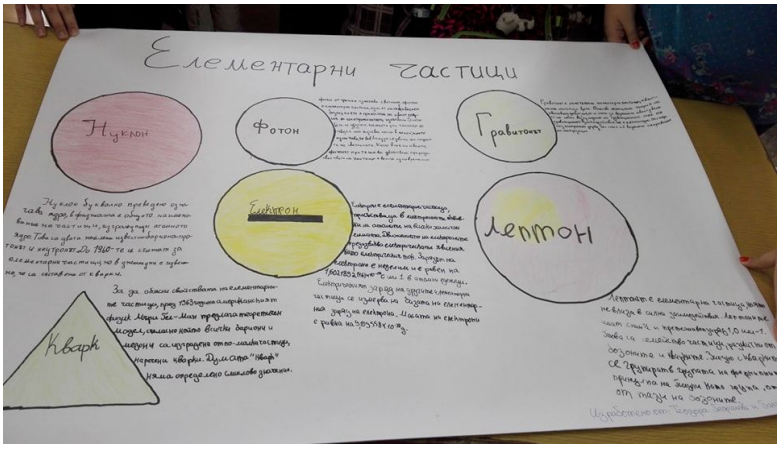
Primary School

The **winning primary school team** comes from a single team of 2nd, 4th, and 6th grade primary pupils of Artemida, − a region near Athens, Greece. Their topic of choice was to combine particle physics with humor and to imagine a dialogue among particles. For instance, what could quarks or protons discuss inside the LCH accelerator? Based on this question the pupils developed very creative and inventive brain-storming ideas, where they finally decided to create a small video, the ″The Quark show″ (available on YouTube [6]) in which scientific knowledge is presented with an appropriate dose of humor.



A scene from “The Quark show” video, showing quarks discussing the relevance of the Higgs boson for them inside the LHC tunnel.

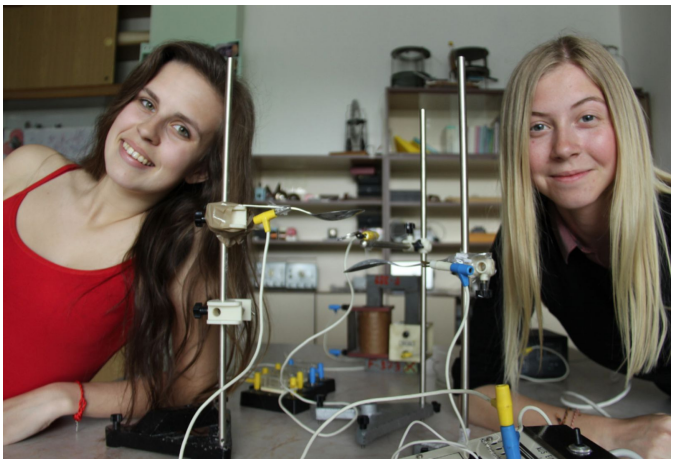
The **2nd winning primary school team** comes from the "St. Kliment Ohridski" primary school in Pavlikeni, Bulgaria.
Their project consist of two posters that describe some of the aspects of the fundamental building blocks of nature, clearly showcasing that these very young pupils were diving deeply into the subject and creating material that could be used for educational purposes.



Poster created by 5th grade pupils from the "St. Kliment Ohridski" Primary School in Pavlikeni, Bulgaria

Secondary School

The **winning secondary school entry** comes from the Ľudovíta Štúra high school in Zvolen, Slovakia. The team consisted of two female students who constructed a low-cost Paul ion trap (under guidance of their teacher who was inspired during the high-school teacher (HST) programme at CERN) and they could demonstrate the trapping of ions using green laser light. There is high potential to inspire many other young people to rebuild and maybe even further improve this easy to build and low-cost experiment.



Radka Veselá, and Andrea Škvareninová from the Ľudovíta Štúra high school in Zvolen showing their own-built ion-trap.

The **2nd winning secondary school team** comes from Maria Regina Gymnasium in Vienna, Austria. They produced chocolates, cookies, chewing-gum, handkerchiefs, bottles, and lots of other things, decorated with funny and imaginative self-designed illustrations on elementary particles and lots of informations on the elementary particles. The enthusiasm and interest of the pupils increased enormously during the project while they learned a lot about elementary particles and also about the CERN. With their presentation at their school, they triggered curiosity among all the other 600 pupils and their parents, answering questions about their project and about the properties of elementary particles. They told about cancer-therapy with protons, about quarks and electrons, about bosons and radioactive decay, about cosmic rays, antimatter, age determination with the C-14 method, light quanta, about the Higgs boson without which there would be no mass inducing curiosity among all to learn more about elementary particles.

The enthusiasm of the pupils is reflected in their colorful way of expressing their work, which can be downloaded from the schools home page [7].

Impact

There are several facets to the impact of the Particles4U project, several of which are not yet measured. First of all, the participants had the opportunity to work together in teams to improve their understanding of particle physics, research, and the scientific method. There is no better means to master a topic, then to be required to explain that topic to others. Secondly, and perhaps equally as important, teachers around the globe were made aware of IPPOG and the European Physical Society and of the fact that there are representatives from IPPOG in their local region and language who are willing to work with them in projects that complement their classroom activities. These teachers and their students are welcome to join the IPPOG network via social media and/or e-mail lists to increase worldwide engagement between students and researchers and between classrooms. The last component of impact will only be known once the winning projects have been turned into reality and shared with other classrooms around the world. We hope the IPPOG network will be able to plan an important role toward reaching this goal.

Acknowledgment

The International Particle Physics Outreach Group would like to thank the European Physical Society for supporting the Particles4U project and for its continued support of Physics Education and Outreach in Europe and around the world.

Bibliography

[1] http://ippog.org
[2] http://facebook.com/ippog

[3] http://twitter.com/ippogOrg
[4] http://ippog.org/particles4u
[5] http://cosmicpi.org
[6] https://www.youtube.com/watch?v=_w9M4v6A3Mo
[7] http://www.maria-regina.at/ahs/downloads/cern-particles4u.pdf

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[1] Cosmic Pi is a low cost cosmic ray detector. It makes the detection and analysis of cosmic rays accessible to students, educators and ordinary people. It uses a specially designed detector combined with the low-cost hardware of the Raspberry Pi computer for data storage and online analysis.