

THE INTERNATIONAL PARTICLE PHYSICS OUTREACH GROUP



WHO WE ARE – WHAT WE DO – WHAT WE TRY TO ACCOMPLISH

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INFN Bologna and CERN
on behalf of the IPPOG Collaboration

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WHY OUTREACH

Outreach refers to activities designed to **raise awareness, appreciation and understanding of particle physics, the research methods and the experimental results** to a mainly non-scientific audience. It is an integral part of the scientific process.

- **Goals:**

- demystify scientific research and increase scientific literacy
- Inform public – Inspire youth – prepare next generation of scientists
- Ensure (continuation of) support and funding
- Tell contributors the outcome of their efforts
- Inform media (strong amplification factor)

Outreach is of particular importance nowadays, when there is a lot of:

- Wrong information and even mud-throwing on science all over the web
- Conspiracy theories which have some impact - at least to a percentage of the public

IPPOG IN A NUTSHELL

IPPOG : Global network of particle physicists active in education and outreach

Main aims :

- Networking and coordination of global activities
- Exchange information, experiences and best practices in outreach activities
- Share resources

Members : 24 country representatives, 5 experiments, 1 international laboratory (CERN)

Flagship activity : International particle physics masterclasses

Meetings take place twice a year (spring & autumn)

First IPPOG Meeting Sep. 1997 at CERN, DG Chris Llewellyn-Smith: *"the particle physics community has a moral obligation to inform the public on its activities. To do this well experiences must be shared among countries in view of the need to optimize the use of resources"*

BRIEF HISTORY

- 1997 EPPOG (European Particle Physics Outreach Group) formed under ECFA and EPS-HEPP board.
- First chair: Frank Close, University of Oxford, UK
- Members: representatives of CERN member states, CERN, DESY, later big LHC experiments
- 2011 EPPOG becomes IPPOG (European -> International)
- 2016 IPPOG becomes International Collaboration with MoU

Member countries no longer required to be CERN Member States

Membership fees to be paid by member countries depend on GDP and Particle Physics community size

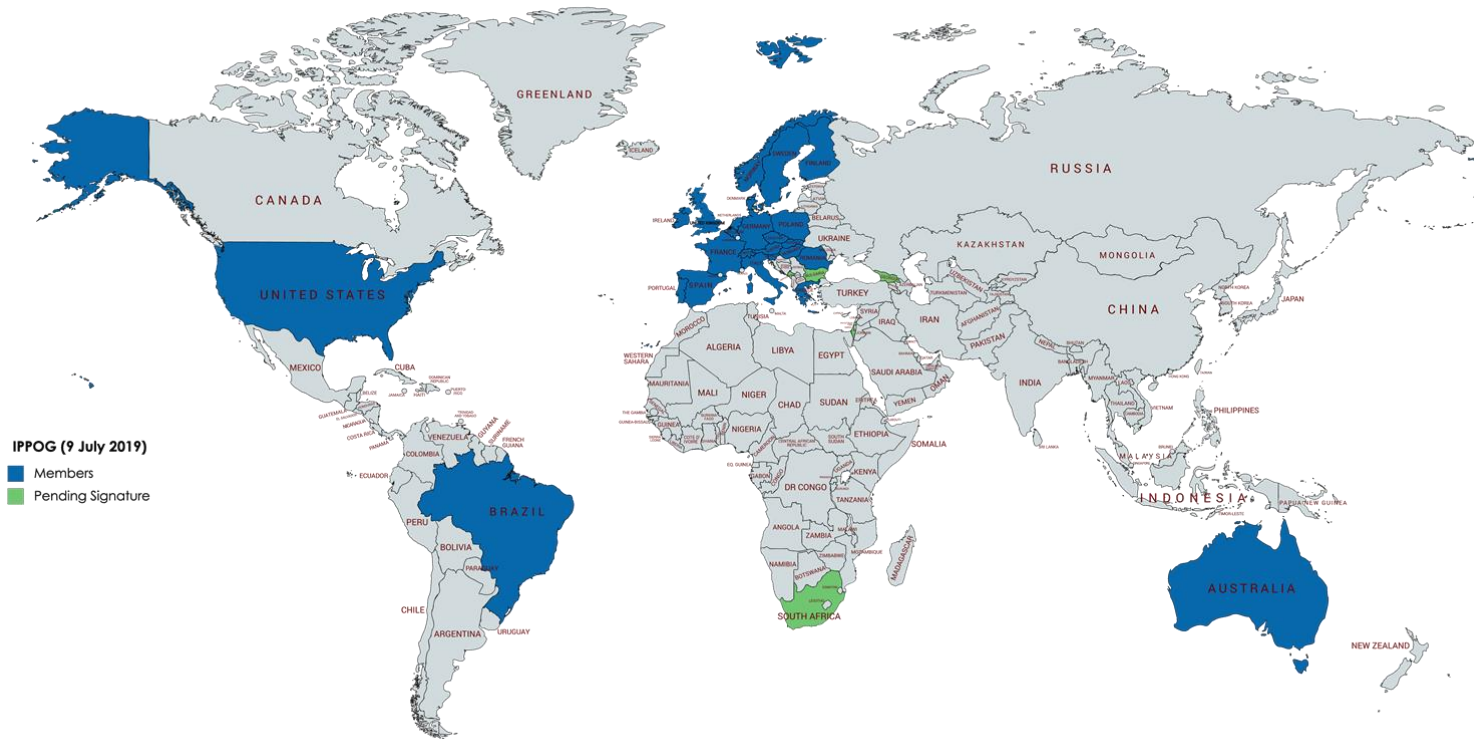
International Laboratories provide strong financial and in-kind support

