# Fundamental Physics and Accelerator Sciences in Africa

Christine Darve

Main organizer of the ASP2010
European Spallation Source, ESS, Sweden
Former staff member at CERN and FNAL

http://AfricanSchoolOfPhysics.web.cern.ch/

Session B2: Invited Session: Science Diplomacy: Africa and the Middle East

# Outlines

- Mission of the African School of Fundamental Physics and its Applications

- Stakeholders:
  - ✓ Students
  - ✓ Founding Agencies, Institutes and Universities
  - ✓ The committees
  - ✓ The lecturers

- The first edition: South-Africa – August 2010

- The second edition: Ghana – July 2012

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# "African School of Fundamental Physics and its Applications"

A non-profit organization created by a small group of worldwide scientists

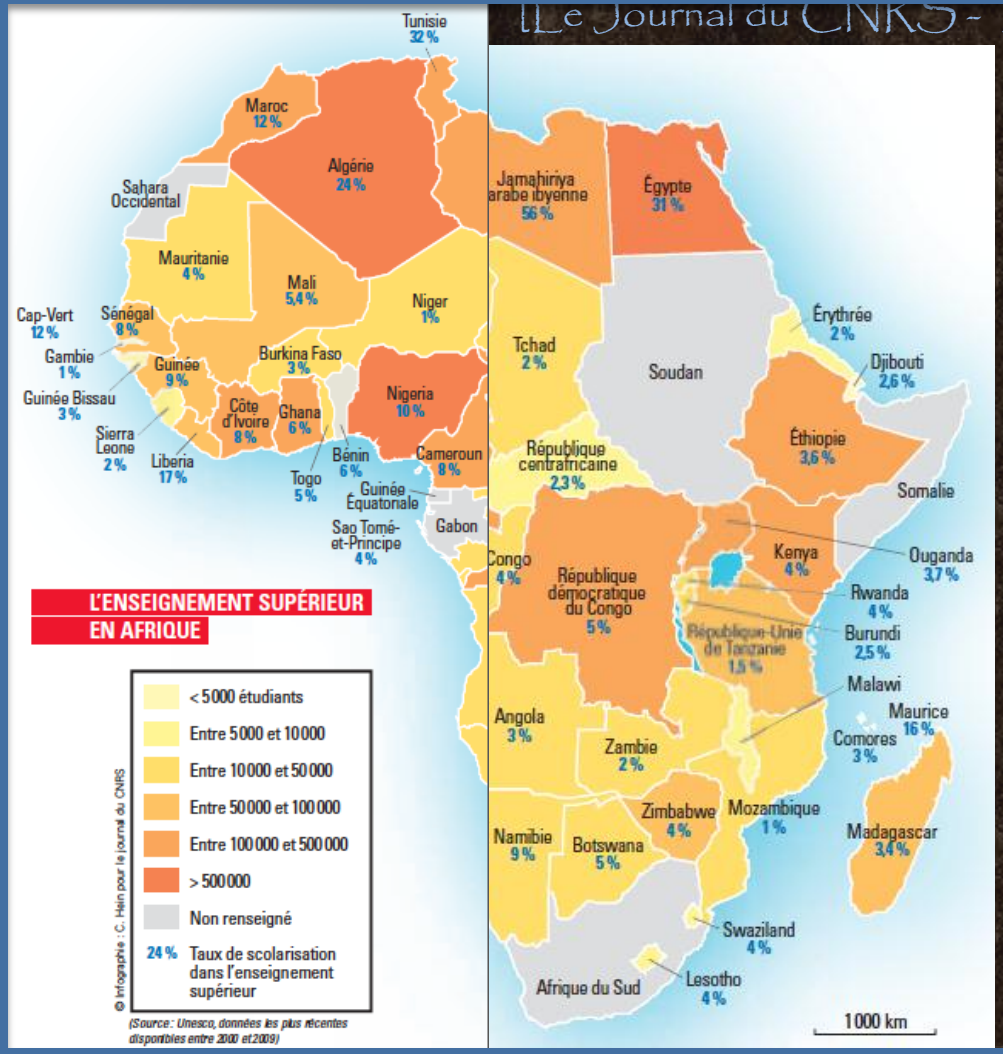
A High-Story to stimulate and include more talented physics students from the less developed countries in the world scientific community


The aim of the school is to build capacity to harvest, interpret, and exploit the results of current and future physics experiments with particle accelerators, and to increase proficiency in related applications and technologies.

- → To contribute to a world w/ equal access to knowledge
- → To establish a biennial school to be hosted across Sub-Saharan Africa
- → To cover the African students 3-week classes attendance
- → To provide high quality classes by international re-known Scientists

# University Education and African Diversities

(Le Journal du CNRS - May 2010)




**EFFECTIFS DE CHERCHEURS**

| Pays | Nombre total | Nombre par million d'habitants |
|---|---|---|
| Bénin | 1000 | 119 |
| Burkina Faso | 187 | 13 |
| Égypte | 95947 | 1198 |
| Éthiopie | 2377 | 30 |
| Madagascar | 1852 | 100 |
| Ouganda | 891 | 29 |
| République centrafricaine | 41 | 10 |
| Sénégal | 8709 | 732 |
| Togo | 834 | 132 |

