

# OUTREACH ACTIVITIES IN HEP

*Dr. Kétévi Adiklè Assamagan  
Brookhaven National Laboratory*

*Visiting Scientist  
at the University of the Witwatersrand, South Africa*



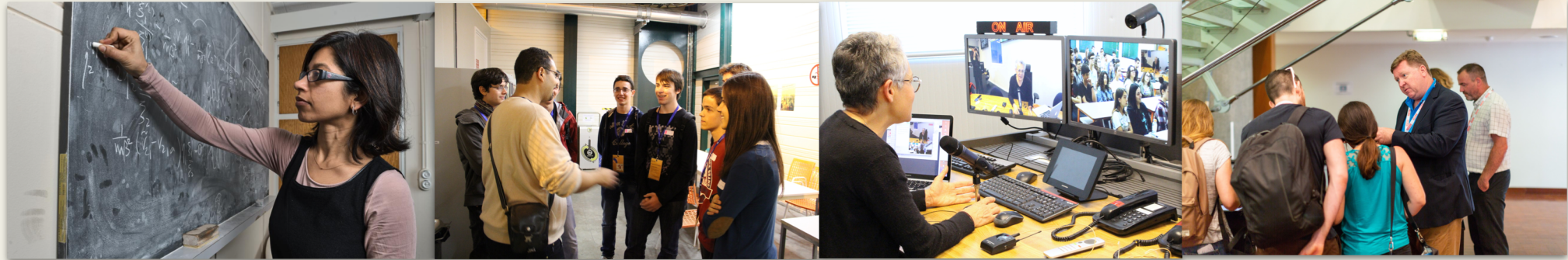
# Outline

- The ECOsystem
- International Masterclasses
- AIMS
- Phantom of the Universe
- The African School of Physics (ASP)





# Education, Communication and Outreach – the ECOsystem



## Professional educators

Help acquire knowledge, competence and confidence.  
Contribute to education research. Our gateway to the future.

## Professional communicators

Advise management. Plan strategically. Help make good use of already existing channels. Monitor upcoming opportunities.

## Scientists

Carry out scientific research. May be outreachers, teachers.  
Sometimes engage with decision makers and society.

→ Coordinated work of all actors is crucial

Perrine Royole-Degieux

# Coordination of ECO at all levels



Public support needed at regional, national, and international level.

Yet ECO resources are unequal across countries



Shall we agree on a minimum human and financial resource to dedicate to ECO, nationally?

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# After the Higgs boson discovery:

building on reputation - capitalizing - enlarging audience



Masterclasses with real Higgs data (since 2013)  
European strategy update (2013)  
CERN 60th anniversary (2014)  
Beam Line for School (2014)  
High School Students Internship Programme (2017)  
Teacher programmes  
Open Days at CERN and European labs  
Travelling exhibitions  
Collider exhibition  
Public event during HEP conferences  
Dark Matter Day (since 2017)  
HL-LHC media event (2018)  
and soon: CERN Science Gateway (2022)

...

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GERMANY



UK



SPAIN



FRANCE



PORTUGAL



ITALY



CERN

Perrine Royole-Degieux

Dr. Kétévi A. Assamagan, BNL & Visiting Scientist at the University of the Witwatersrand



# Demonstrate impact

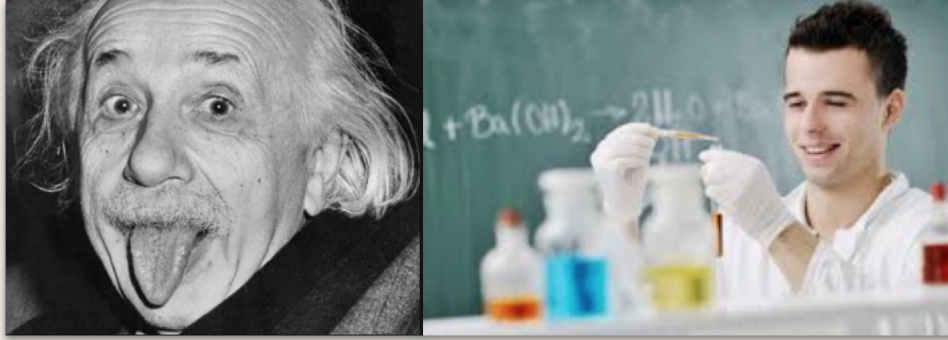


We need to demonstrate economic, social and environmental impacts of our research, using appropriate metrics.



How to generate support from third-party advocates for our field (and its impact on society)?

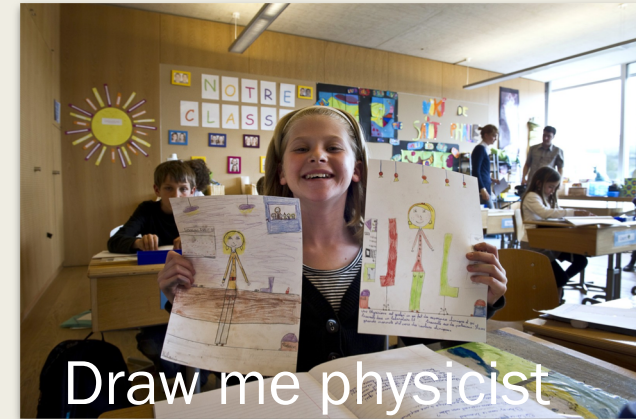
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# What does a physicist look like?

## Perceptions count

Efforts have already been made, although there is a significant lack of diversity in our field.