Experiments provide in-kind support (measurements, tools and other resources, e.g. to be used for the masterclasses)

Increase prestige : new countries, experiments and labs express interest to become members

Introduce associate membership

IPPOG MEMBERS



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CERN, ALICE, ATLAS, CMS, LHCb, Belle2
Accepted as associate members : DESY

IPPOG'S FLAGSHIP ACTIVITY : INTERNATIONAL MASTERCLASSES IN PARTICLE PHYSICS

Hands-on activity for 16-18 year old pupils : Invited by a University or Institute, they spend a day of immersion in particle physics

Goal : Interest. Inspire. Motivate. (can't teach all of particle physics in a day!)

Typical schedule of the day:

Morning : introductory lectures on

- Particle physics (elementary particles, forces, Standard Model and beyond)
- Detectors – accelerators – experimental methods
- Visit of laboratory / experimental site / discussion with scientists and graduate students

Lunch – usually offered by the Host Institute

Afternoon : students analyse real data from an experiment and do a physics measurement

- They work in groups of 2 per computer; analysis is visual in most cases

At the end of the day (16:00 CET) : Video Conference

- moderated by two physicists at CERN and connecting up to 5 institutes
- presentation / merging/ discussion of results, answering questions, quiz

IPPOG'S FLAGSHIP ACTIVITY : INTERNATIONAL MASTERCLASSES IN PARTICLE PHYSICS

History and present status

- 1996: Masterclasses started in the UK
- 2005: Adopted by EPPOG for the international launch in Europe
 - Video-conference linking the institutes participating on the same day
 - Use data from LEP (the Large Electron Positron collider, CERN, 1989-2000)
 - **OPAL** Identifying Particles
 - **DELPHI** Hands on CERN
 - Z⁰ decays / calculation of branching ratios
- 2006: U.S. joined program
- 2010: preparing to move to LHC-based Masterclasses
- 2011: Start using data from LHC

