International Particle Physics Outreach Group

IPPOG Resource Database

Making Particle Physics outreach & education available worldwide

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Outline

- Why outreach in particle physics and related sciences matters?
- IPPOG - strategic pillar for worldwide outreach – EPPSU context
- IPPOG Resource Database (RDB)

  - What? Who for?

  - Development of new RDB

  - Curation

- Invitation for audience to take part!

Challenges of HEP / science community

Main challenges of scientific community

- Challenged financial support of large experimental endeavours
- Falling interest of young people to study physics and STEM
- Mistrust in science

Reasons

- Misperception of physics / science in society – complicated, abstract, disconnected from real life
- Lack of awareness and understanding

Why is physics & basic research misperceived?

Scarce exposure of society to modern physics

- ✓ School curricula – mostly no modern physics
- ✓ Media – misinformation and disinformation

Cell phones and computers were sewn into reality thanks to fundamental science.

Despite this:

Most students finish high school believing that there are only:

- *3 elementary(?) particles (electron, proton, neutron)*
- *2 types of forces (gravitational and electromagnetic)*

Why exposure of society to HEP matters?

Exposure to modern physics, like HEP and its technological applications **increases the interest of students in physics** and their perception of its role in society and sustainable development.

Study in Germany and UK:

General interest in physics at schools has increased strongly thanks to inclusion of extra-curriculum activities in HEP (exhibitions, Physics Masterclasses, teaching)!

European Particle Physics Strategy Update

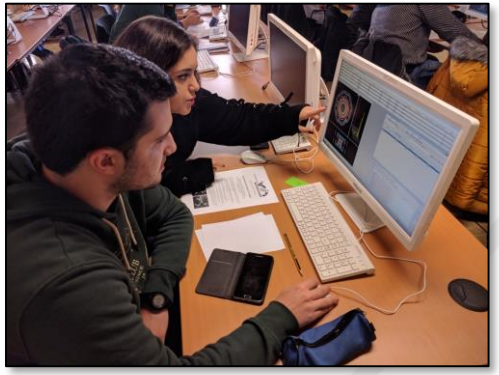
CERN-ESU-014

Exploring the fundamental properties of nature inspires and excites. It is part of the duty of researchers to share the excitement of scientific achievements with all stakeholders and the public. The concepts of the Standard Model, a well-established theory for elementary particles, are an integral part of culture. ***Public engagement, education and communication in particle physics should continue to be recognised as important components of the scientific activity and receive adequate support. Particle physicists should work with the broad community of scientists to intensify engagement between scientific disciplines. The particle physics community should work with educators and relevant authorities to explore the adoption of basic knowledge of elementary particles and their interactions in the regular school curriculum.***

Importance to update physics curricula is now officially recognised by full HEP community

7 Environmental and societal impact

International Particle Physics Outreach Group



- ✓ Outreach
- ✓ Informal education
- ✓ Extra-curricula activities

The way to bridge the gap between contemporary science and school education and increase appreciation of science by society

The International Particle Physics Outreach Group (IPPOG) has been making concerted and systematic efforts to present and popularise particle physics and related sciences across all audiences and age groups since almost 25 years.

Today, HEP and **scientific community has in IPPOG a strategic pillar** in fostering long-term, sustainable support for fundamental scientific research around the world.

IPPOG Collaboration

International Particle Physics Outreach Group

International Scientific Collaboration

- Active Researchers with Experience in Education & Outreach
- Experts in Communication & Education

Physics topi

- Particle
- Neutrino
- Astro-pa
- Heavy io

Organise Gl

- Internati
- World-W

Support Local Activities

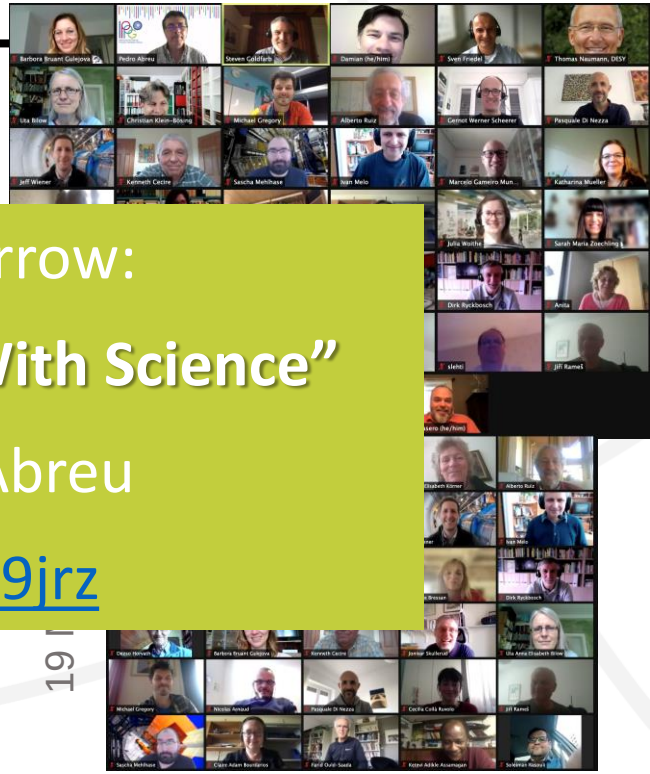
- Sharing of expertise, best practices, outreach material database
- Resources to support events, kick-start activities

See POSTER session tomorrow:

“IPPOG Reaching Across Globe With Science”

by IPPOG co-chair Pedro Abreu

https://tinyurl.com/93r59jrz



IPPOG Website & Resource Database

IPPOG is an ideal platform for:

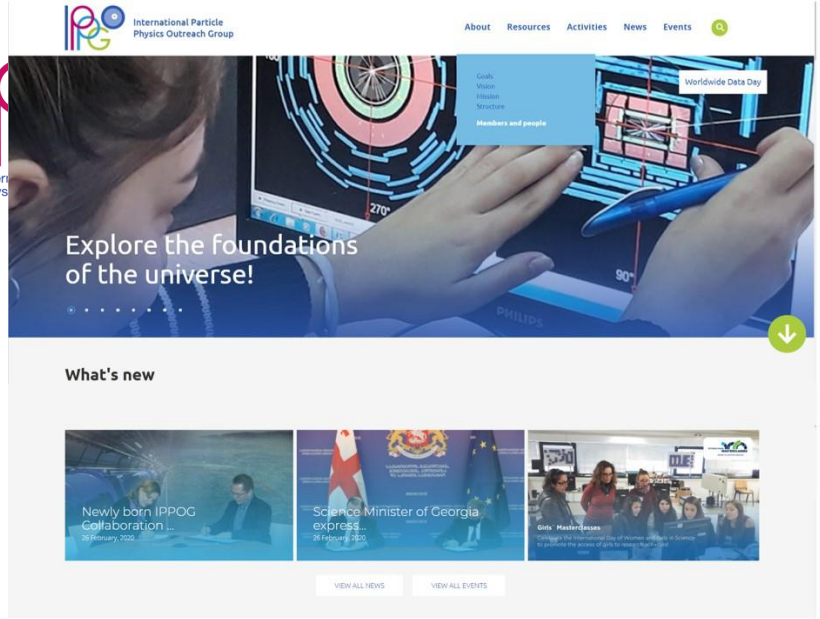
- *sharing, developing and improving*
- *explanatory and teaching materials, strategies, methods, activities and tools*
- *to reach broader audiences*
-