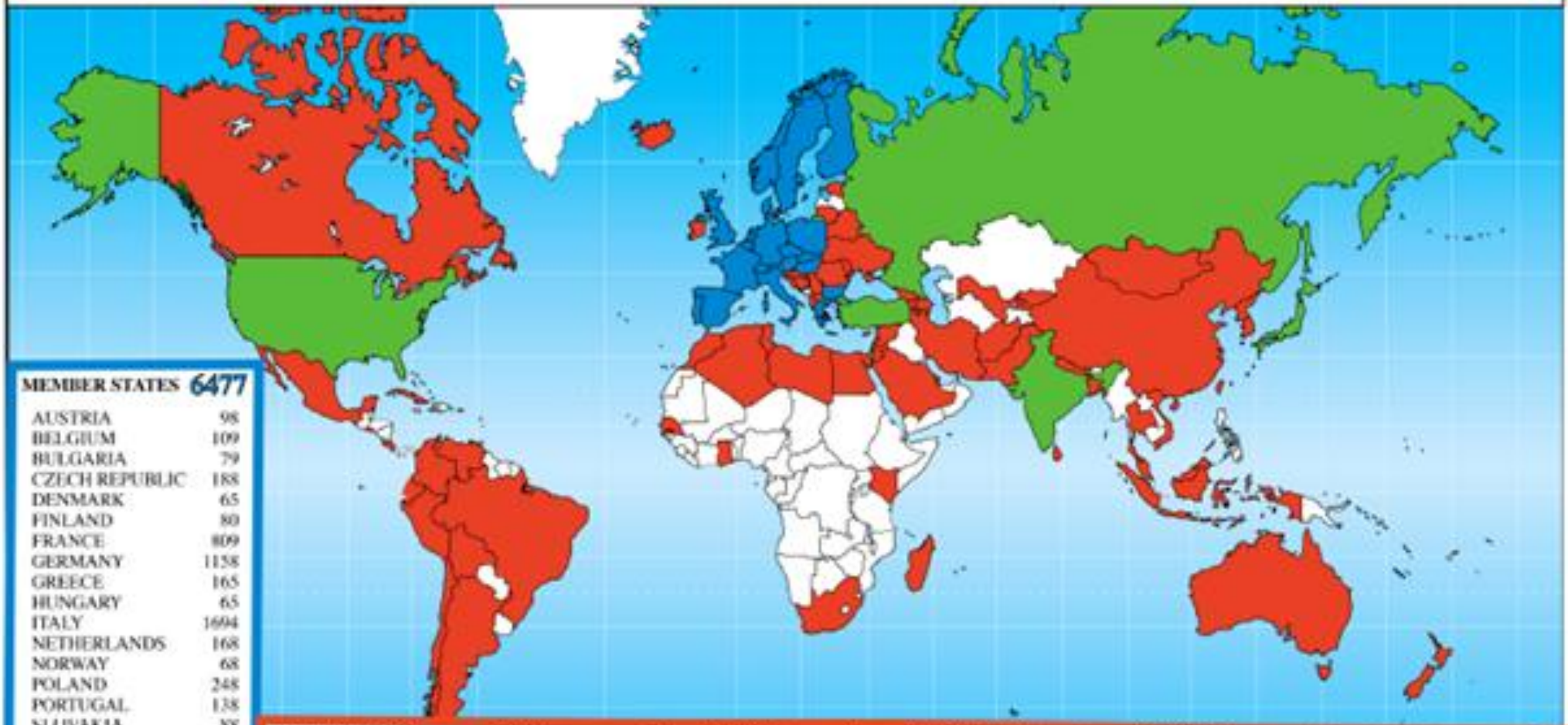
(Source : Unesco, données 2007)

**DÉPENSES EN RECHERCHE ET DÉVELOPPEMENT**

| Pays | Total (en dollars) | Part du PIB en % |
|---|---|---|
| Afrique du Sud | 4120396 | 0,95 |
| Burkina Faso | 18391 | 0,11 |
| Égypte | 927917 | 0,23 |
| Éthiopie | 106791 | 0,17 |
| Madagascar | 25862 | 0,14 |
| Maroc | 761726 | 0,64 |
| Ouganda | 119654 | 0,41 |

(Source : Unesco, données les plus récentes disponibles entre 2000 et 2009)

# Distribution of All CERN Users by Nationality on 10 November 2010



| MEMBER STATES | 6477 |
|---|---|
| AUSTRIA | 98 |
| BELGIUM | 109 |
| BULGARIA | 79 |
| CZECH REPUBLIC | 188 |
| DENMARK | 65 |
| FINLAND | 80 |
| FRANCE | 809 |
| GERMANY | 1158 |
| GREECE | 165 |
| HUNGARY | 65 |
| ITALY | 1694 |
| NETHERLANDS | 168 |
| NORWAY | 68 |
| POLAND | 248 |
| PORTUGAL | 138 |
| SLOVAKIA | 88 |
| SPAIN | 354 |
| SWEDEN | 74 |
| SWITZERLAND | 210 |
| UNITED KINGDOM | 619 |

| OBSERVER STATES | 2496 |
|---|---|
| INDIA | 177 |
| ISRAEL | 62 |
| JAPAN | 241 |
| RUSSIA | 974 |
| TURKEY | 101 |
| USA | 941 |

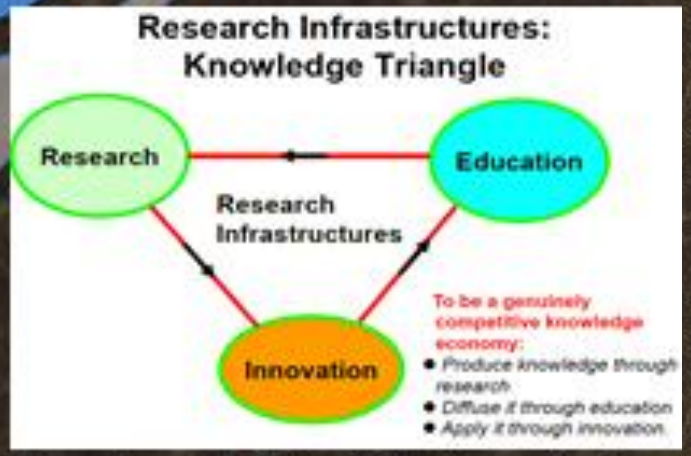
| OTHERS | 1289 |
|---|---|
| AFGHANISTAN | 1 |
| ALBANIA | 5 |
| ALGERIA | 11 |
| ARGENTINA | 15 |
| ARMENIA | 21 |
| AUSTRALIA | 21 |
| AZERBAIJAN | 5 |
| BANGLADESH | 3 |
| BELARUS | 38 |
| BOLIVIA | 2 |
| BOSNIA AND HERZEGOVINA | 1 |
| BRAZIL | 78 |
| CANADA | 142 |
| CHILE | 2 |
| CHINA | 208 |
| CHINA (TAIPEI) | 40 |
| COLOMBIA | 25 |
| COSTA RICA | 2 |
| CROATIA | 23 |
| CUBA | 5 |
| CYPRUS | 13 |
| ECUADOR | 2 |
| EGYPT | 8 |
| EL SALVADOR | 1 |
| ESTONIA | 9 |
| GEORGIA | 33 |
| GHANA | 1 |
| GIBRALTAR | 1 |
| HONG KONG | 1 |
| ICELAND | 3 |
| INDONESIA | 2 |
| IRAN | 21 |
| IRELAND | 23 |
| JORDAN | 2 |
| KENYA | 1 |
| KOREA, D.P.R. | 3 |
| KOREA REP. | 98 |
| KYRGYZSTAN | 1 |
| LEBANON | 10 |
| LITHUANIA | 14 |
| LUXEMBOURG | 4 |
| LIBYA | 1 |
| MACEDONIA F.Y.R. | 2 |
| MADAGASCAR | 3 |
| MALAYSIA | 6 |
| MALTA | 2 |
| MAURITIUS | 1 |
| MEXICO | 46 |
| MOLDOVA | 2 |
| MONGOLIA | 1 |
| MOROCCO | 13 |
| NEPAL | 3 |
| NEW ZEALAND | 9 |
| PAKISTAN | 37 |
| PALESTINE (O.T.) | 2 |
| PERU | 3 |
| QATAR | 1 |
| ROMANIA | 104 |
| SAN MARINO | 1 |
| SAUDI ARABIA | 3 |
| SENEGAL | 1 |
| SERBIA | 34 |
| SINGAPORE | 1 |
| SLOVENIA | 29 |
| SOUTH AFRICA | 10 |
| SRI LANKA | 5 |
| SYRIA | 2 |
| THAILAND | 3 |
| TUNISIA | 6 |
| UKRAINE | 42 |
| UZBEKISTAN | 2 |
| VENEZUELA | 9 |
| VIET NAM | 8 |