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# A few examples of ECOsystem in HEP

- International Masterclasses
- Phantom of the Universe

# INTERNATIONAL MASTERCLASSES - Overview

## What is a Masterclass?

- “Particle physicist for a day”
- *Intro*
- *Tour*
- *Analyze authentic HEP data*
- *Videoconference*



## *International Masterclasses 2019 and beyond*

- *> 50 Countries*
- *> 10<sup>4</sup> Students*
- *4 LHC experiments*
- *1 new Neutrino experiment*
- *More on the way*



Uta Bilow & Kenneth Cecire



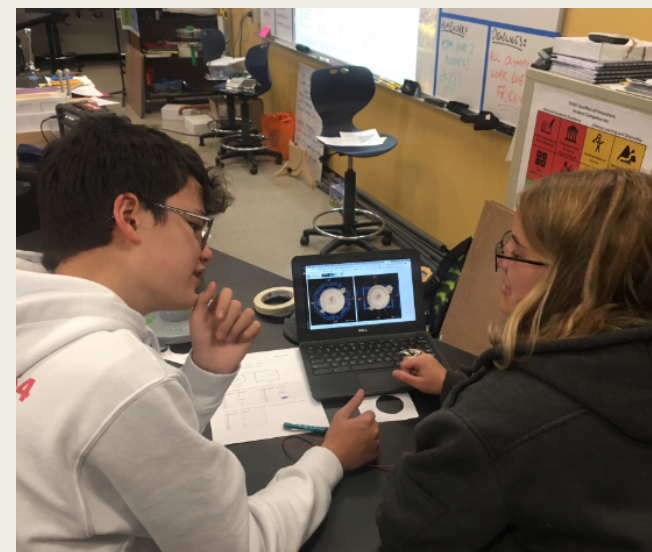
# Masterclasses Expand

## **New opportunities**

- *World Wide Data Day (W2D2)*
- *Masterclasses for International Day of Women and Girls in Science (IDWGS)*

## **New measurements**

- *CMS upgrade*
- *Belle II*
- *MINERvA*
- *More neutrino Masterclasses*
- *Particle Therapy Masterclass*
- *J/Psi Masterclass from GSI*
- *More on the way*



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# World Wide Data Day - W2D2

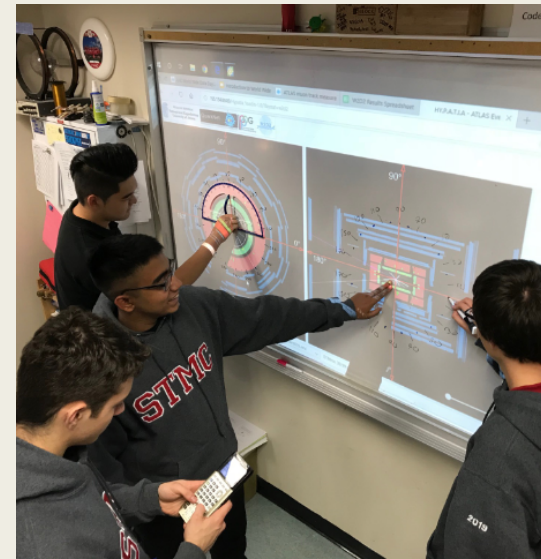
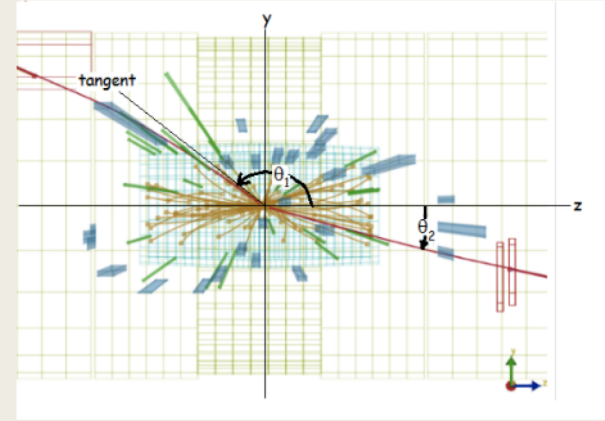


## What it is

- *Simple measurement:  $\phi$  and  $\theta$  of muons in CMS or ATLAS events*
- *Can be done by teachers and students in school*
- *Worldwide combination of data*
- *24-hour shift of videoconferences*

## Get involved

- *Takes place in Oct or Nov each year (2019: Oct 16)*
- *Inform physics teachers*
- *Contact Ken*



Uta Bilow & Kenneth Cecire

# International Day of Women and Girls in Science - IDWGS



## What it is

- *LHC Masterclass measurements*
- *By and for girls*
- *Learn about particle physics*
- *Discuss women in science*

## Get involved

- *Takes place in Feb each year*
- *Recruit students, teachers, tutors*
- *Women as role models*
- *Encourage young women with a friendly physics environment*
- *Contact Uta Bilow*

Uta Bilow & Kenneth Cecire



# Interesting Future

## Challenges

- *Growing (more countries, more days/weeks/months)*
- *More centers for videoconferences*
  - CERN, Fermilab, TRIUMF
  - Plus KEK, GSI
- *Organization and Coordination*
- *Structure will expand*

## Opportunities

- *Rich offerings develop all involved*
- *New offerings yield new methods*
- *Multiplying pathways to reach students and teachers*



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# Phantom of the Universe

A Planetarium Show

Seen by about **4 million** people

More than **500** planetariums in

**66** countries on **6** continents.

(In the US in **43** states)

<http://PhantomOfTheUniverse.org>

**21** languages

**Dark Matter Day:** Shown in many planetariums

**Michael Barnett, Kaushik De, Reinhard Schwienhorst  
and an international team including:**

- Academy Award-winning actress as narrator
- Academy award winning sound by Skywalker Sound
- Hollywood scriptwriter and producer

A banner image for the planetarium show 'Phantom of the Universe'. It features a dark space background with vibrant, glowing green and yellow light trails or nebulae. The title 'Phantom of the Universe' is written in a large, white, sans-serif font, and 'A Planetarium Show' is written in a smaller, white, sans-serif font below it.