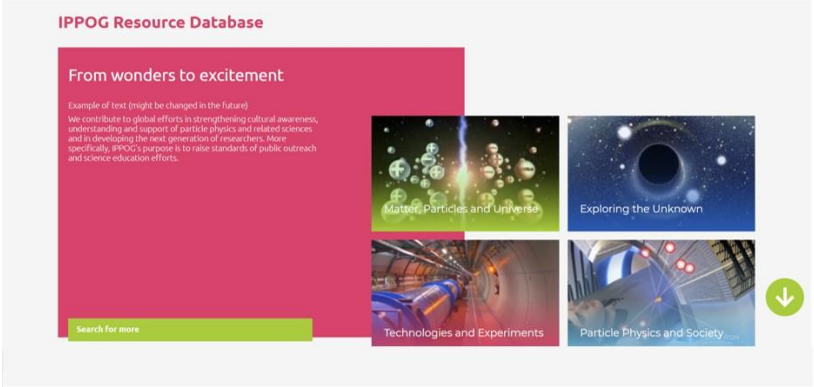
IP

-

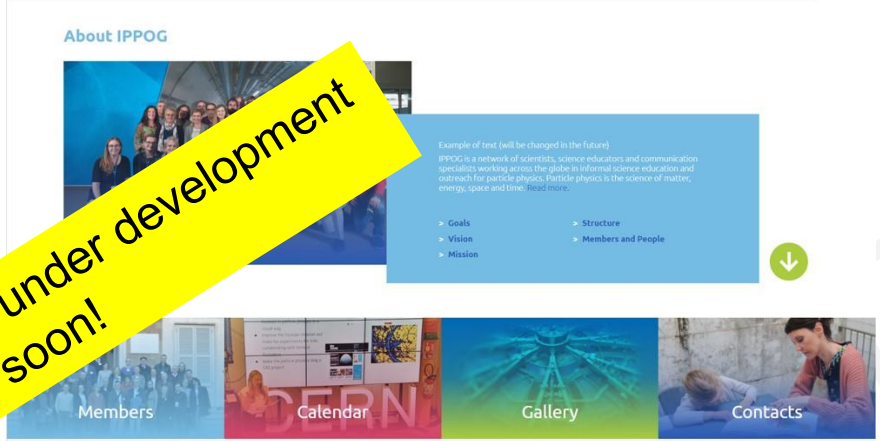
"IPPOG wants the new website to become more open to students, teachers and the general public, and for the RDB to become the primary source of particle physics outreach material in the world."

- *strengthen IPPOG online presence by creating a new website including a new RDB*
- *greatly broaden the audience type and use of the webpages & available resources*

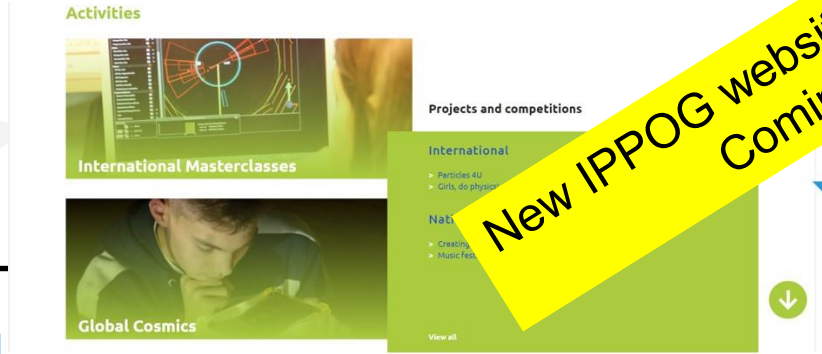




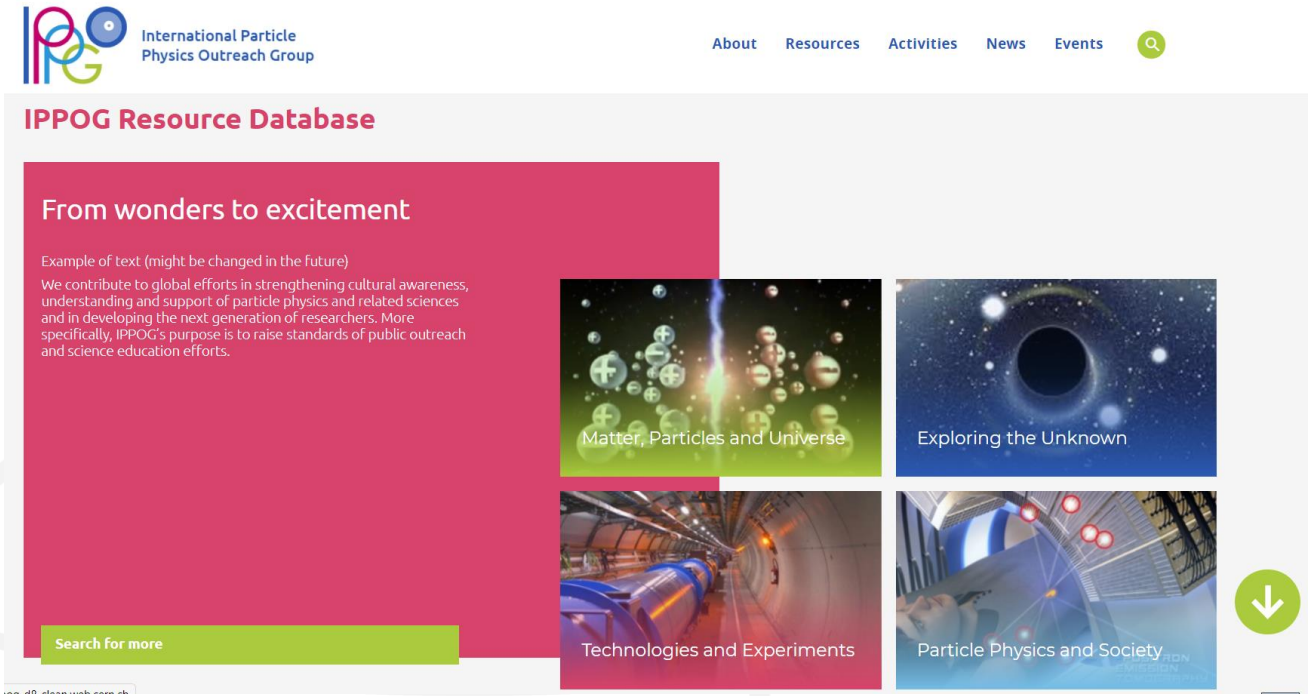
Scroll down



New IPPOG website under development
Coming soon!