# A Possible Recipe

Academic Training for students

Forum for local scientists and policy makers

Public lectures for everybody




Courtesy of Daniel Adams, SA chief director: Emerging Research areas & Infrastructure

Contribute to foster Science in Africa

# The topics of interest

| Theoretical Physics | Experimental Physics | Accelerator and Applications |
| --- | --- | --- |
| • Nuclear and Particle Physics<br>• Beyond the Standard Model<br>• Astro-particle physics and Cosmology<br>• Theoretical Heavy-ion physics | • Particle Detectors<br>• Particle Identification and Data Analysis<br>• Exp. Particle physics, current status of the field<br>• Exp. Nuclear Physics<br>• Exp. Heavy Ion Physics<br>• Exp. Astro-particle Physics | • Accelerator physics and Technology<br>• Physics of Particle Beams<br>• Instrumentation<br>• Medical Applications<br>• Light Source<br>• Energetics |

Information Technology and GRID, Computing tools, MC, PYTHIA, ROOT

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# ASP Students

Goals: Provide partial or full financial support to 60-70 students and create a scientific melting pot of cultural diversity

- Diversity of academic levels
  - Mainly Master and PhD students
- Diversity of education background
  - From theoretical physics to engineering sciences
- Diversity of the countries of origin
  - Priority to Sub-Saharan African students
- Women participation
  - Role of women in LDC
- Local Universities
  - Involve students and professors

# Founding Agencies and Institutes

Financial support of the ASP2012 is possible by **developing a new Joint Collaboration formed of:**

## Institutional Support

AIMS, SA
BNL, USA
CEA, France
CERN, Switzerland
CNRS/IN2P3, France
DESY, USA
DITANET, UK, Euro
EPFL, Switzerland
ESS, Sweden (+private donation)
FNAL, USA
ICTP, Italy
INFN, Italy
IUPAP, USA
JLAB, USA
JSA, USA
NEI - AIMS
NITheP, South Africa
PSI, Switzerland
SLAC, USA
Uppsala University, Sweden

## Governmental Institutions

Department of Energy, USA
Department of Science and Technology, South Africa
French Embassy Accra
NRF, South Africa
NSF, USA

# ASP 2012 - International and Local Organizing Committees

International Organizing Committee

Bobby S. Acharya, ICTP
Ketevi A. Assamagan, BNL
Christine Darve, ESS
Jonathan R. Ellis, CERN, King's College
Steve Muanza, CNRS-IN2P3

Local Organizing Committee:

E. H. K. Akaho, Director General, GAEC
B. Agyei-Tuffour, University of Ghana
F. K. A. Allotey, IMS, Legon-Accra
P. Amoako-Yirenkyi, KNUST, Kumasi
S. K. Danuor, Head of Physics, KNUST
I. K. Dontwi, Director of National IMS
A. L. Mahu, KNUST
M. L. McIntyre, University of Ghana
S. Y. Mensah, University of Cape Coast
R. K. Nkum, Provost, College of Science, KNUST
B. G. K. Nkrumah-Buandoh, University of Ghana

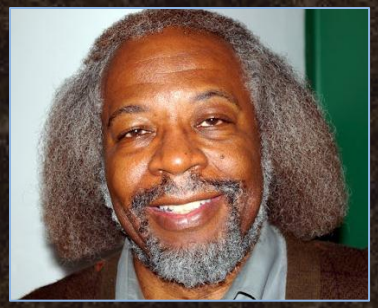
# ASP 2012 - International Advisory Committee

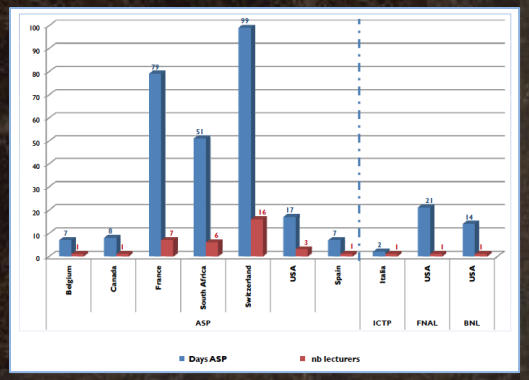
E. Auge, CNRS-IN2P3, Paris, FR
H. Bachacou, CEA, FR
V. Breton, CNRS-IN2P3, Orsay, FR
J. Cleymans, University of Cape Town, SA
S. Connell, U. of Johannesburg, SA
A. Dabrowski CERN, CH
R. Dastranj Tabrizi SFU, CA
L. Elhouadriri, TJNAF, USA
T. Ekelof, Uppsala University, SE
E. G. Ferreiro, USC, Sant. de Comp., SP
F. Ferroni, INFN, IT
H. Gordon, BNL, Upton, NY, USA
J. Govaerts, UCL, Louvain, BE
N. Holtkamp, SLAC, USA
J. Huston, SU, USA
M. Kado, CNRS, IN2P3, FR