# Phantom of the Universe

A Planetarium Show

## Why a planetarium show?

<http://PhantomOfTheUniverse.org>

- **More dramatic than IMAX (it surrounds you).**
- **Great way to show Galaxies, Collisions, etc.**
- **They present our show for months at a time.**
- **Planetariums have the perfect science-interested audience for us – general public and K12.**
- **110 million people a year watch planetarium shows.**

**None of this would have been possible with an ordinary film.**

**Michael Barnett, Kaushik De, Reinhard Schwienhorst  
and an international team**

# A few examples in Africa

- AIMS
- The African School of Physics



# **African Institute for Mathematical Sciences**

One-year intensive MSc program



In August 2016



# AIMS so far

- 1210 alumni, 250+ entering this month
- 30% women
- almost half continue to PhDs
- 65% currently working in Africa
- 3000 applications this year for
- Six centres so far: South Africa, Senegal, Ghana, Cameroon, Tanzania, Rwanda



# African School of Fundamental Physics and Applications

- Also known as “The African School of Physics”
- Acronym: ASP
- Logo: as above
- <https://www.africanschoolofphysics.org>
- Organized biennially in different African countries since 2010 by an International Organizing Committee (IOC)
  - [ASP-IOC@CERN.CH](mailto:ASP-IOC@CERN.CH)

ASP	Host Country	Applicants	Students	Mentorship	Teachers	Pupils	Conference
2010	South Africa	125	65	Continuously, even when there is no formal school			
2012	Ghana	138	50				
2014	Senegal	330	70				
2016	Rwanda	429	75	Program formalized in 2016	20	150	
2018	Namibia	523	85		63	> 1200	+60

# ASP Organization

Local Organizing Committee (LOC) –  
in the host country  
Local logistics  
Liaise with Education and Research  
branches of host country government

## Objective:

Increase capacity  
development in  
fundamental physics  
and related  
applications in Africa

International Advisory Committee  
(IAC)  
Representatives of funding agencies  
Advise on the program  
Advise of the host country selection

## Assessment of Impact

Survey of students  
Survey of their Professors  
Follow academic developments

International Organizing Committee  
(IOC)  
Overall management  
Fund raising  
Coordination of activities  
Activity reports to Funding agencies

International Lecturers (IL)  
Design the scientific Program  
Help with the student selections  
Mentor and Coach students  
continuously

## Spin-Offs

ASP Mentorship/Coaching Program  
Networking and sharing of information  
Align ASP with educational priorities  
Improve future editions of ASP  
Promote research collaborations  
Promote research consortia



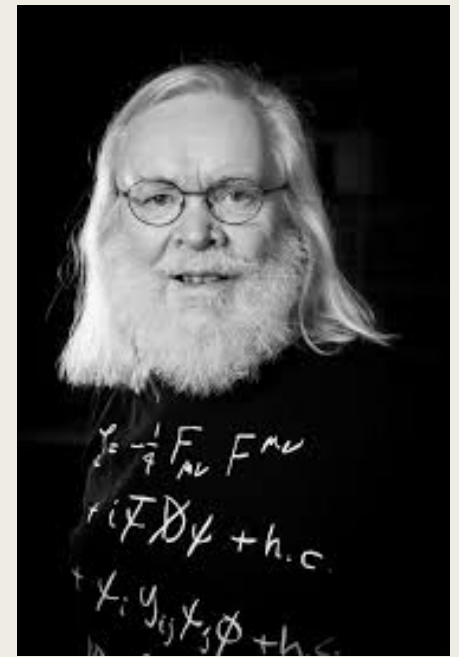
# Current Members of the IOC



Dr. Anne E. Dabrowski  
CERN



Dr. Steve G. Muanza  
CNRS-IN2P3  
France



Prof. John R. Ellis  
CERN and  
King's College London



Prof. Bobby Acharya  
ICTP and  
King's College London



Dr. Christine Darve  
ESS



Prof. Fernando Ferroni  
GSSI-INFN

Dr. Kétévi A. Assamagan  
BNL





# ASP Scientific Program

## Fundamental Physics and Applications

*Astrophysics and Cosmology;  
Nuclear and Particle Physics;  
Accelerator, Medical and Radiation Physics;  
High Performance Computing;  
Renewable Energies and Energy Efficiency;  
Material Physics;  
Physics Education & Communication*

*Emphasis tailored to the physics  
interests of the host country, e.g.  
Namibia: astro & cosmology,  
material physics*

# ASP Activities

## Student Program

**3-week** intensive school 3<sup>rd</sup> year of University to Ph.D. Mostly African Students. 70-80 Students selected from >500 applications by a committee of lecturers.