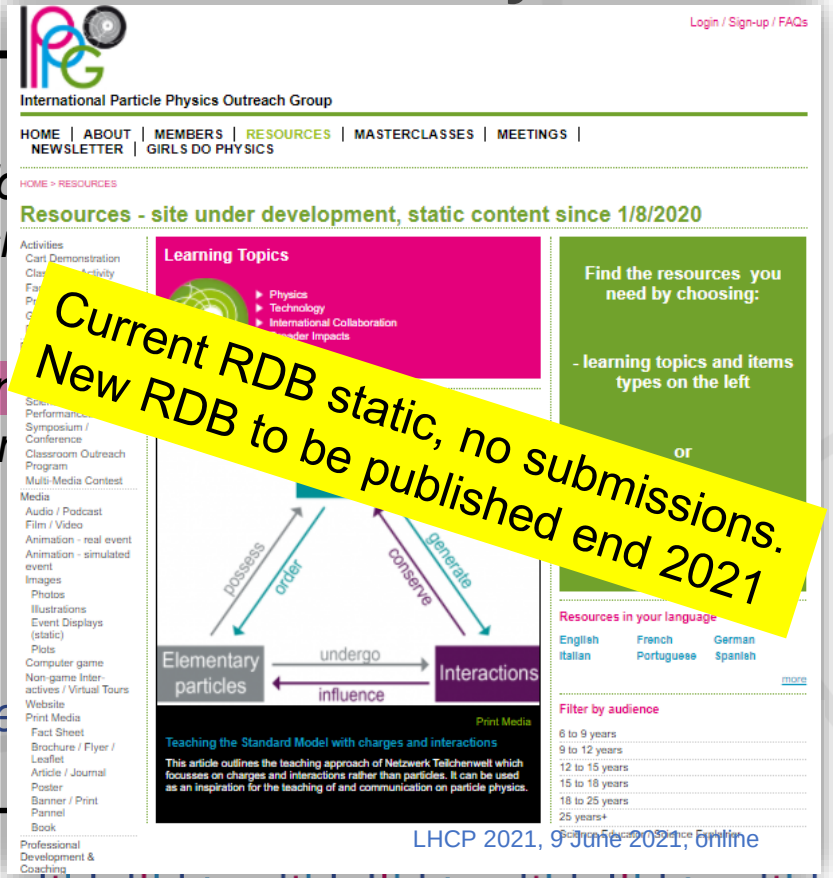


IPPOG Resource Database



IPPOG Resource Database History

- *Idea born in 2009: transformation of EPPOG (fo forum" to a possible world leader in informal sci related fields: IPPOG.*
- *Initially "EPPOG Best Practice Database" mear and laboratories for outreach and informal scier*
- *self-sustaining, users vote on highest quality &*
- *First version released in 2011*
- *Today about 370 items collected over last 10 ye*



New IPPOG Resource Database is / will be…

- *online platform to facilitate the exchange of HEP E&O resources across the globe*
- *collection of high-quality engaging materials (e.g. videos, posters, talks, hands-on activities, tools, brochures and more)*
- *content recommended by experts*
- *to share wonders and excitement of HEP with teachers, students and general public*
- *readily understandable and regularly updated to reflect the latest discoveries in HEP*
- primary source of HEP outreach material in the world

New IPPOG Resource Database

REVIEW and REDESIGN of Resource Database

- Several years of discussions, efforts and feedback
- New improved Resource Database proposal in 2017
- Intense collaboration with high school teachers (“IPPOG Friends” group)

GOALS

- Broaden audiences
- Improve functionality and user-friendliness for both users and contributors
- Simplify categories
- Full coverage of relevant topics
- Keep the content up-to-date
- Continuous feedback and improvements

IPPOG Resource Database Challenges

TECHNICAL

- ❑ Dedicated submission form at CDS

In-kind contribution from CERN

- ❑ Interface between CDS and Drupal (external company)

CONTENT

- ❑ Curation of existing / “old” items
- ❑ Collection of new / up-to-date best items
- ❑ New content development

IPPOG RDB Curation

RDB CURATION group (since summer 2020)

~ 40 experts from around the world: - physics teachers, scientists and science communicators

Alberto Ruiz Jimeno
Andreas Delannoy
Ani Torres
Anna Marie Wolf
Carlos Cunha
Cassondra McHugh-Lowther
Cédric Vanden Driessche
Claire Adam-Bourdarios
Claire Bonnoit-Chevalier
Daniela Ambar Gayoso Miranda
Dario Menasce
Despina Hatzifotiadou
Enrique Arce-Larreta
Harry Stuckey
Ian Bearden
Ivan Melo
Jean-Christophe Pelhate
Joel Klammer
José María Díaz Fuentes
Julia Woithe
Kevin Martz
Kevin Mosedale
Lucia Battistella
Luís Afonso
Maria Niland
Marla Glover
Michael R. Fetsko
Michael Wadness
Miki Otsuka
Moritz Springer
Patricia Teles
Pierluigi Paolucci
Ram Krishna Sharma
Richard Dower
Robert Nickson
Soleiman Rasouli
Spencer Pasero
Stefania Della Sciucca
Yury Ivanov

CRITERIA

- ✓ Is the physics right?
- ✓ Is it a topic of interest?
- ✓ Is it related to particle physics or associated fields?
- ✓ Is it up-to-date or has it been superseded?
- ✓ Are you aware of a similar resource in the same language?
- ✓ Do you consider this resource as really outstanding?

- ❑ Special Curation tool developed – launched Dec ‘20
- ❑ 366 resources: each evaluated by 2-3 experts =>
- ❑ > 800 items to curate by end of summer 2021!