Y.-K. Kim, FNAL, Batavia, IL, USA
M. Lindroos, ESS, SE
G. Margaritondo, EPFL Lausanne, CH
B. Masara, SAIP, Pretoria, SA
H. Montgomery, TJNAF, VA, USA
F. Quevedo, ICTP, Trieste, IT
L. Rivkin, PSI, Villigen, CH
E. Tsesmelis, CERN, Geneva, CH
T. Vickey, U. of the Witwatersrand, SA
S. Vigdor, BNL, Upton, NY, USA
Z. Vilakazi, iThemba LABS, Cape Town, SA
R. Voss, CERN, CH

# World-Class Lecturers

- People-oriented lecturers willing to share their experience with less developed countries students
- Highly motivated characters
- Most of ASP lecturers are financially supported by their home institutes
- Provide fruitful interactions with students
- Lectures typically attend the ASP for 3 - 7 days





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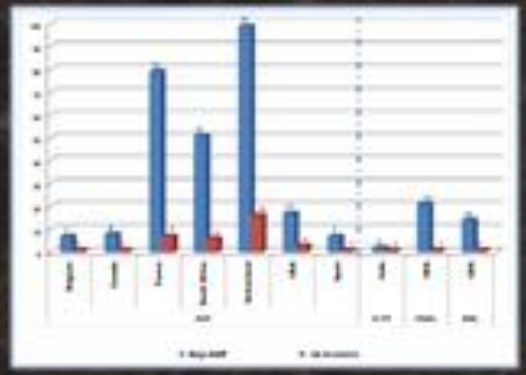

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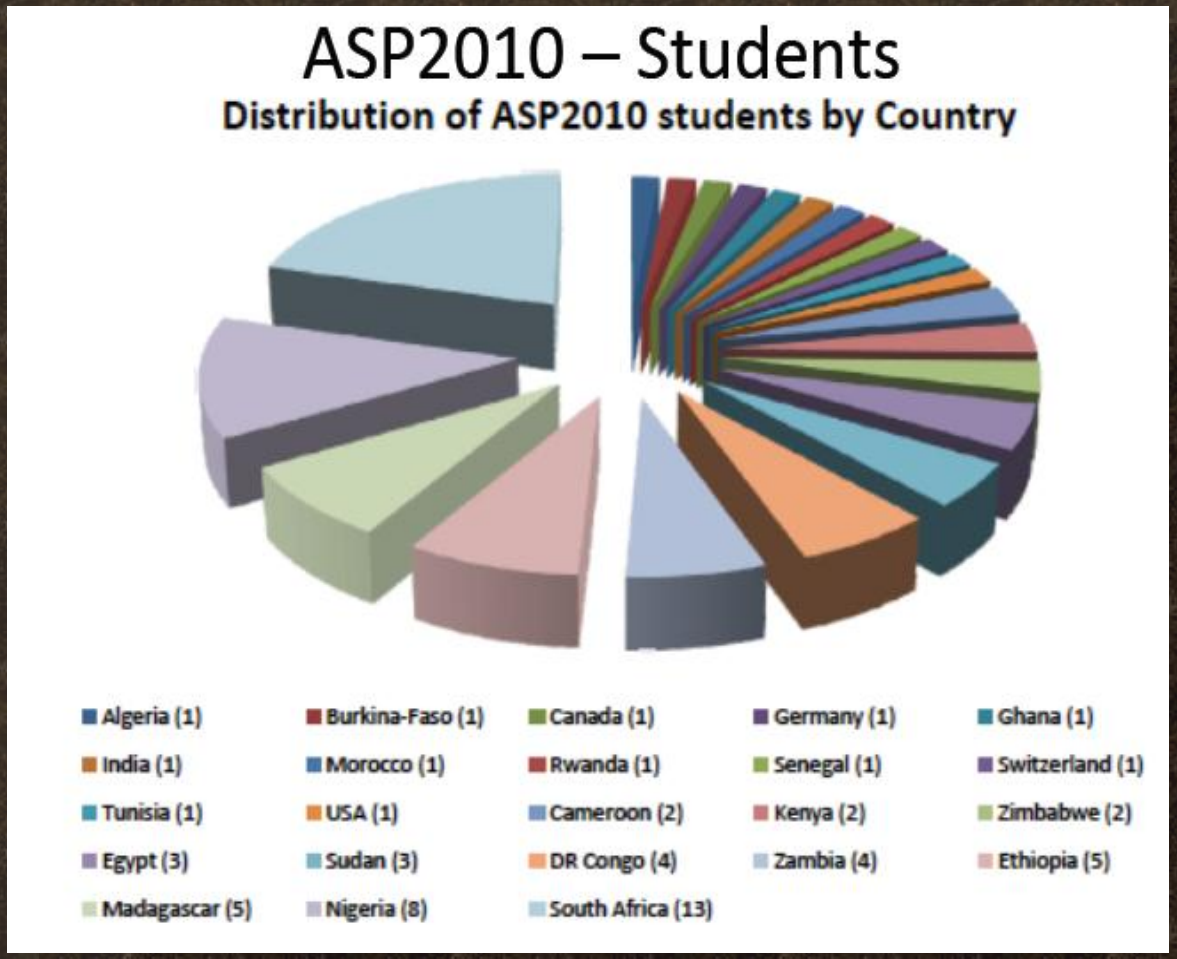
# The First School:

The ASP2010 took place in the "Rainbow Nation", from August 1st till 21st, 2010

Financial support was provided by 15 institutes from Africa, America and Europe.