- **ATLAS** W+W⁻ (MINERVA) structure of the proton
- **ATLAS** Z⁰ (HYPATIA) mass, width (+Z¹ from MC)
- **CMS** J/ψ (in 2011) and W/Z (in 2012)
- **ALICE** Looking for strange particles (V⁰ decays)
- **ALICE** Nuclear modification factor
- **LHCb** Measurement of the D⁰ lifetime

Central organisation : [Uta Bilow \(TU Dresden\)](#) and for the USA : [Ken Cecire \(Notre Dame and QuarkNet\)](#)



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Information for
Teachers and Educators

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Institutes and Physicists

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and Girls in Science

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24.08.2019

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International Masterclasses

15th International Masterclasses 2019

Each year more than 13.000 high school students in [55 countries](#) come to one of about 225 nearby universities or research centres for one day in order to unravel the mysteries of particle physics. Lectures from active scientists give insight in topics and methods of basic research at the fundamentals of matter and forces, enabling the students to perform measurements on real data from particle physics experiments themselves. At the end of each day, like in an international research collaboration, the participants join in a video conference for discussion and combination of their results. See [here](#) for media coverage.

International Masterclasses 2019 will take place from 7.3. - 16.4.2019.

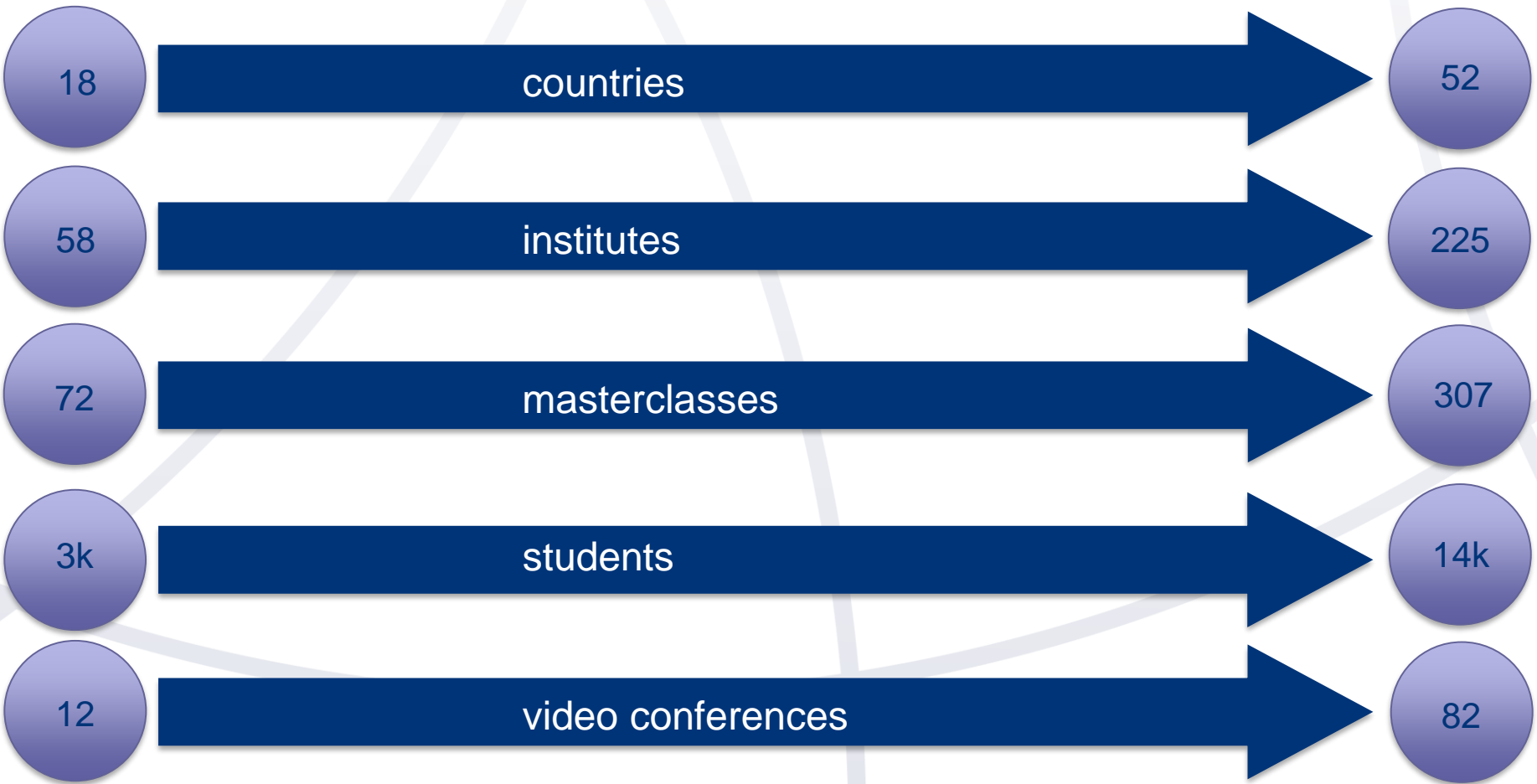
Discover the world of Quarks and Leptons with real data