IPPOG RDB Curation tool

GREAT FUNCTIONALITIES

(impossible with google docs)

- ✓ SECURITY: users sign in with their account and can edit only their entries
- ✓ SECURITY: editable (only new tags) and non-editable fields
- ✓ SEARCH & FILTERING : each tag / column can be filtered with chosen values
- ✓ DROPDOWN MENUS with predefined lists
- ✓ MULTIPLE CHOICE when entering values
- ✓ CLEAR: red line - taken by somebody else; blue line - mine
- ✓ UNDO / CLEAR OPTION
- ✓ VIEW and EXPORT options
- ✓ PLAN: TO BE USED (at least partly) to help populating new RDB…

IPPOG Resource Database Curation

Keep it?	IPPOG's best?	Topic	Subtopic	Type	Audience	Language	School topic	Online usage	Additional Keyword/Tag	Related resource	Comment

1. KEEP IT?

YES

NO

2. IPPOG's BEST

1-10 rating (10 is for best)

3. TOPICS and SUBTOPICS

1) MATTER, PARTICLES AND UNIVERSE

PARTICLES

INTERACTIONS

COSMOLOGY

HIGGS

ANTIMATTER

QUARK-GLUON PLASMA

NEUTRINOS

2) EXPLORING THE UNKNOWN

SUPERSYMMETRY

DARK MATTER

DARK ENERGY

EXTRA DIMENSIONS

3) TECHNOLOGIES and EXPERIMENTS

ACCELERATORS

DETECTORS

COMPUTING

DATA ANALYSIS

4) PARTICLE PHYSICS AND SOCIETY

WHY FUNDAMENTAL RESEARCH

INTERNATIONAL COLLABORATION

4. ITEM TYPE

Photos/ Posters/ Charts

Videos

Animations / Simulations

Presentations (ppt,pdf)

Games

Classroom materials / Tutorials / Lesson plans / Text books

Books

Projects / Competitions

Exhibition items

Souvenirs

Academic article

5. AUDIENCE

Primary school level

Lower secondary school level

Upper secondary school level

Broad public

Educators

Scientists

6. LANGUAGES

Arabic

Catalan

Chinese

Czech

Danish

Dutch

English

Finnish

French

German

Hungarian

Italian

Japanese

Norwegian

Polish

Portuguese

Romanian

Russian

Serbian

Slovak

Slovenian

Spanish

Swedish

Turkish

NEW

Link to school physics curiculum

7. SCHOOL TOPIC

Blue part is just to lead the choice of the tags, which are in black!

School curriculum topic	School curriculum sub topic	Particle Physics topic	Comment
Nature of science	Scientific inquiry & reasoning	all	E.g. theory vs experiment: comparing predictions and observations for Higgs discovery
Measurements and uncertainties	Sensors	Detectors	expanding the human senses
	Measurements	all	E.g. non-SI units such as eV, "particle level" origin of SI units
	Measurement uncertainties		E.g. 5 sigma threshold, precision measurements
Matter	Structure of matter	Particles	Elementary particles, Particle systems up to atoms, molecules, vacuum as absence of matter
	States of matter	Quark-gluon-plasma	E.g. plasma, ionisation, LHC cooling with liquid helium (cryogenics)
	Phase transitions	Detectors, Interactions	E.g. as detection technique (cloud and bubble chambers),
	Mass	Interactions, Higgs	E.g. rest energy of particles E=mc^2
Charges & fundamental interactions	Charges	Interactions, Particles	E.g. charges as particle properties that determine interactions, colour charge, electric charge, ...
	Gravity	Interactions	
	Strong interaction	Interactions	E.g. atomic nuclei
	Weak interaction	Interactions	E.g. beta transformation of radioactive nuclei
	Electromagnetism	Interactions	Magnetic and electric fields & forces, electricity, electronics
Mechanics	Energy (conservation), work & power	Accelerators, Detectors	E.g. kinetic and rest energy
	Accelerated motions	Accelerators	E.g. circular motion
	Momentum (conservation)	Accelerators, Detectors	E.g. Collisions (elastic & inelastic)
	Oscillations and waves	Accelerators	E.g. RF cavities
	Relativistic mechanics	Accelerators, Detectors	E.g. SRT - relativistic muons from cosmic radiation
Special topics	Quantum physics	Detectors, Accelerators	E.g. uncertainty principle, photoelectric effect, tunneling, superconductivity, spin
	Cosmology	Cosmology	Including big bang, CMB, dark matter, dark energy
	Medical imaging	Applications	E.g. X-ray machines, PET
	Objects in the universe		Stars, supernovae, black holes, ...
	Computing	all	

