International Particle Physics Outreach Group

Reaching Across the Globe with Science

Steven Goldfarb, IPPOG Chair

Presented on behalf of the IPPOG Collaboration, CHEP, Adelaide, Australia, 5 Nov 2019
Why?
How much?
Who to believe?  
What to do?
What are the answers they see?
A Handy Flowchart For the Anti-Vaccine Science Denier

VACCINES CAUSE AUTISM!
"Findings of this meta-analysis suggest that vaccinations are not associated with the development of autism or autism spectrum disorder. Furthermore, the components of the vaccines (thimerosal or mercury) or multiple vaccines (MMR) are not associated with the development of autism or autism spectrum disorder."

VACCINES CAUSE DIABETES!
"In this large, population-based, case-control study, we did not find an increased risk of type 1 diabetes associated with any of the routinely recommended childhood vaccines."

VACCINES CAUSE MS!
"No long-term association of vaccines with MS or any other central nervous system demyelinating syndromes, which argues against a causal association."

YOU CAN’T TRUST SCIENCE!

Homeopathy
The Journal of the Faculty of Homeopathy

Donald J. Trump
@realDonaldTrump

The concept of global warming was created by and for the Chinese in order to make U.S. manufacturing non-competitive.
Yet, in this environment, we have big plans...
Future Plans for Particle Physics

Landscape of proposed large-scale infrastructures

CLIC

FCC\textsubscript{ee/eh/hh}

CEPC / SppC

LHeC

ILC
Future Plans for Particle Physics

Time scales

- Japan
  - 20km tunnel: 4 years
  - 40km tunnel: 9 years
  - CepC: 90/160/240 GeV, 16/2.5/5.6 ab\(^{-1}\)
- China
  - 100km tunnel: 8 years
  - 100km tunnel: 10 years
  - FCC-ee: 50/160/250 GeV, 150/10/5 ab\(^{-1}\)
- CERN
  - HL-LHC: 13 TeV, 3-4 ab\(^{-1}\)
  - LHeC: 1.2 TeV, 0.25-1 ab\(^{-1}\)
  - CLIC: 380 GeV, 1.5 ab\(^{-1}\)

Construction/Transformation
Preparation
Proton collider
Electron collider
Electron-Proton collider

2020 2030 2040 2050 2060 2070 2080 2090
How do we prepare for this?
Education, Outreach & Communication

Communication
- Report Goals and Results to the public
- Extend Reach through methods & networks

Education & Outreach
- Establish Understanding of scientific process
- Instil Appreciation of fundamental research
- Build Trust with communities
- Train Next Generation of scientists

Education, Outreach and Communication are **Strategic Pillars** of Research
They are what we have to do **before** we build, not just after!
International Scientific Collaboration
  • Active Researchers with Experience in Education & Outreach
  • Experts in Communication & Education

Global Network
  • 26 Countries, 5 Experiments, 1 International Lab (CERN)
  • Linked with national networks

Organise Global Activities
  • International Particle Physics Masterclasses
  • World Wide Data Day, Global Cosmics, etc.

Support Local Activities
  • Sharing of expertise, best practices, material database
  • Resources to support events, kick-start activities
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.

- Chris Llewellyn-Smith, CERN DG

**1997** Birth of European Particle Physics Outreach Group (EPPOG) formed under the joint auspices of ECFA and EPS-HEPP

**2011** Global Expansion to IPPOG
- Israel, Australia, USA (now South Africa, Brazil,...)

**2016** Formal Scientific Collaboration
- Memorandum of Understanding
IPPOG Goals

Sustainable Development of Particle Physics Outreach
• Discussion forums for scientists active in Outreach and Informal Education
• Information exchange between individuals, institutions and laboratories
• Active working groups addressing specific challenges of global Outreach

Improving Outreach Standards Worldwide
• Development of Strategies based on current best practices and experience
• Long-Term links between scientists and education specialists
• Continual development & improvement of explanatory material