## Mentorship / Coaching Program

**At all times**

Work with Academic Advisors  
Connect Students with Researchers  
Place students at Laboratories  
Listen to students and help address their academic needs if possible

## High School Teachers Program

**1-week** intensive workshop to Train High School Teachers for improved physics teaching

## Learners Program

**1-week** learners Outreach  
10-12<sup>th</sup> grade learners  
Encourage learners to develop and maintain interests in Physics and Applications

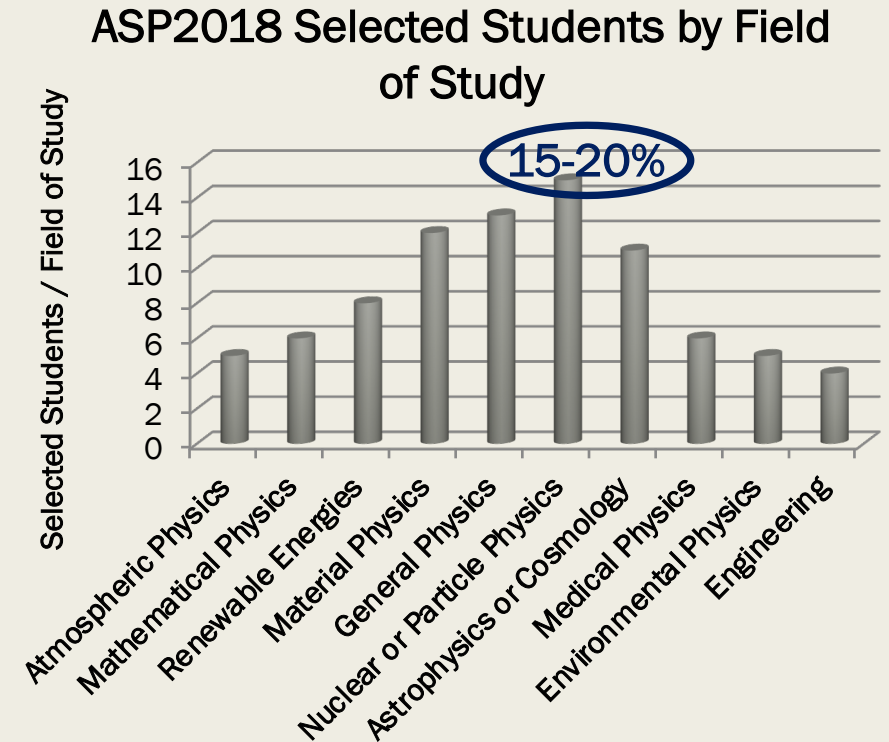
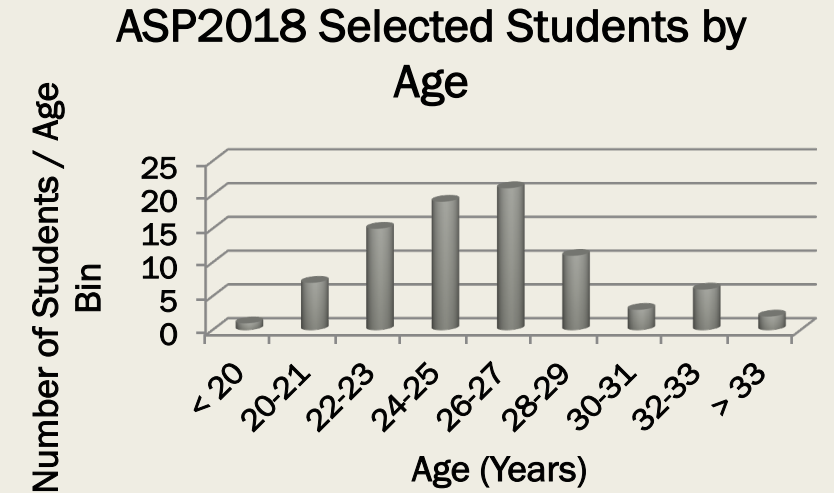
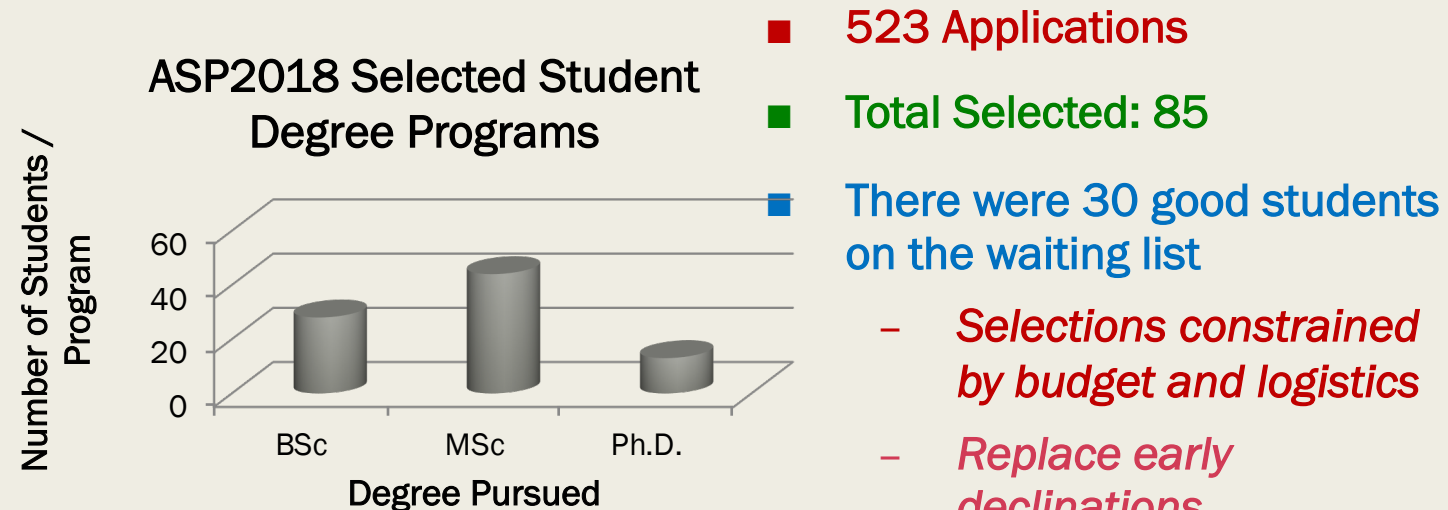
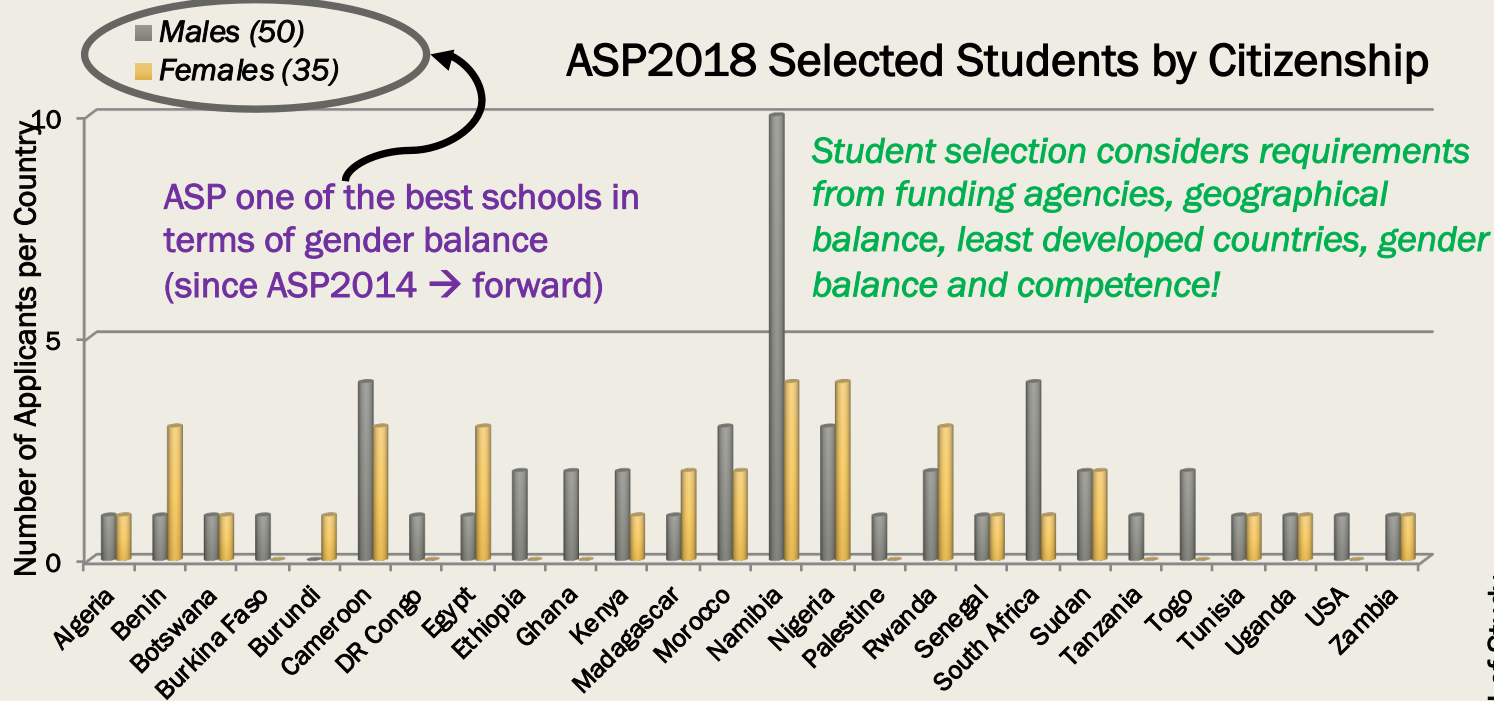
## ASP Conference