8. ONLINE USAGE

YES

NO

9. ADDITIONAL KEYWORD / TAG

Free text

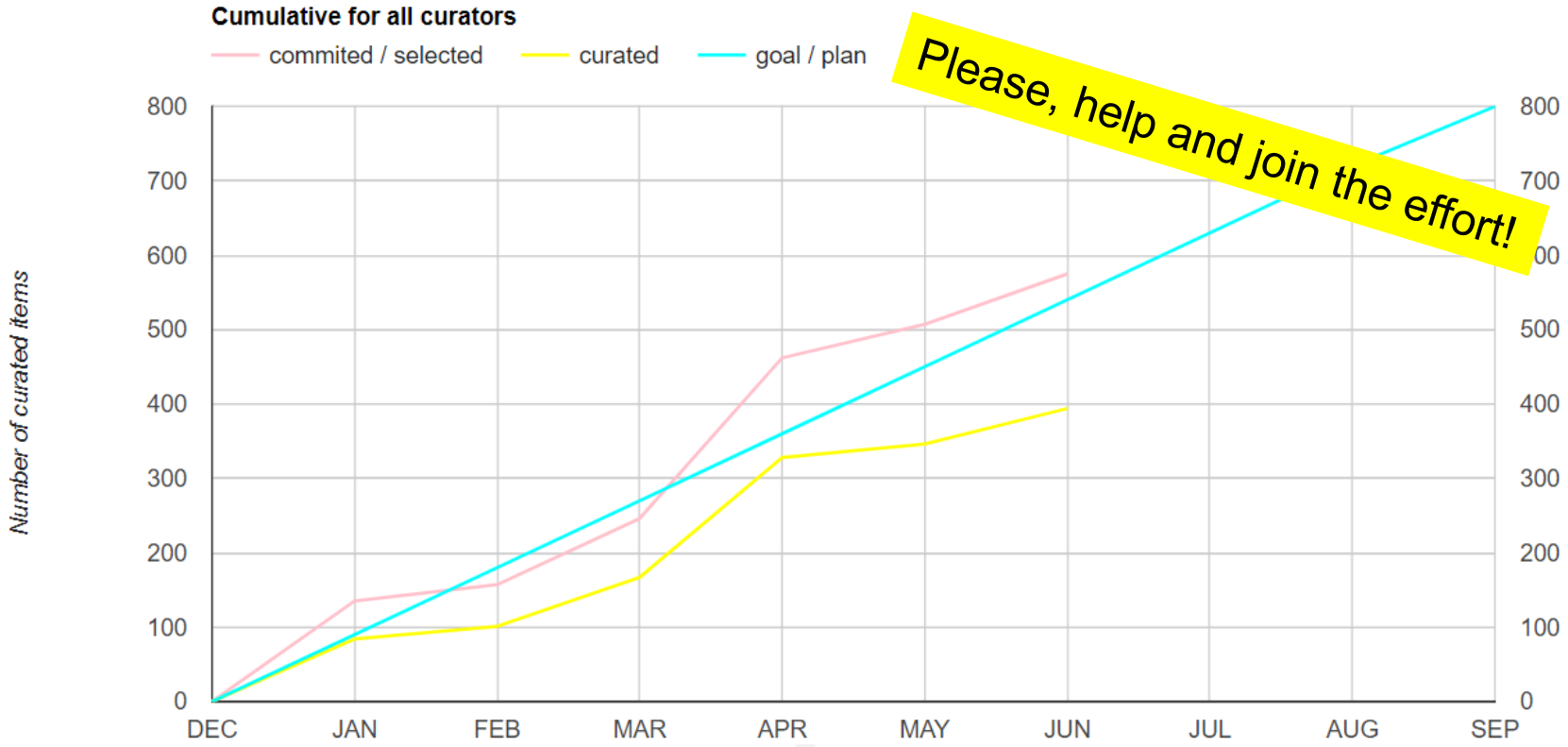
10. RELATED RESOURCES

Choose from all other items/resources!