CERN, ICTP,

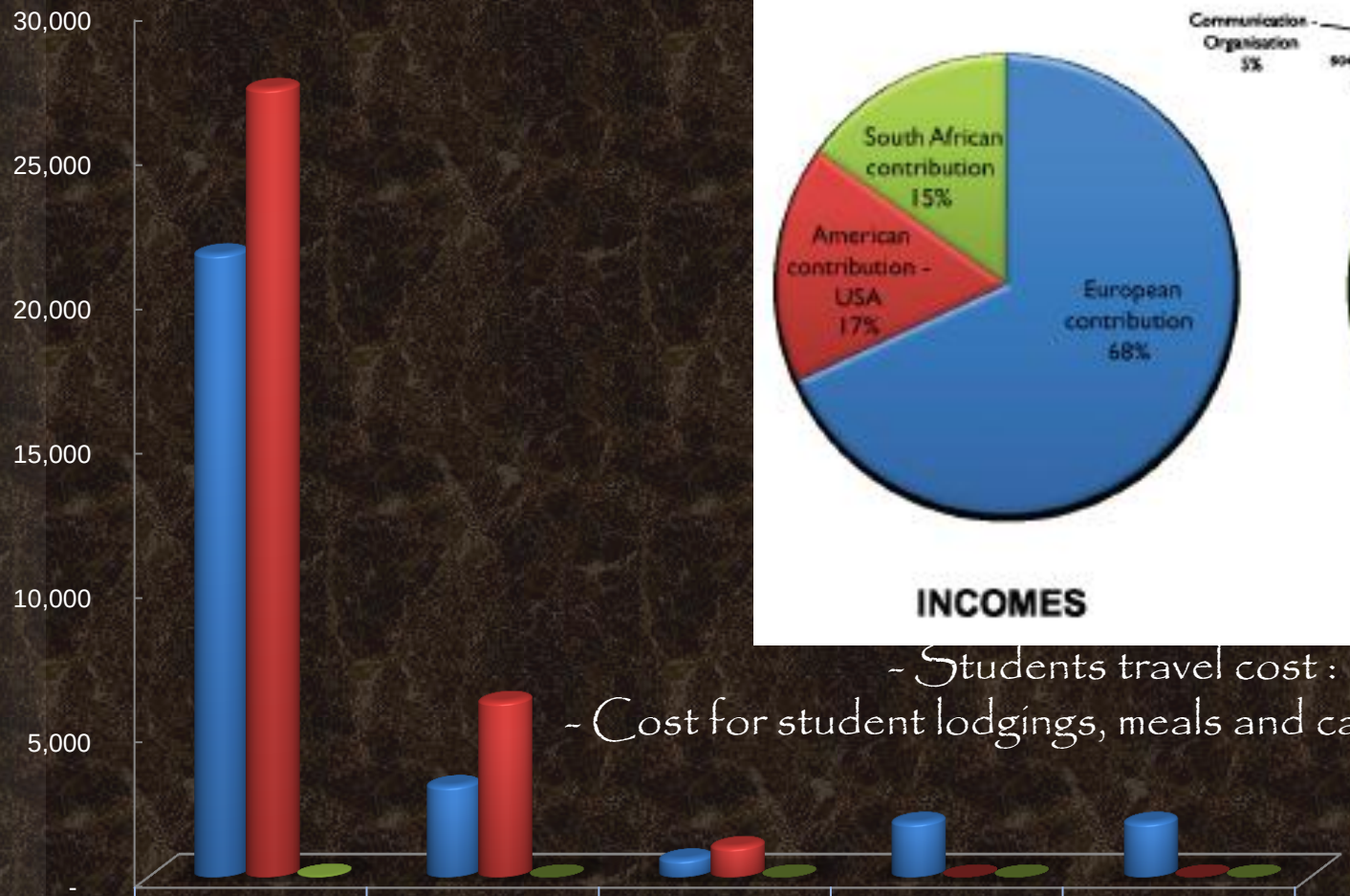
- France: CEA, CNRS-IN2P3, Institut des Grilles,
- Spain: Univ. S. de Compostela,
- South Africa: NITheP, NRF/SAIP,
- Switzerland: EPFL, PSI,
- USA: BNL, FNAL/DoE, IUPAP, J-Lab/TJNAF, NSF



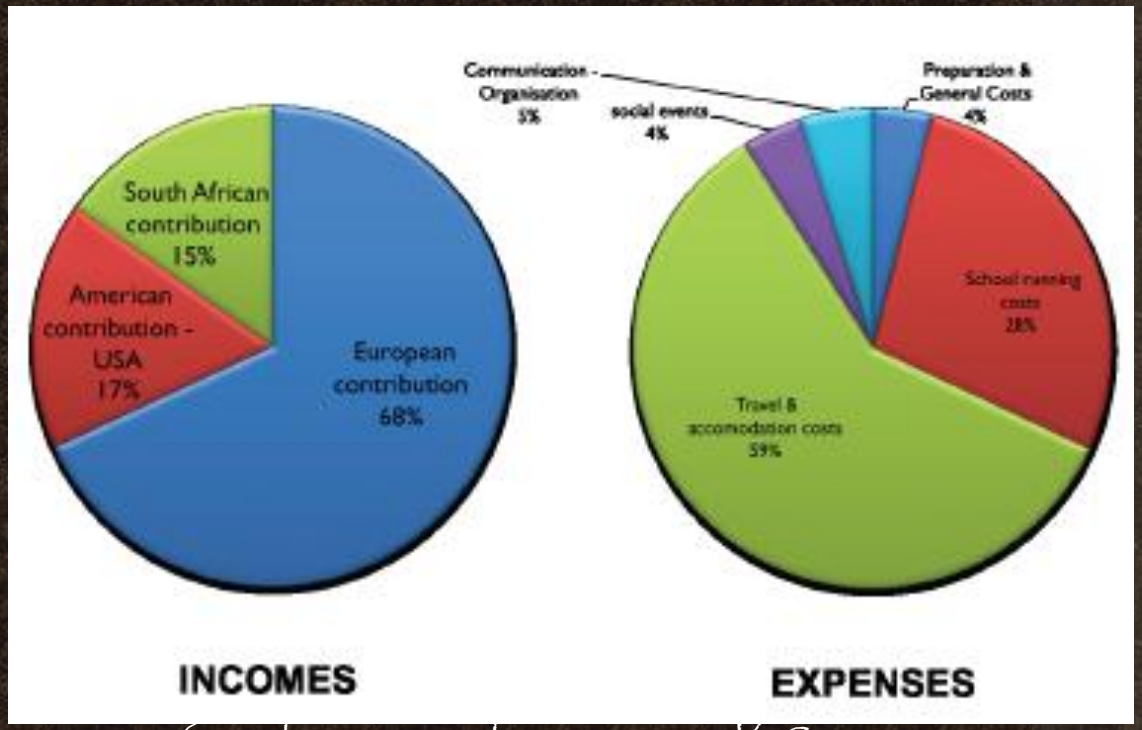

- 50 students from 17 African countries with full financial support.
- Additional students from Canada, Germany, Switzerland, US and India.