Extending Global Reach
• Expansion to Countries and Peoples underrepresented in Particle Physics
• Usage of new methods, activities and topics to reach broader audiences
• Active online communication platforms
IPPOG Membership
26 Countries, 5 Collaborations, 1 International Lab
MoU Commitments

Experiments
• Recognition of outreach as key component of research programme
• Recognition of efforts of collaboration members who do outreach
• In-Kind contributions (data, tools, educational material, in-kind support)

Countries
• Representative, access to national research programme & education networks
• Modest monetary support for IPPOG activities & infrastructure

Laboratories
• CERN contributes 5 kEUR + Masterclass Coordinator + Scientific Secretary + Infrastructure for Web, Finance, Legal Support
Organisation

Chairs
- Hans Peter Beck (Universität Bern) 2013-2019 (completing 2nd term)
- Steven Goldfarb (University of Melbourne) 2017-2019 (completing 1st term)

Core Team
- Strategic Development: Barbora Gulejova (Universität Bern)
- Community Lead: Claudia Marcelloni (CERN)

Coordination
- Masterclasses: Uta Bilow (Dresden University), Ken Cecire (University of Notre Dame)
- Global Cosmics: Sabine Hemmer (INFN), Carolin Schwerdt (DESY)

Organisational Bodies
- Advisory Boards & Committees: Finance, Speakers & Publications
- Steering Groups: Masterclasses, Global Cosmics, Web Development
- Working Groups: Bringing Masterclasses to New Countries, Explaining Particle Physics Hot Topics, Exhibits & Exhibitions
Sharing Ideas

17th IPPOG Meeting
- GSI-FAIR, Darmstadt, Germany, May, 2019
- Steering Group Meetings & Reports:
  - Global Cosmics, Masterclasses
- Working Group Meetings & Reports:
  - Exhibits & Exhibitions
  - Explaining Particle Physics to a Lay Audience
  - Expanding Masterclasses to New Countries
  - Outreach of Applications for Society
- Panel Discussion:
  - Outreach on the benefits to society from fundamental research

18th IPPOG Meeting
- CERN, 28-30 Nov 2019

CHEP, Adelaide, Australia, 5 Nov 2019
International Particle Physics Masterclasses

The Flagship of IPPOG
• Students become “Researchers for a Day”
• Invited to research institute or university
• Given introductory lectures on particle physics research
• Taught to use analysis tools to examine real data
• Spend 2 hours on research
• Discuss results via videoconference with other students around the world

In 2020
• 26 Feb – 8 Apr

See Track 8 talks of Farid Ould-Saada, Monday 15:00
and Lukasz Graczykowski, Thursday 12:00
International Particle Physics Masterclasses

The Measurements
• ATLAS W-Path (Study Ratio $W^+ / W^-$, extra credit for $H \rightarrow WW$)
• ATLAS Z-Path (Measure Z Mass, extra credit for $Z'$ bosons, $H \rightarrow \gamma\gamma$)
• CMS (Identify W, Z, H Decays)
• ALICE Strange Particles
• ALICE $R_{AA}$ Measurement
• LHCb $D^0 \rightarrow K\pi$
• MINERνA

New Masterclasses being explored
• IceCube, Auger, BELLE II
• Particle Therapy (GSI/FAIR)

Tools & Data Continually Renewed

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and Lukasz Graczykowski, Thursday 12:00
International Particle Physics Masterclasses

International Day of Women and Girls in Science 2016-2019

See Track 8 talks of Farid Ould-Saada, Monday 15:00
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International Particle Physics Masterclasses

QuarkNet
- 51 Institutes
- 54 LHC Masterclasses
  - 32 CMS
  - 22 ATLAS
- 12 MINERvA Masterclasses

TU Dresden
- 188 Institutes
- 266 LHC Masterclasses
  - 30 ATLAS W
  - 101 ATLAS Z
  - 64 CMS
  - 41 LHCb
  - 27 ALICE SP
  - 3 ALICE R_AA

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How did the masterclass affect your interest in physics?
90 responses