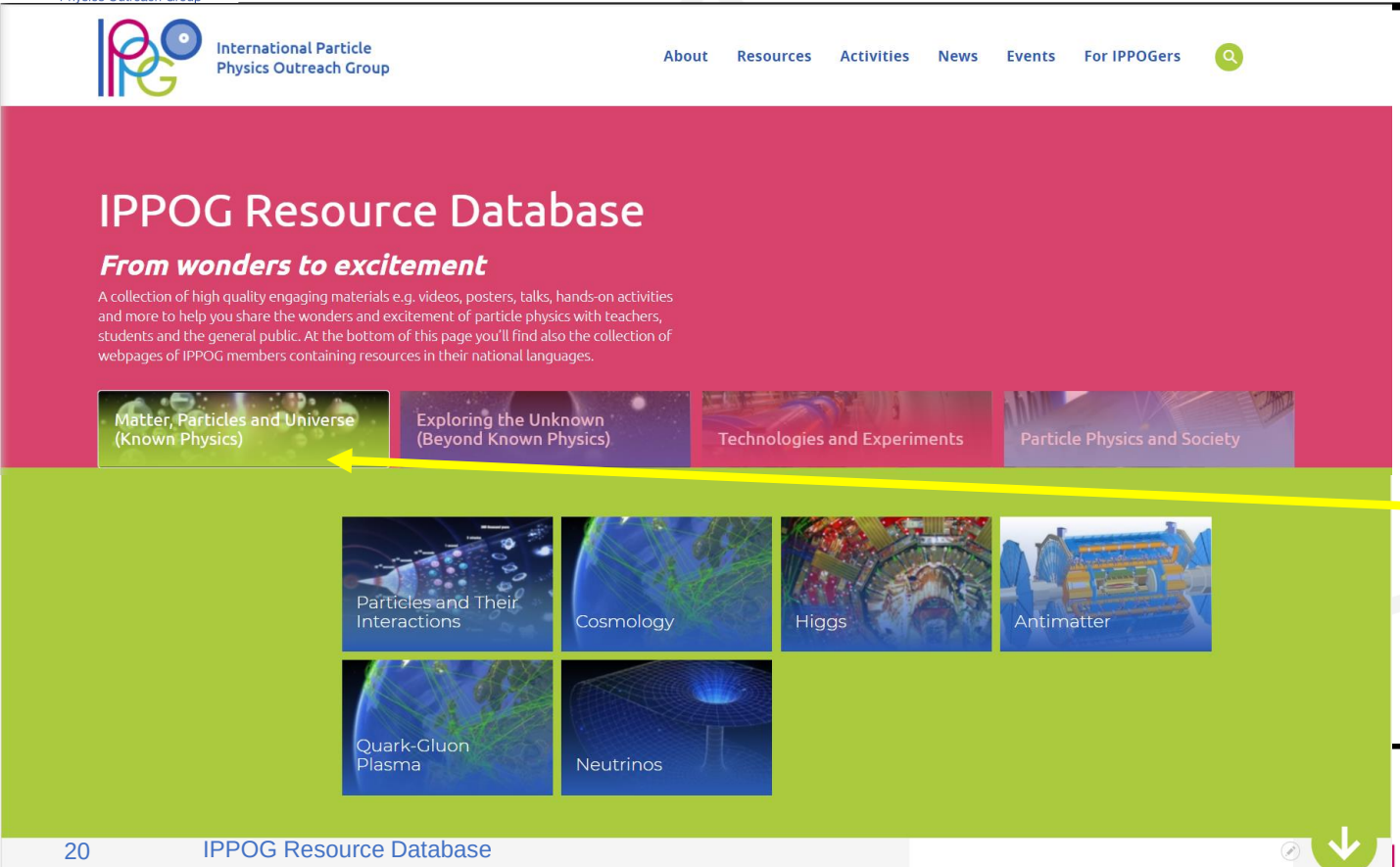
11. COMMENT

Free text

IPPOG RDB curation time evolution



New IPPOG RDB website preview



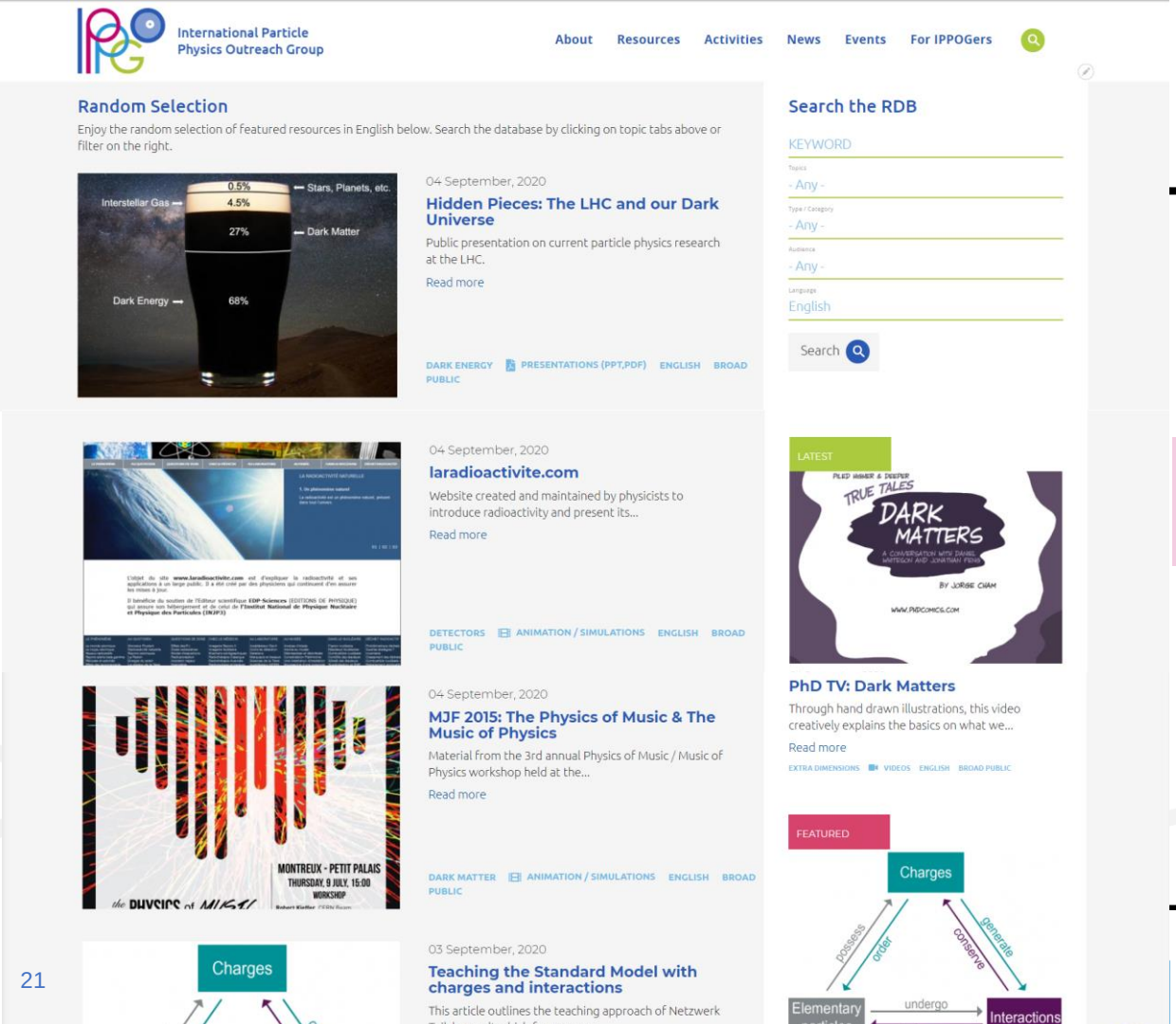
SEARCH:

1) Choose physics topic (from picture)

2) Filter in search engine

Hover on 1 from 4 main topics:

- Subtopics shown
- Random selection changing at each refresh shown below

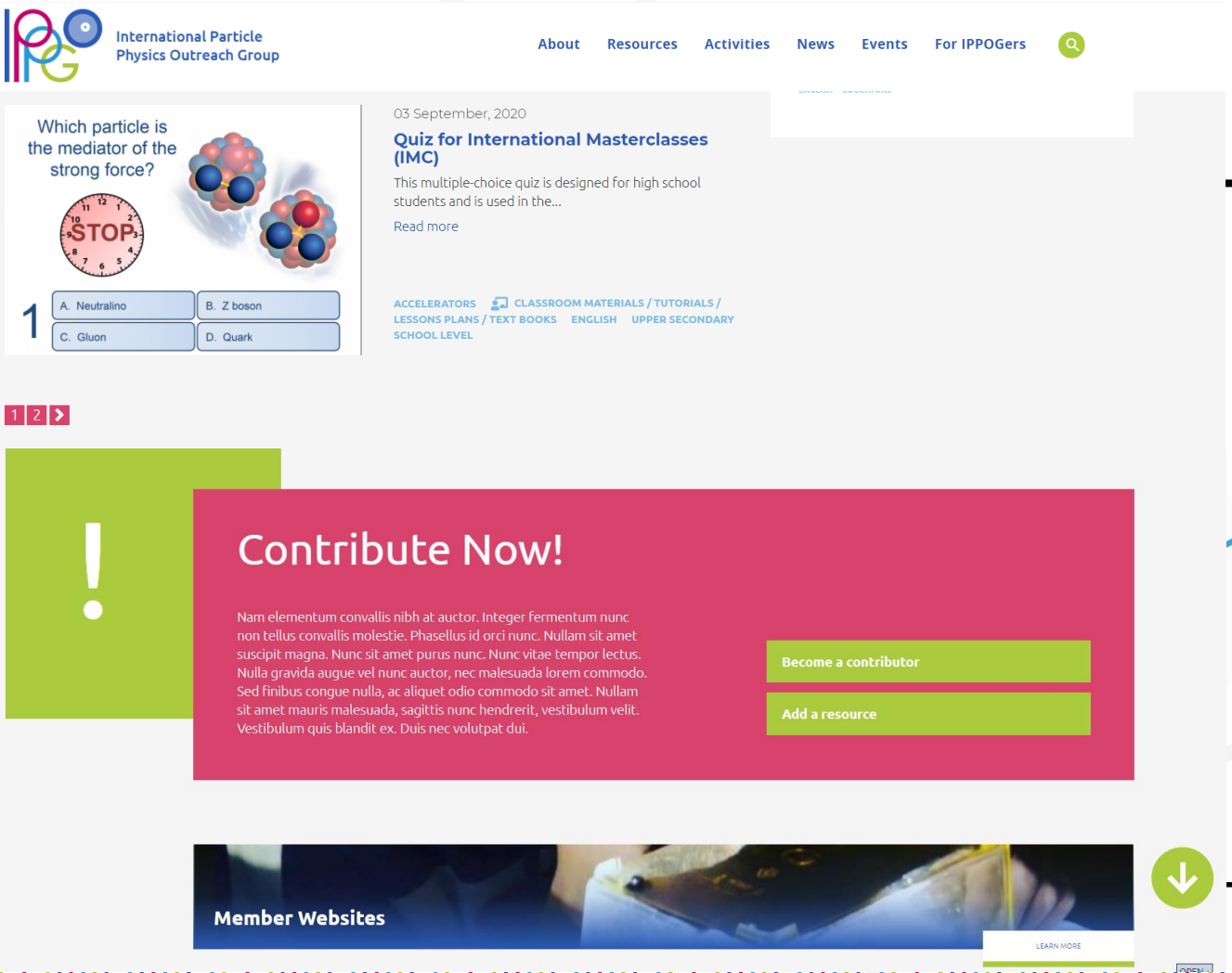


SEARCH:

1) Choose physics topic (from picture)

2) Filter in search engine

Order of items according to rating



USER FRIENDLY SUBMISSIONS:

- Clear instruction
- Form for contributors

IPPOG Resource Database Challenges

TECHNICAL

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CONTENT

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- ❑ Collection of new / up-to-date best items
- ❑ New content development