- 16% of the students were women.
- > 10% of local students

# Balancing the Budget




| | Sub saharian Africa | North Africa | India | Europe | North America |
|---|---|---|---|---|---|
| accomodation | 21,577 | 3,173 | 635 | 1,904 | 1,904 |
| Travel | 27,302 | 6,086 | 1,061 | - | - |
| nb students | 50 | 5 | 1 | 3 | 3 |




- Students travel cost : 34,4 K€
- Cost for student lodgings, meals and catering: 29 k€ for 20 days

# Lectures and lecturers – Theoretical Physics

Monday 02
Opening address by Frederik SCHOLTZ, NIThep Director, SA
THR1 - Theory Recaps
Jan GOVAERTS *(Louvain U., BE)*
Visit of Stellenbosch University
TH1 I - Foundations of Nuclear and Particle Physics
Jean CLEYMANS *(UCT, SA)*

Tuesday 03
TH1 II - Foundations of Nuclear and Particle Physics and
TH1 - Discussion Session
Jean CLEYMANS *(UCT, SA)*
TH6 I - Computer Physics
Peter SKANDS *(CER*
TH2 I - The Standard Model
Alan CORNELL *(Wits U*
Physics at Fermilab
Young-Kee KIM, *(FNAL*

Wednesday 04
TH6 II - Computer Physics
Peter SKANDS *(CERN*
TH2 II - The Standard Model
Alan CORNELL *(Wits U., SA)*
TH4 I - Astrophysics & Cosmology
Bruce BASSET *(SA Astron, Observ.)*

Thursday 05
TH4 II - Astrophysics & Cosmology
Bruce BASSET *(SA Astron, Observ.)*
TH2 The Standard Model: Discussion Session
Bruce BASSETT *(South African Astron. Observ.,*
*SA)*
TH5 I - Theory of Heavy-Ion Collisions
Elena GONZALEZ FERREIRO *(Uni. de*
*Santiago de Compostela)*
THX - Theory Star Lecture
John Ellis *(CERN)*

Friday 06
EPR II - Experimental Recaps: Part 2. Basics of Statistics
and TH4 - Astrophysics & Cosmology: Discussion Session
Bruce BASSETT *(South African Astron. Observ.,*
*SA)*
TH6 Computer Physics: Lab Session I
and TH6 Computer Physics: Lab Session II
Peter SKANDS *(CERN)*
TH5 - Theory of Heavy-Ion Collisions: Discussion Session
Elena GONZALEZ FERREIRO *(U.de Sant. de*
*Comp.)*

# Lectures and lecturers – Experimental Physics

**Monday 09**

EP1 II - Particle Detectors and
EP1 - Statistics & Detectors
Daniel FROIDEVAUX *(CERN)*

EP2 I - Particle ID & Data Analysis
Ketevi Adikle ASSAMAGAN *(BNL, USA)*

EPR I - Experimental Recaps: Part 1. Interactions Particle-Matter and Particle detectors
Daniel FROIDEVAUX *(CERN)*

**Tuesday 10**

TH3 - Beyond the Standard Model and
Jim GATES *(Maryland Uni., USA)*

EP7: Astroparticle Physics Experiments I
Mathieu DE NAUROIS *(CERN)*

**Wednesday 11**

EPR II - Experimental Recaps: Part 2. Basics of Statistics
Marumi KADO (LAL, IN2P3)

EP3 I - Experimental Particle Physics
Steve Guy MUANZA *(CNRS, IN2P3)*

EP6 I - High Energy Physics Computing: Part 1. ROOT
Andrea DOTTI *(CERN)*

**Thursday 12**

EP6 II: Part 2. Introduction to GRID Computing and
EP6 - High Energy Physics Computing Lab I: ROOT
Bruce BECKER *(SA-GRID)*

EP4 - Programmes in Experimental Nuclear Physics and applications in SA
Zeblon VILAKAZI (iThemba Labs, SA)

EPX - Experimental Star Lecture
Albert DE ROECK *(CERN)*

**Friday 13**

EP5 - Heavy-Ion Collisions Experiments I
Valerie RAMILLIEN BARRET *(Lab. de Phys. Corpusculaire, F)*