- get out of school for one day and come to a nearby university or research centre
- get insight into topics and methods of basic research at the fundamentals of matter and forces
- perform measurements on real data from particle physics experiments at CERN
- participate in an international video conference for discussion of results

Statistics International Masterclasses

2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018



IPPOG REACH: THE 2019 MASTERCLASSES



Masterclasses : 7.3. - 16.4.2019
 54 countries
 239 institutes
 15k students (preliminary number)
 1k teachers (preliminary number)



Coordination.: QuarkNet

- 51 institutes (48)
- 54 LHC Masterclasses (50)
 - 22 ATLAS (19)
 - 32 CMS (31)
 (Incl. TRIUMF program)
- 12 MINERvA Masterclasses

Coordination.: TU Dresden

- 188 institutes (177)
- 266 LHC Masterclasses (257)
 - 30 ATLAS W (35)
 - 101 ATLAS Z (104)
 - 64 CMS (58)
 - 41 LHCb (39)
 - 27 ALICE SP (18)
 - 3 ALICE R_AA (3)

BUILDING ON THE SUCCESS OF INTERNATIONAL MASTERCLASSES

International Data Day : students analyse LHC data at school with help from teacher and connect to videoconference (availability 24 hours to cover as many countries/continents as possible)

International Day of Women and Girls in Science (11 February, introduced by UN) : masterclasses for girls

Working Group : **Extending Masterclasses to New Countries**

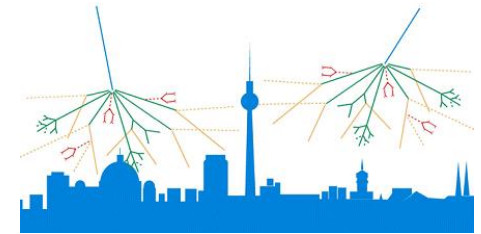
Aims to introduce masterclasses to new countries

New Physics measurements in addition to LHC data

- Neutrino physics masterclasses – Minerva
- Astroparticle physics masterclasses - IceCube
- Hadron Therapy masterclass presented at last IPPOG meeting (@GSI, May 2019)

GLOBAL COSMICS

Various projects for measuring cosmic rays in schools exist in many countries. In the last ~4 years IPPOG started a campaign to bring all these under a common umbrella – working group GLOBAL COSMICS.