Collecting new resources for RDB

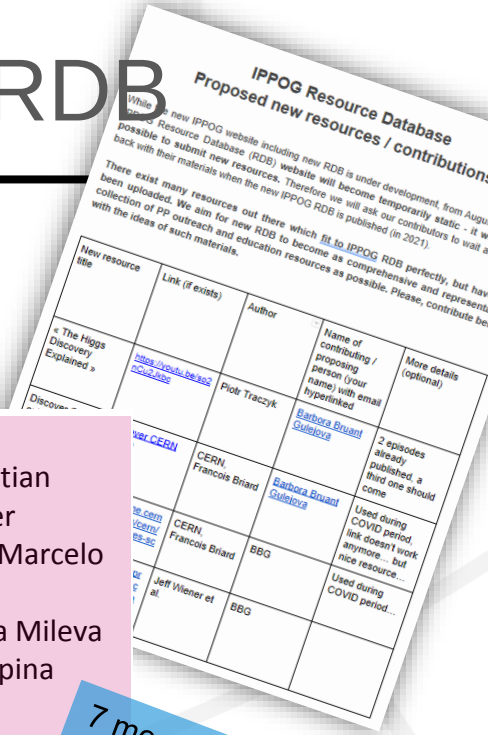
- Collecting efforts since December 2020 (google doc)

New RDB Working Group (May 2021):

- Complete
- Wrap up
- Evaluate
- Assign new tags
  - with help of dedicated curation tool

Open to join!

RUI[illegible]O, Alberto
[illegible]AZANASHVILI, Alexander
[illegible]ANDBERG, Jonas
WOZNIAK, Krzysztof Wieslaw
WETZLER, Susan
WEGNER, Jeremy
KLAMMER, Joel
GLOVER, Marla
COYLE, Helen
PAOLUCCI, Pierluigi
KIRILOVA, Galina
KLEIN BOESING, Christian
BEARDEN, Ian Gardner
GAMEIRO MUNHOZ, Marcelo
GORISEK, Andrej
HADJIISKA, Roumyana Mileva
HATZIFOTIADOU, Despina
MELO, Ivan
PRICE, Darren
BARDEEN, Marge
ADAM BOURDARIOS, Claire



7 members also in RDB curation group

Later we will create RDB standing committee

IPPOG Resource Database Challenges

TECHNICAL

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IPPOG New content under development

IPPOG Working Groups

- ❑ Explaining PP to Lay audience — Analogies, images, examples, stories…
- ❑ Outreach of Applications for Society — Stories with human touch

RDB main topic No 4

Tool for community to shape attitude and perception of physics and fundamental research by decision makers, funding bodies, media and public and even motivate young people to undertake physics studies.

TAKE PART!

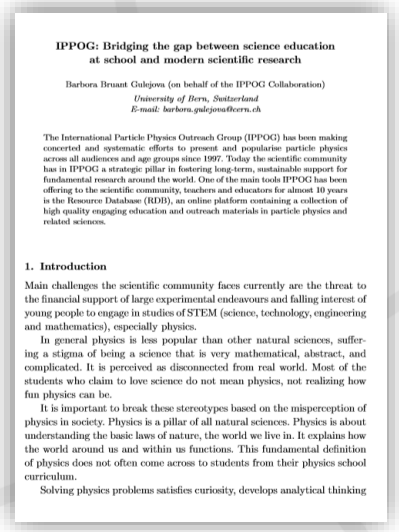
- ✓ STAY TUNED!!! New IPPOG websites coming up end 2021
- ✓ BECOME RDB CONTRIBUTER! Submit resources (2022)
- ✓ PROPOSE RDB ITEMS NOW!
- ✓ JOIN CURATION GROUP and/or RDB WG!

Contact barbora.gulejova@cern.ch

Learn more ….

IPPOG - Bridging the gap between science education at school and modern scientific research

Article submitted to World Scientific WSPC Gribov 90 (Pre-print available)
https://cds.cern.ch/record/2746338 and http://arxiv.org/abs/2011.14743



IPPOG: Bridging the gap between science education at school and modern scientific research

Barbora Bruant Gulejova (on behalf of the IPPOG Collaboration)

University of Bern, Switzerland
E-mail: barbora.gulejova@cern.ch

The International Particle Physics Outreach Group (IPPOG) has been making concerted and systematic efforts to present and popularise particle physics across all audiences and age groups since 1997. Today the scientific community has in IPPOG a strategic pillar in fostering long-term, sustainable support for fundamental research around the world. One of the main tools IPPOG has been offering to the scientific community, teachers and educators for almost 10 years is the Resource Database (RDB), an online platform containing a collection of high quality engaging education and outreach materials in particle physics and related sciences.

1. Introduction

Main challenges the scientific community faces currently are the threat to the financial support of large experimental endeavours and falling interest of young people to engage in studies of STEM (science, technology, engineering and mathematics), especially physics.

In general physics is less popular than other natural sciences, suffering a stigma of being a science that is very mathematical, abstract, and complicated. It is perceived as disconnected from real world. Most of the students who claim to love science do not mean physics, not realizing how fun physics can be.

It is important to break these stereotypes based on the misperception of physics in society. Physics is a pillar of all natural sciences. Physics is about understanding the basic laws of nature, the world we live in. It explains how the world around us and within us functions. This fundamental definition of physics does not often come across to students from their physics school curriculum.

Solving physics problems satisfies curiosity, develops analytical thinking

Private zoom room for further discussion

https://cern.zoom.us/j/64513997002

THANK YOU

Meeting ID: 645 1399 7002
Passcode: same as this session passcode

BACKUP SLIDES

Outreach for future PP endeavours

Future projects (FCC) will require a long-term, world-wide commitment of **significant monetary resources** and **human expertise.**

For success of such an endeavour are needed:

- ✓ the establishment of **broad public support,** as well as the **commitment of key stakeholders and policy makers** throughout Europe and the world
- ✓ **New generation of technically skilled specialists**, physicists and engineers…

Current, well-focused concerted and global **outreach and communication** efforts to engage the public are **already today of vital strategic importance**.

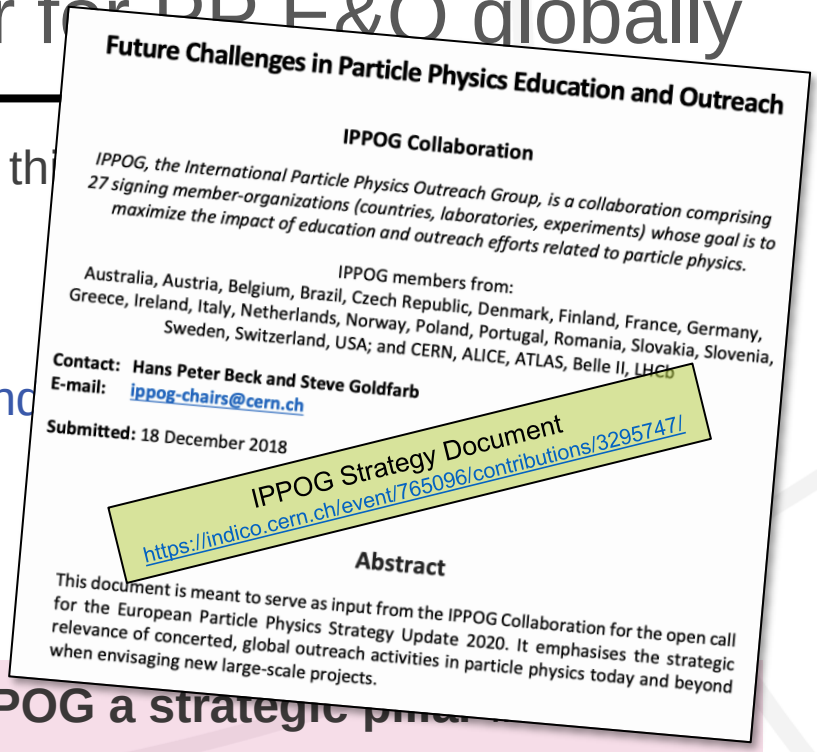
IPPOG Collaboration, Input to EPPSU 2019