EP6 Lab II
Bruce BECKER *(SA Grid))*

EP7 DS
Mathieu DE NAUROIS *(LPNHE, F)*

# Lectures and lecturers – Accelerator and Applications

## ASP2010, SA - Accelerator and Technology week

Preliminary Schedule - by Ch. Darve / May 28, 2010

| | | Monday 16 | Tuesday 17 | Wednesday 18 | Thursday 19 | Friday 20 |
|---|---|---|---|---|---|---|
| | Subject | AT1 - Beam Optics | AT2 - Accelerators | AT3 - Instrumentation | AT4 - Applications | AT5 - Applications |
| | *Lecturers* | *Bernhard Holzer* | *Ph. Lebrun*<br>*Bernhard Holzer*<br>*John Weisend* | *Uli Raich*<br>*John Weisend*<br>*Ch. Darve*<br>*Marco Silari* | *Lenny Rivkin*<br>*Giorgio Margaritondo*<br>*Marco Silari*<br>*Manjit Dosanjh*<br>*Thierry Muanza* | *Norbert Holtkamp*<br>*Heinrich Schwoerer*<br>*Lenny Rivkin* |
| Classes | h1<br>9:00 - 10:00 | History & Applications (BH) | Fundamental Physics, Cryogenics (PhL) | Beam Diagnostics (UR) | Synchrotron Radiation (LR) | Magnetic Confinement Fusion (NH) |
| | h2<br>10:00 - 11:00 | Beam Dynamics & Stability (BH) | RF Cavities (+long. dyn) (BH) | | Appl. of Synch. Rad. (Protein Cryst. Mat. sc., Med. Imag.) (GM) | |
| | h3<br>11:15 - 12:15 | | Warm Magnets (JW) | Magnets and RF Instrumentation (CD+JW) | | Laser driven plasma accelerator (HS) |
| | h4<br>13:30 - 14:30 | Accelerator Operation (BH) | Cold Magnets (JW) | Intro to Medical Accelerator (MS) | Radionuclide Production and Radiation Therapy (MS) | Light Sources (LR) |
| | *Tutors* | *B. Holzer + A. Dabrowski + J. Weisend+Ch. Darve+ U. Raich + B. Becker* | *B. Holzer + A. Dabrowski + J. Weisend+Ch. Darve+ U. Raich + Ph. Lebrun* | *Lecturers + SA* | *Lecturers + SA* | *Lecturers + SA* |
| Practices and Discussion Sessions | p1<br>14:45 - 15:45 | AT1_DS1: Accelerator Optics Design (BH, LB, JW, CD, AD) | Star lecture: LHC (Ph. L) | i-Themba Labs Visit<br>* Cyclotrons for medical applications<br>* Neutron&X-ray beamlines for Acc.-driven Sources<br>* Laser Practices<br><br>Radiation Measurement (MS) | Medical App. + Hadron Therapy (MD) | AT5_DS1: Magnetic Confinement Fusion (NH) |
| | p2<br>15:45 - 16:45 | | | | Medical Therapy - Cancer th. w/ part. Beam (TM) | AT5_DS2: SLS (LR) |
| | p3<br>17:00 - 17:45 | AT1_DS2: IT - GRID & Application (BB) TBC | AT2_DS1: Accelerator System Design (Part I) | | AT4_DS1: Radio-isotope&Cancer Rad. Th. eGRID(MD, MS) | AT5_DS3: Laser Practices - TBD or Radio-Protection |
| | p4<br>17:45 - 18:30 | | AT2_DS2: Accelerator System Design (Part II) | | | |
| | | | AT2_DS3: Accelerator System Design (Part III) | | | |

# Hands-on activities

*iThemba Lab. for Accelerator Based Science*

→ Radiation Environment: @ iThemba Scintillator:

→ Medical Applications by M. Dosanjh and M. Silari

→ Laser Instrumentation: @ Stellenbosch

Students became acquainted with the use of scintillation detectors and performed measurements of environmental radioactivity



→ GEANT4 at Stellenbosch Uni.

# iThemba LABS

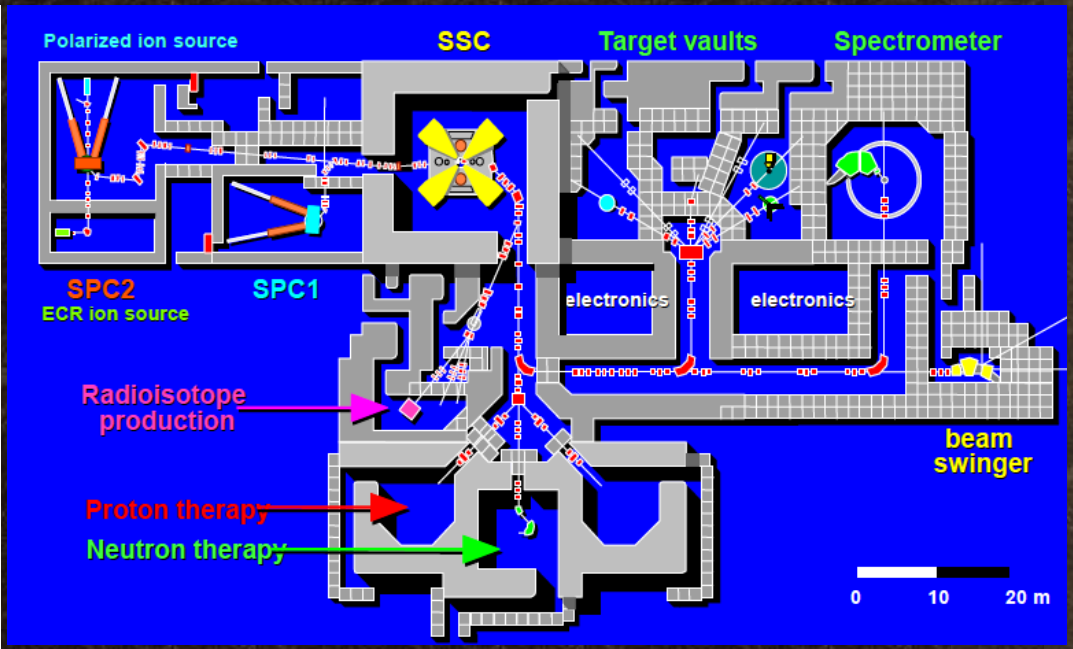
- "As well as being an important producer of radioisotopes, it is the only laboratory in the southern hemisphere where hadron therapy is performed with neutron and proton beams, which have to date treated more than 1400 and 500 patients, respectively," explains Zeblon Vilakazi, director of the iThemba LABS.

NRF National Research Foundation | iThemba LABS Laboratory for Accelerator Based Sciences

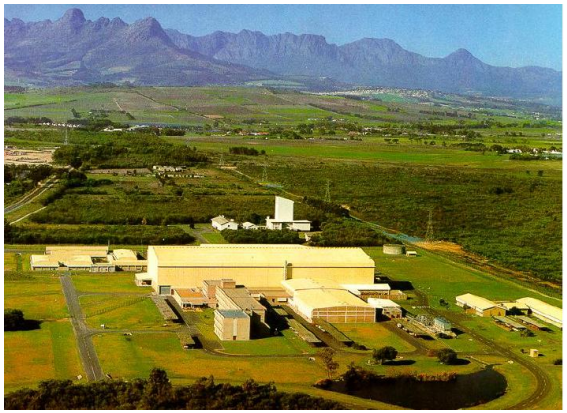
## iThemba LABS

iThemba L(aboratory) for A(ccelerator)-B(ased) S(ciences) is a multi-disciplinary research centre, operated by the NRF (National Research Foundation). It provides accelerator and ancillary facilities for:

- Research and training in the physical, biomedical and material sciences
- Treatment of cancer patients with energetic neutrons and protons and related research
- Production of radioisotopes and radiopharmaceuticals for use in nuclear medicine, research and industry and related research