- 71.1% more interested
- 21.1% less interested
- 7.8% no effect

International Particle Physics Physics Outreach Group

CHEP, Adelaide, Australia, 5 Nov 2019
The IPPOG Collaboration, S. Goldfarb
Global Cosmics

High School Initiatives Exploring Cosmic Rays

Sabine Hemmer (INFN), Carolin Schwerdt (DESY)

- International Muon Week (1-5 Apr 2019)
  - 54 sites participated
- World-wide project: measure average speed of muons
- International Cosmic Day (6 Nov 2019)
  - What are cosmic particles? Where do they come from? How can they be measured?

http://globalcosmics.org
World-Wide Data Day (W2D2)

16 Oct 2019 (24h)
- Participating groups: 48
- Students: 969
- Moderators: 8

Measurement
- Students measure theta and phi for dimuon events
- Data analysis at school, physics discussion in VC
- Measurement used in Chile, Mexico, Namibia workshops in 2018
- Great growth in Mexico: 9 groups
- Measurement stable

http://tiny.cc/w2d2-18
CERN’s Beamline 4 Schools

IPPOG Participation
• Local Contacts to Schools
• Help Remove Language Barrier
• Give Guidance for Physics, Feasibility

http://beamlineforschools.cern
Public Events & Festivals

- Colours of Ostrava, Czech Rep, 2019
- Pohoda Festival, Slovakia, 2019
- Universal Science, CHEP Sofia, Bulgaria, 2018
- Adelaide, Australia, 2019
In The Media

The IPPOG Collaboration, S. Goldfarb

CHEP, Adelaide, Australia, 5 Nov 2019

I Laboratori Nazionali del Gran Sasso e il Gssi per la prima volta all’International Cosmic Day

Italy, 17 Nov 2018

Giornata Internazionale delle Donne nella Scienza: l’INFN partecipa con numerose iniziative

Italy, 5 Feb 2019

Jornal da USP

Brazil, 26 Mar 2019

Novinky.cz

Slovakia, 5 Apr 2019

Czech Rep, 26 Feb 2019

Serbia, 18 Mar 2019

Montenegro, 14 May 2019

Четири училища се събират в Смолян за майсторски клас на ЦЕРН

Bulgaria, 23 Jan 2019

Žilinského kraja sa opäť ponulilo do hlbín sveta častíc

Slovakia, 5 Apr 2019


Czech Rep, 26 Feb 2019

Žele da se bave naukom: Davíd cí studiarit automatóku, Milicí je zanimljiva struja

Serbia, 18 Mar 2019

Nová granátová laska za 9,8 miliardy faktů: Ženské univerzity v Polsku a České republice neúnavně studují vzdělávací potřeby mladých vědců.

Montenegro, 14 May 2019
In Conferences

APS April 2019 – Denver, CO, USA
• International Masterclasses: Particle Physics for High School Students and Teachers, Ken Cecire, IPPOG Masterclass Coordinator

LHCP 2019 – Puebla, Mexico
• Particle Physics Outreach as a Strategic Pillar for Society: A report from IPPOG, Sascha Mehlhase, ATLAS IPPOG Rep

EPS HEPP 2019, Ghent Belgium
• Future Challenges in Particle Physics Education and Outreach, Hans Peter Beck, IPPOG Chair
• Developments in International Masterclasses, Uta Bilow, IPPOG Masterclass Coordinator

ICNFP 2019 – Kolymbari, Crete, Greece
• The International Particle Physics Outreach Group, Despina Hatzifotiadou, ALICE IPPOG Rep

CHEP 2019 – Adelaide, Australia
• International Particle Physics Masterclasses - Current development to expand scope and global reach, Farid Ould-Saada, Norway IPPOG Rep
• The International Particle Physics Outreach Group - Reaching Across the Globe with Science, Steven Goldfarb, IPPOG Chair
• New developments for ALICE MasterClasses and the new Particle Therapy MasterClass, Lukasz Graczykowski, IPPOG Associate
• The IPPOG Resource Database – Making Particle Physics Outreach & Education Available Worldwide, Marzena Lapka, CMS IPPOG Rep