IPPOG – strategic pillar for PP E&O globally

IPPOG is already laying down the ground work for thi

de-facto through its **mission**:

- **Establish Understanding** of scientific process
- **Instil Appreciation** of fundamental research and reasoning
- **Build Trust** with communities
- **Train Next Generation** of scientists



Future Challenges in Particle Physics Education and Outreach

IPPOG Collaboration

IPPOG, the International Particle Physics Outreach Group, is a collaboration comprising 27 signing member-organizations (countries, laboratories, experiments) whose goal is to maximize the impact of education and outreach efforts related to particle physics.

IPPOG members from:
Australia, Austria, Belgium, Brazil, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Sweden, Switzerland, USA; and CERN, ALICE, ATLAS, Belle II, LHCb

Contact: **Hans Peter Beck and Steve Goldfarb**
E-mail: ippog-chairs@cern.ch

Submitted: 18 December 2018

IPPOG Strategy Document
https://indico.cern.ch/event/765096/contributions/3295747/

Abstract

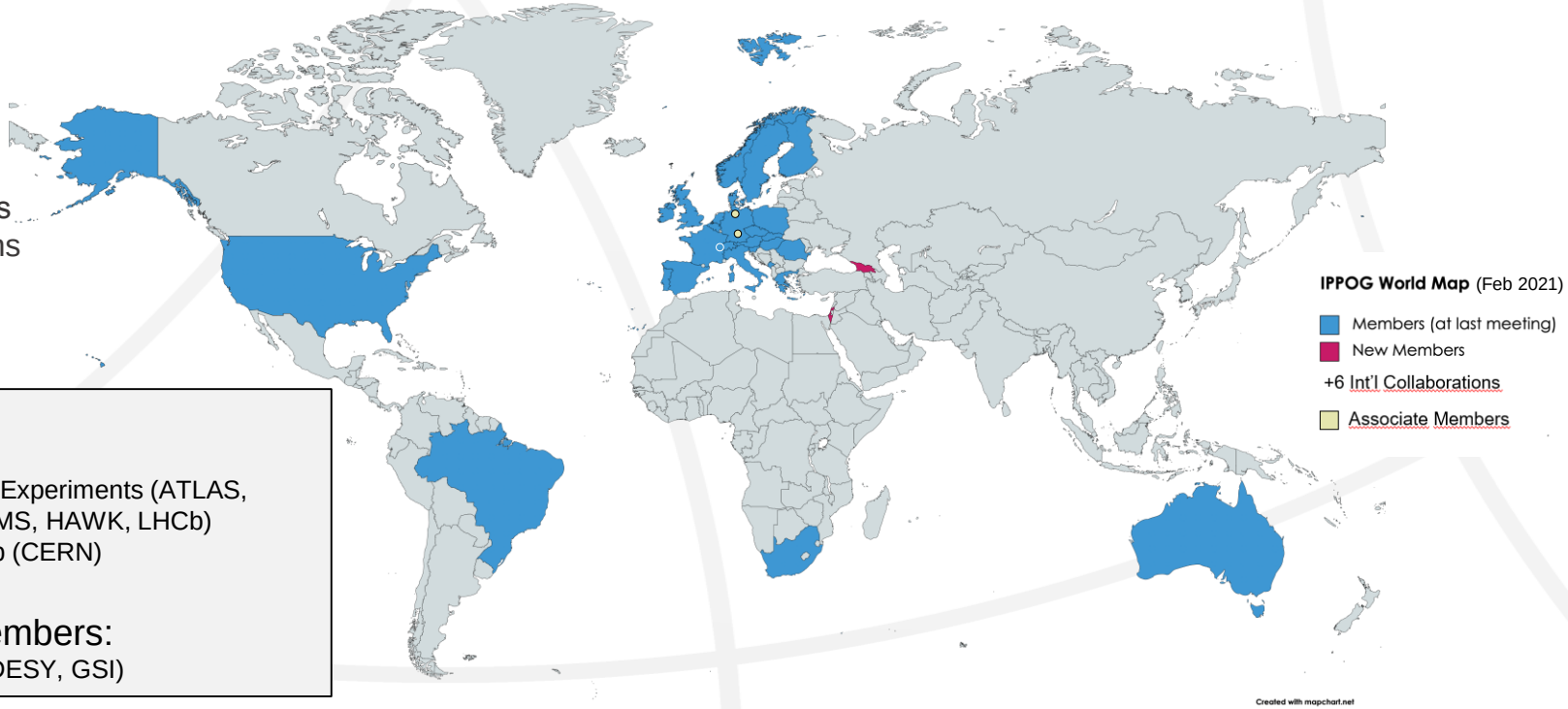
This document is meant to serve as input from the IPPOG Collaboration for the open call for the European Particle Physics Strategy Update 2020. It emphasises the strategic relevance of concerted, global outreach activities in particle physics today and beyond when envisaging new large-scale projects.

Today, PP and **scientific community has in IPPOG a strategic pill**

long-term, sustainable support for fundamental scientific research around the world.

IPPOG: Global Network

- Asia
- Africa
- Australia
- Europe
- The Americas
- International Labs and Collaborations



37 Members:

- 30 Countries
- 6 Collaborations / Experiments (ATLAS, ALICE, Belle II, CMS, HAWK, LHCb)
- 1 International Lab (CERN)

2 Associate Members:

- 2 National Labs (DESY, GSI)

Activities with global reach

International Masterclasses in Particle Physics

- Flagship activity for high schools students (15–18 y.)
- Real Data from ATLAS, CMS, ALICE, LHC-b, Belle-II, MINERvA, Hadron therapy

Worldwide data Day

Global Cosmics

- Network of Cosmic Rays Projects for Schools
- International Cosmic Day and International Muon Week

… and many other projects, competitions, campaigns and activities…