**1-week** International Conference  
Participation of ASP Alumni  
Participation of Research Faculties  
Networking and collaborations

## ASP Forum

**1-day** to discuss capacity development and retention in Africa & the role of ASP

# ASP2018 Students Profile



# High School teachers Program

**Objective:**  
Support teachers growth  
in the planning and  
delivering of instructions

**One week event:**  
Up to 70 teachers from the  
host country identified by the  
Local Organizing Committee  
and the Ministry of Education



**Teachers program  
runs in parallel to  
the students  
program**



# High School learners Program

## Objective:

Motivate high school pupils to develop and maintain interest in Physics

## One week:

We cover up to 40 high schools around the venue; 1500-2000 high school learners



Learners program runs in parallel to the students program

Program designed such that the lecturers that are not lecturing to students can help with the learners program



# ASP2018 – Conference

## Objective:

- Attract ASP alumni;
- Attract African research faculties;
- Attract international participants not part of ASP;
- Foster new research collaborations

## One week:

The physics topics taught at the school form the core of the ASP conference.

People may attend only the conference part of ASP. We had 60 extra participants in ASP2018

Peer-reviewed conference proceedings published by the African Review of Physics

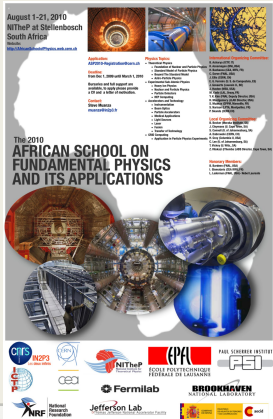


<http://aphysrev.ictp.it/index.php/aphysrev/issue/view/35>

# ASP Forum

## One day. Objective:

Align ASP with the research and education priorities of African countries

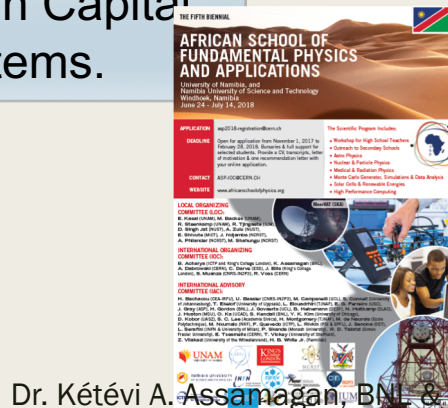


**AfLS and compact acc.**  
**Prof. H. WINICK**, Prof.  
Emeritus, SLAC and  
**Prof. L. SERAFINI**  
(INFN, IT)

**Dedicated to Knowledge and Transfer of Technology**  
Dr. D. ADAMS, chief director:  
Emerging Research areas &  
Infrastructure, Human Capital  
and Knowledge Systems.