Workshop
“High School Cosmic Ray
Experiments”, February
2017, Centro Fermi,
Rome

Previous effort: Eurocosmics

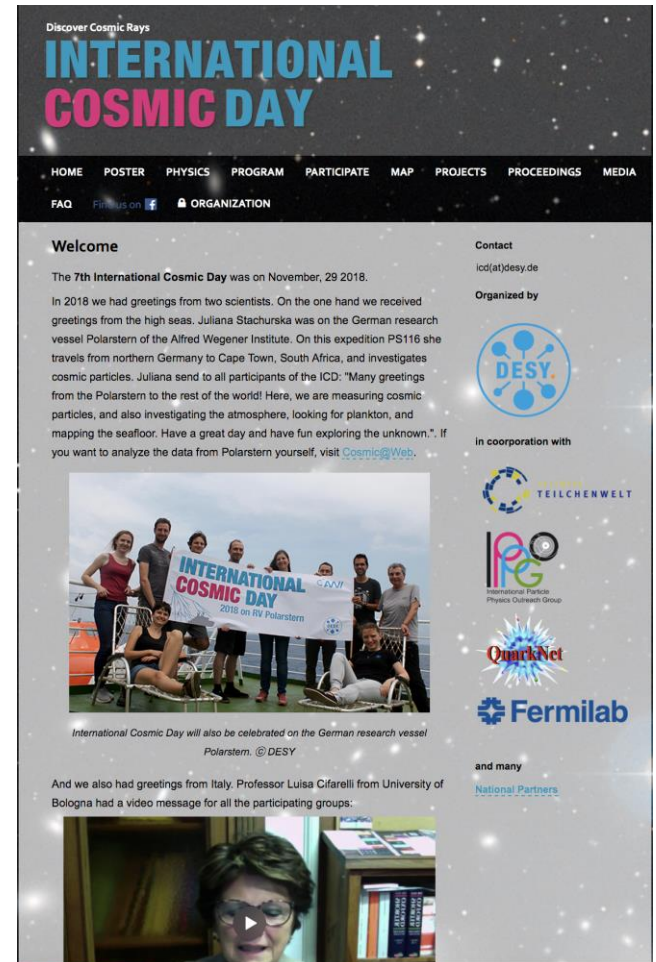
GLOBAL COSMICS

A list of Cosmic rays experiments at schools
can be found at :

<https://icd.desy.de/e49245/>

Promotion and support for activities such as:


- **International Cosmic Day** (in November),
organised by DESY
- **International Muon Week** (in Spring)
organised by Quarknet



Discover Cosmic Rays

INTERNATIONAL COSMIC DAY


HOME POSTER PHYSICS PROGRAM PARTICIPATE MAP PROJECTS PROCEEDINGS MEDIA

FAQ Find us on  ORGANIZATION

Welcome


The 7th International Cosmic Day was on November, 29 2018.

In 2018 we had greetings from two scientists. On the one hand we received greetings from the high seas. Juliana Stachurska was on the German research vessel Polarstern of the Alfred Wegener Institute. On this expedition PS116 she travels from northern Germany to Cape Town, South Africa, and investigates cosmic particles. Juliana send to all participants of the ICD: "Many greetings from the Polarstern to the rest of the world! Here, we are measuring cosmic particles, and also investigating the atmosphere, looking for plankton, and mapping the seafloor. Have a great day and have fun exploring the unknown". If you want to analyze the data from Polarstern yourself, visit Cosmic@Web.




International Cosmic Day will also be celebrated on the German research vessel Polarstern. © DESY

And we also had greetings from Italy. Professor Luisa Cifarelli from University of Bologna had a video message for all the participating groups:





Contact
icd(at)desy.de



Organized by



In cooperation with



International Particle Physics Outreach Group



and many
National Partners

IPPOG SUPPORT FOR BEAMLINE FOR SCHOOLS (BL4S)

CERN competition for high-school students

They participate in the competition by proposing experiments

Two winning teams every year are invited to CERN (to DESY in 2019 and 2020) to do their experiment at a beam line in an experimental hall of CERN; CERN also provides the equipment necessary and support by physicists dedicated to BL4S.