**East Afr. Science and New ICTP Center**  
Rwandan Ministry of Education



Dr. Kétévi A. Assamagan, BNL & Visiting Scientist at the University of the Witwatersrand



**UN support**  
Dr. H. TOURE, UN ITU Secretary  
General.  
Prof. A. WAGUE and O. KA  
M. NGOM - US Embassy rep.



Dr T. TJIVIKUA, Vice-Chancellor,  
Namibia University of Science  
and Technology (Namibia)  
Dr. R. ADAM (SKA, SA)





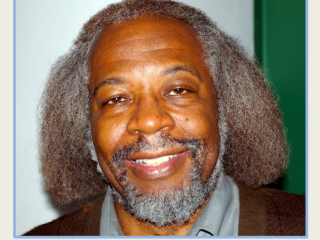
# ASP Mentorship Program

- It runs continuously even when there is no school;
- Open to ASP student alumni in Ph.D. programs;
- Pairing of students to lecturers. Lecturers to mentor and coach them;
  - *Not a replacement of academic advisors, rather in addition to / in collaboration with it*
- Helps IOC track students after the school;
- Helps answer the questions, “Where are they now?”, “What happens to them after they’ve attended ASP?”
  - *These are legitimate questions*
  - *Mentorship program supplemented by periodic of surveys*
- Program formalized soon after ASP2016;
- Through this program, we place ASP alumni in high education programs in South Africa, Asia, Europe and North America



# World-Class Lecturers

- ✧ People-oriented lecturers willing to share their experience with African students
- ✧ Highly motivated and motivating characters
- ✧ Most of ASP lecturers are financially supported by their home institutes
- ✧ Provide fruitful interactions with students
- ✧ Lecturers typically attend the ASP for 3 - 7 days





**THE SIXTH BIENNIAL  
AFRICAN SCHOOL OF**

**THE SECOND BIENNIAL  
AFRICAN CONFERENCE ON**

**FUNDAMENTAL PHYSICS AND APPLICATIONS**

July 5-25, 2020      July 20-24, 2020

**Co-organised by Mohammed V & Gadi Ayyad Universities, Morocco**  
**at Faculty of Science Semlalia, Marrakesh**

**ASP**

To increase capacity development in fundamental physics and related applications in Africa. The ASP has evolved to be much more than a school. It is a program of actions with directed ethos toward physics as an engine for development in Africa

**SCIENTIFIC PROGRAM**

► TOPICS

- Astrophysics & Cosmology
- Nuclear & Particle Physics
- Accelerator, Radiation & Medical Physics
- Renewable Energies & Energy Efficiency
- Materials Physics
- High Performance Computing
- Physics Education
- Physics Communication
- Quantum Information

► ACTIVITIES

- Workshop for High School Teachers
- Outreach for Secondary Schools
- Physics Lectures and Tutorials for Students
- Forum to Discuss Capacity Development & Retention
- African Conference on Fundamental Physics & Applications

**PARTICIPATING INSTITUTIONS:**

FEI    ICTP    THE UNIVERSITY OF BIRMINGHAM    UFFSALA UNIVERSITET

INFN    DESY    KING'S COLLEGE LONDON    UNIVERSITY OF WISCONSIN    CNRS    IN2P3    MAGAZICH    HEP

CERN    ESRF    NERSC    TEMBA LABS    NRF    RISA    UPAP

www.africanschoolofphysics.org / asp2020/

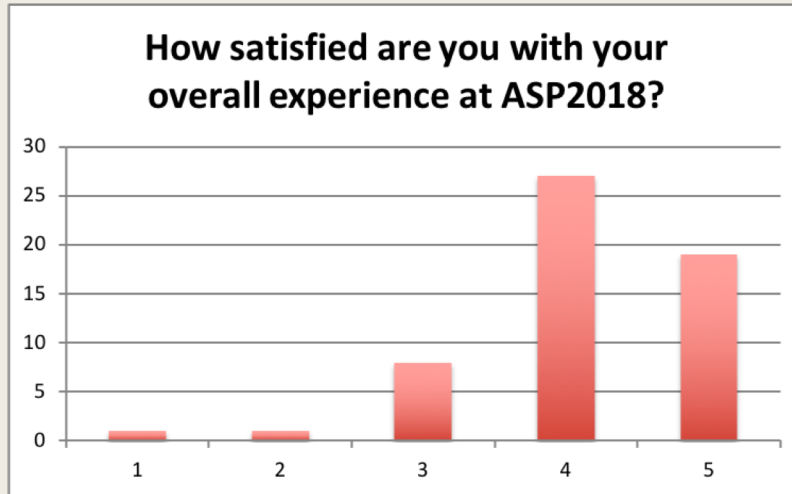
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- A photograph showing a person in a blue and red robe kneeling in the desert, interacting with a camel. The camel is standing and looking down at the person. The background is a vast, sandy desert under a clear blue sky.



# ASP Impact

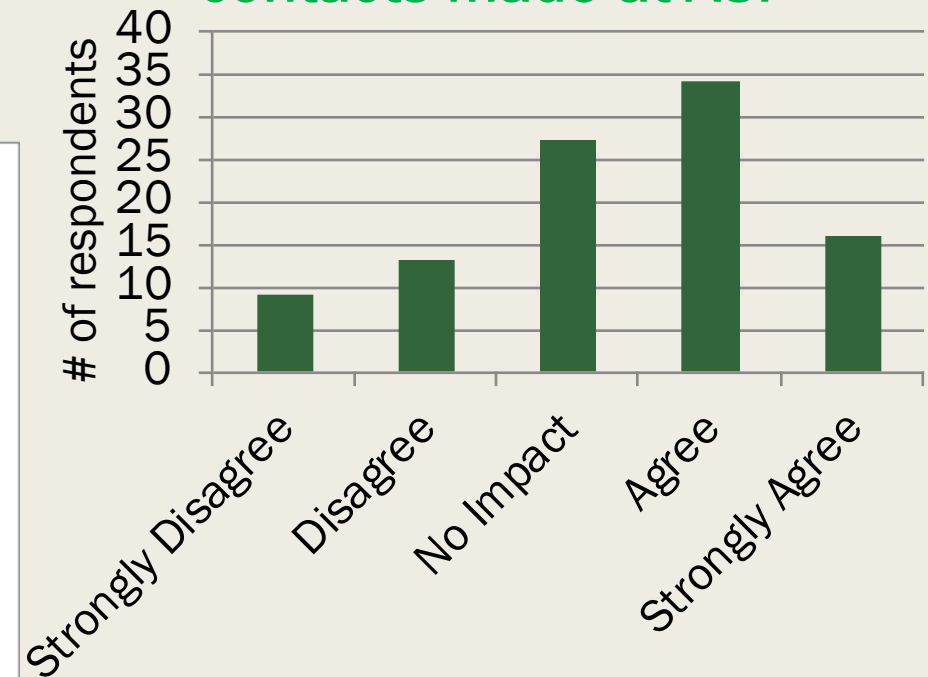
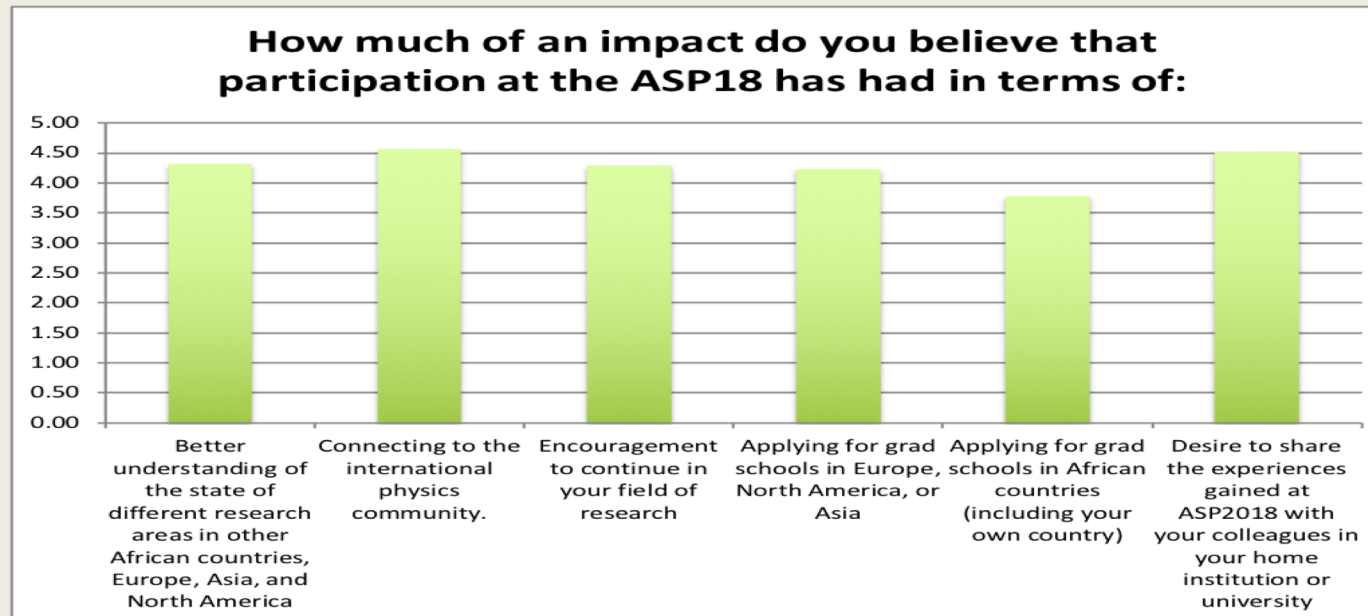
## ■ Two types of surveys done

- One toward the end of each edition (current participants)
- One every 4 years (all alumni)