IPPOG members help as :

- Ambassadors for spreading the word about the BL4S competition through their networks of school teachers
- Reference persons (per country) during the phase of preparation of the proposals
- Members of the pre-selection committee of the proposals

IPPOG RESOURCES DATABASE

- Cart Demonstration
- Classroom Activity
- Facilitated Activity
- Presentation
- Game
- Display

Programs & Events

- Science Fair /
- Science Festival
- Science Camp
- Science Shows &
- Performances
- Symposium /
- Conference
- Classroom Outreach
- Program
- Multi-Media Contest

Media

- Audio / Podcast
- Film / Video
- Animation - real
- event
- Animation -
- simulated event
- Images
- Photos
- Illustrations
- Event Displays
- (static)
- Plots
- Computer game
- Non-game Inter-

Learning Topics



- ▶ Physics
- ▶ Technology
- ▶ International Collaboration
- ▶ Broader Impacts

LATEST

FEATURED



Search by

Learning Topic

- Any -

Audience

- Any -

Item Type

- Any -

Availability

- Any -

Duration

- Any -

Language

- Any -

Key Words

GO

Resources in your language

English

French

German

Italian

Portuguese

Spanish

[more](#)

Filter by audience

6 to 9 years

PARTICLES4U COMPETITION

Competition by IPPOG
for young students
funded by an EPS
award

Develop projects
describing the relevance
of particle physics in
everyday life

77 responses
From 15 countries

HOME / PARTICLES4U (ENGLISH)

Particles4U (Deutsch)
 Particles4U (Español)
 Particles4U (Français)
 Particles4U (Italiano)
 Particles4U
 (Nederlands)
 Particles4U (Norsk)
 Particles4U (Polski)
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 Particles4U (Česky)
 Particles4U (ελληνικά)
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Particles4U (English)

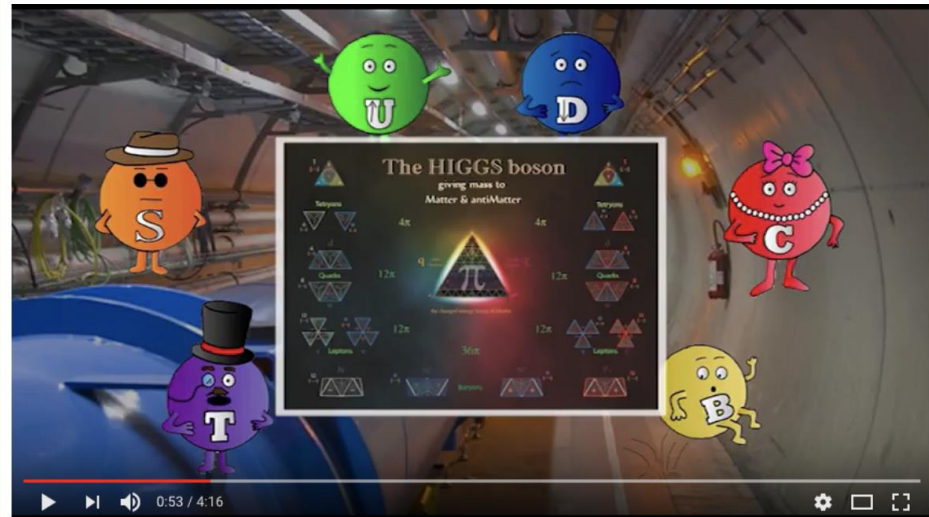
Announcing: Winners of the 2018 Particles4U Competition

Congratulations to all participants of this year's **Particles4U Competition**. We received a total of 77 entries from 15 countries spanning the globe: **Austria, Brazil, Bulgaria, Colombia, France, Greece, Iran, Italy, Japan, Philippines, Poland, Slovakia, South Africa, Spain, and the United States.**

The jury was impressed by the quality of the projects and found it very difficult to decide on the winners. The criteria applied for the final selection were: quality, originality, participation, physics, feasibility, and overall impact of the project. Two winners were selected from each category.