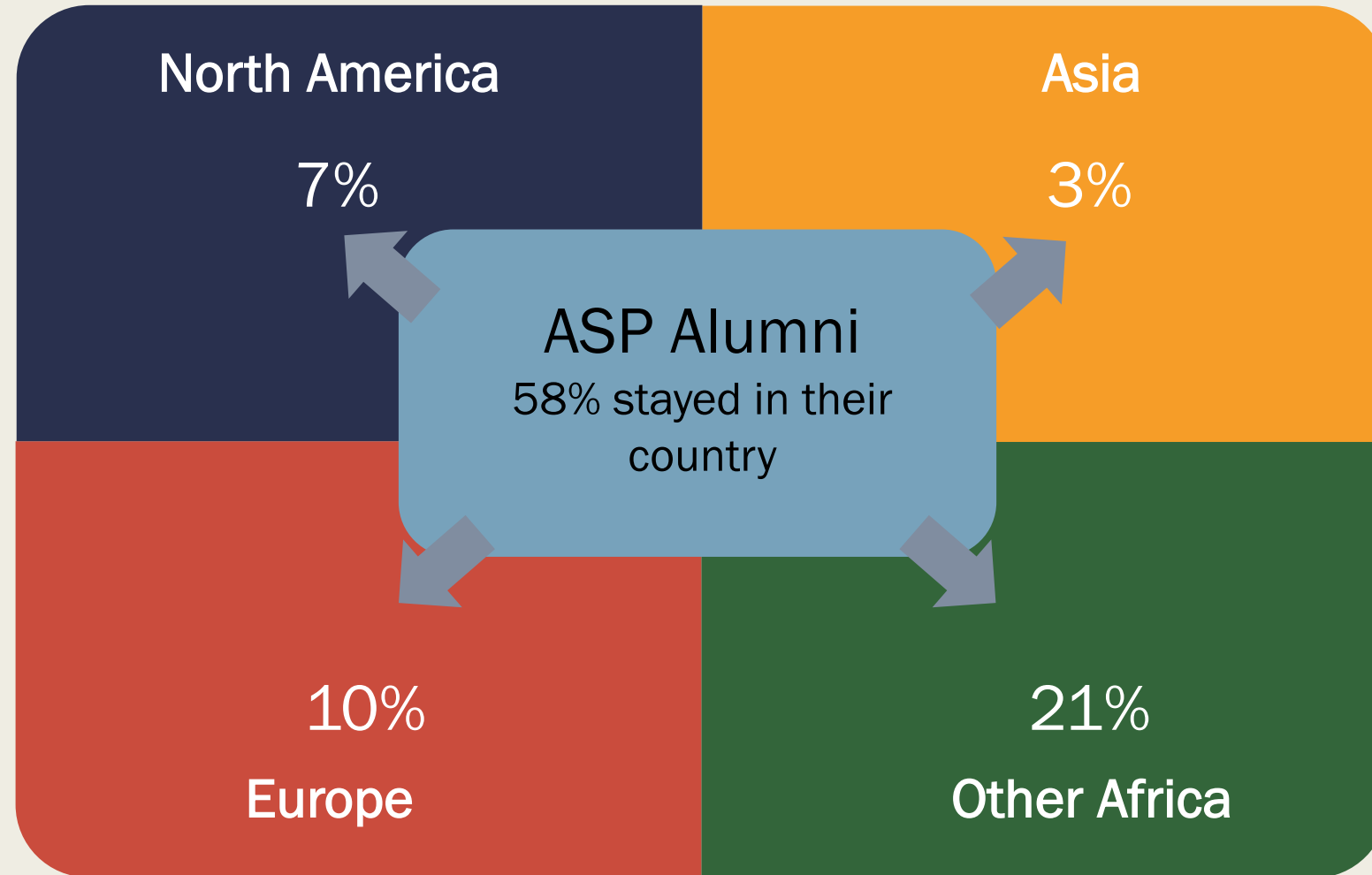


5 = very satisfied; highest impact

**My research has benefited through professional contacts made at ASP**



# Retention. Where do ASP alumni go?





# ASP - finally some relaxing time: Excursions and Festivities





# Conclusion

- There are many successful ECOsystem in HEP
- The key is to
  - *educate and demonstrate the impact of HEP*
  - *increase and encourage diversity*

*With coordination at all levels*
- ASP has evolved to be much more than a school. It is a program of actions with directed ethos toward physics as an engine for development in Africa.

# Additional slides

# ASP Sponsorships for Participants

“If each African country supports its participants, or contributes 2500 Euros every year to the ASP budget, ASP will be entirely financed by African countries. And \*2500 Euros\* is marginal even for the least developed country”

Budget for each cycle: 200 kEuros

ICTP Support major Student participation  
Management of application database  
Arrange student travels

Host Country Support Significant  
In-kind support  
Direct Financial contributions  
Human Resources toward ASP Organization

ASP2018 Sponsors in addition to USA DOE Labs (BNL)



African Contributors (2018):

- Namibia
- SA DST/NRF
- IUCEA

Integrated: ~40% ASP2018 budget

Fund Management  
Funds centralized and managed by the South African Institute of Physics (SAIP)

IOC

*Writes Proposals, Requests for Supports*  
*Produces Final Reports of Activities*  
*Seeking permanent financial backing*

Lecturers and Organizers  
Supported by External Sources - Significant  
Support received then used to maximize student participation

# ASP Overview

## ASP2010

First Edition in South Africa  
August 1-21, 2010  
125 Applications and 65 selected  
from 17 countries

## ASP2020 Morocco

Host countries selected  
2.5 years earlier  
through a bidding process

Serious efforts to  
advertise widely

## ASP2018

Fifth Edition in Namibia  
June 24 to July 14, 2018  
523 Applications and 85 students  
selected from 26 countries

### Expansion

- Pupils Outreach  
(30 schools, 1500 learners, 1 week)
- Teachers Workshop (63 teachers, 1 week)
- Professional Physics Conference (1 week)

ASP Mentorship / Coaching Program  
Formalized since 2016. Runs continuously.  
Permanent assistance to students even  
when there is no formal school

## ASP2012

Second Edition in Ghana  
July 15 to August 8, 2012  
138 Applications and 50 students  
selected from 15 countries

## ASP2014

Third Edition in Senegal  
August 3-23, 2014  
330 Applications and 70 students  
selected from 21 countries

## ASP2016

Fourth Edition in Rwanda  
August 1-19, 2016  
429 Applications and 80 students  
selected from 28 countries

### Expansion:

- Pupils Outreach added  
(3 schools, 150 pupils, 3 days)
- Teachers Workshop Added  
(20, 2 days)

Feedbacks to improve future ASPs