Primary School (Age 12 and under) Winners

2nd and 6th Primary Schools of Artemida, Athens, Greece



Students from the 2nd and 6th primary schools of **Artemida**, a region near **Athens, Greece** combined particle physics with humor and to imagine a dialogue among particles. Their video is called "**The Quark Show.**"

- **Award:** A school visit from a particle physicist, an award certificate, and a special gift from CERN for each of the participants.



Girls, do Physics!

Inspiring and empowering girls around the world to engage in physics or related STEM subjects.

Girls, do Physics! is an Instagram campaign organised by the International Particle Physics Outreach Group (IPPOG) to inspire girls to become interested in and study physics and related STEM subjects and break the stereotype that physics is more suitable for boys.

The campaign will run between February 11, the UN International Day of Women and Girls in Science, and March 8, the International Day of Women.

HOME

IPPOG

CAMPAIGN

MOTIVATION

ROLE MODELS

TEAM

CONTACT



IPPOG AT INTERNATIONAL CONFERENCES

- Concerted effort started some years ago to bring outreach in International Conferences. Main aims:
 - To convince the members of our community (physicists) about the importance of outreach
 - To increase awareness about existing resources and activities
- Outreach talks in plenary sessions
- Outreach parallel sessions
- Outreach activities during conferences

IPPOG AT INTERNATIONAL CONFERENCES IN 2019

- **APS April Meeting, 14 Apr, Denver, Colorado, USA**
“International Masterclasses: Particle Physics for High School Students and Teachers”
 - Ken Cecire, IPPOG Masterclass Coordination
- **LHCP 2019, 20-25 May, Puebla, Mexico**
“Particle Physics Outreach as a Strategic Pillar for Society: A report from IPPOG,”
 - Sascha Mehlhase, ATLAS IPPOG Representative
- **EPS HEPP 2019, 10-17 July, Ghent, Belgium**
“Future Challenges in Particle Physics Education and Outreach,”
 - HPB, IPPOG Chair“Developments in International Masterclasses”
 - Uta Bilow, IPPOG Masterclass Coordination
- **CHEP 2019, 4-8 Nov, Adelaide, Australia**
“Open Data and Software for Particle Physics Outreach”
“The IPPOG Resource Database for Education & Outreach”
“Reaching the Public with Event Visualisation? Virtual Reality”

IPPOG's VISION

- Expand geographically (new members from all continents)
- Expand beyond CERN and even beyond particle physics (BELLE, contacts with Astroparticle Physics community, recently also contacts with Gravitational Waves community)
- Expand the topics of masterclasses

RECOMMENDATIONS FOR PHYSICISTS

- If you are a PhD student – young post-doc : share your enthusiasm with the young generation.
- If you are a more senior (older) physicist : share your enthusiasm and experience; encourage your younger colleagues
- If you are a group leader / in managerial position : choose candidates who are enthusiastic about outreach; encourage participation in outreach
- Remember : it is rewarding and satisfying
- *More concerted and systematic effort toward presentation and popularization of science would be helpful in many respects; it would provide a potent antidote to overspecialization; it would bring out clearly what is significant in current research, and it would make science a more integral part of the culture of today.*

Victor Weisskopf Science, Vol. 176 (1972)

- Contact IPPOG representatives for information
- Contact your IPPOG representatives to make them aware of activities/resources

Appendix: IPPOG References

Reference	Address
IPPOG Home Page	http://ippog.org
IPPOG Particle Physics Masterclasses	https://physicsmasterclasses.org
IPPOG Resource Database	http://ippog.org/resources
IPPOG Facebook Page	https://facebook.com/ippog
IPPOG Friends Facebook Group	https://facebook.com/groups/friends.ippog
IPPOG on Twitter	https://twitter.com/lppogOrg (@lppogOrg)
IPPOG on Instagram	https://instagram.com/lppogOrg (@lppogOrg)



Thanks a lot for your attention!