Courtesy of Zeblon Vilakazi




| Some Accelerators in South Africa | | | | |
|---|---|---|---|---|
| **Organisation** | **Type** | **Date** | **Particle** | **Energy (MeV)** |
| **CSIR** | Cyclotron | 1956/60 | $H_2^+$ | 5.8 - 15.2 |
| | | | $^2H^+$ | 11.5 - 17.3 |
| | | | $^3He^{++}$ | 18 - 39 |
| | | | $^4He^{++}$ | 23 - 34.6 |
| **SUNI / iThemba LABS** | VdG | 1964 | p a.o. | 6 |
| **NECSA** | VdG | 1962 | p a.o. | 4 |
| **Univerity of Potchestroom** | VdG | 1972 | p a.o. | 2 |
| **University Pretoria** | VdG | 1964 | p a.o. | 2.5 |
| **WITS** | Tandem | Nov. 72 | p a.o. | 12 (6) |
| **iThemba LABS** | Cyclotron | 1984 | p a.o. | 8 |
| | Cyclotron | 1986 | p a.o. | 11.5 - 227 |
| | | | Xe | 790 |
| | Cyclotron | 1994 | p to Xe | 8 (41.6) |
| **De Beers** | RFQ | 1997 | d | 4 and 5 |
| **De Beers** | RFQ | 2003 | d | 4 and 5 |
| **Pretoria Private Hospital** | Cyclotron | 2006 | p | PET isotopes |
| **NECSA** | Cyclotron | 2007 | p | PET isotopes |

# Discussion Sessions

- Following the classes, discussion sessions permitted to answer questions and develop specific topics of interest.

# Few star lecturers – Virtual and Real ambassadors of sciences

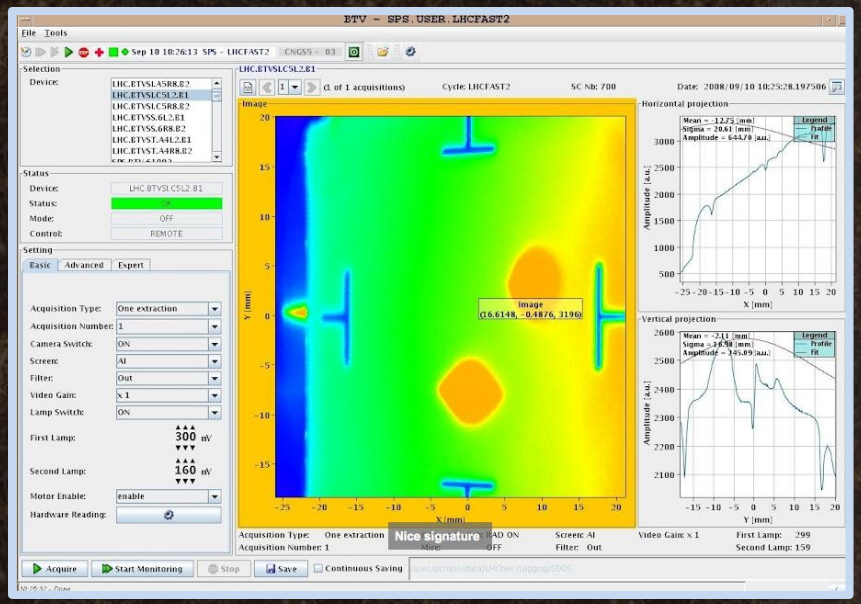
What is the origin of mass for fundamental particles?
Why are there so many kinds of particles?
Do all the forces become one?
Are there extra dimensions of space?
What are neutrinos telling us?
Do charged leptons change from one kind to another?
Are there undiscovered principles of nature:
new symmetries, new physical laws?
What happened to the antimatter?
What is dark matter? dark energy?
How did the universe come to be?

Evolved Thinker

In 1872 : Gauguin was wondering:
"*Where Do We Come From? What Are We? Where Are We Going?*"

# CERN Control Centre

- A special movie dedicated to each ASP2010 student by the CCC team to experience a live demonstration of proton acceleration.
- Life communication with the CERN experts using remote connection from SA to CCC.
- Broadcasted connection




# Forum/Outreach Day: A Gateway to Innovation

ASP Closure of ASP2010 and Introduction of Outreach, Forum Day
*Christine DARVE (ASP2010 Main organizer)*

DST Address
*Daniel ADAMS (Chief Director: Emerging Research Areas & Infrastructure - Human Capital and Knowledge Systems)*

The Road Map of Hadron Colliders (Tevatron and LHC) - Physics Views
*By Peter JENNI (ATLAS Former SpokesPerson)*

The Road Map of Particle Accelerators - Technological Views
*By Philippe LEBRUN (Former Head of CERN Accelerator Technology Dep.)*

Knowledge & Technology Transfer
*By Claudio PARRINELLO (CERN Head of Knowledge and Technology Transfer)*

Energetics and Fusion
*By Norbert HOLTKAMP (ITER Principal Deputy Director General)*

Progress in Particle therapy in Europe
*By Manjit DOSANJIH (ENLIGHT Coordinator and Life Sciences Adviser)*

Posters:
Naima Zahar :Fast neutron filter design for the neutron diffraction technique
Ahmed Rebai : Radio Detection of Ultra High Energy Cosmic Rays With The CODALEMA Experiment

Dedicated to Knowledge and Transfer of Technology

The South African government was represented by Dr. Daniel Adams, chief director: Emerging Research areas & Infrastructure, Human Capital and Knowledge Systems.

# Several Public lectures

## @ NTM science center in Cape town

| August $6^{th}$ , 2010 | August $13^{th}$ , 2010 |
|---|---|
| "Gauguins questions in Physics"<br>John ELLIS (CERN, CH)<br>"How to answer Gauguins questions"<br>Christine Darve (Fermilab, USA)<br>Steve MUANZA (IN2P3, France) | "The LHC - Searching for the Higgs Boson"<br>Ketevi Assamagan (Brookhaven Lab, USA)<br>"The Future? Beyond the LHC"<br>Anne Dabrowski (CERN, CH) |

To share experience with society

**The MTN Sciencentre address is 407 Canal Walk (Upper level, Entrance 5),**
**Century City near Cape Town**
**There is no cost to attend the event but seating is limited and booking is advised.**
**Secure parking is available.**
**Contact Jani on 021 529 8100 or jani@mtnsciencentre.org.za to book your seat.**
**Visit http://www.mtnsciencentre.org.za for more details**

# Excursion and School Banquet

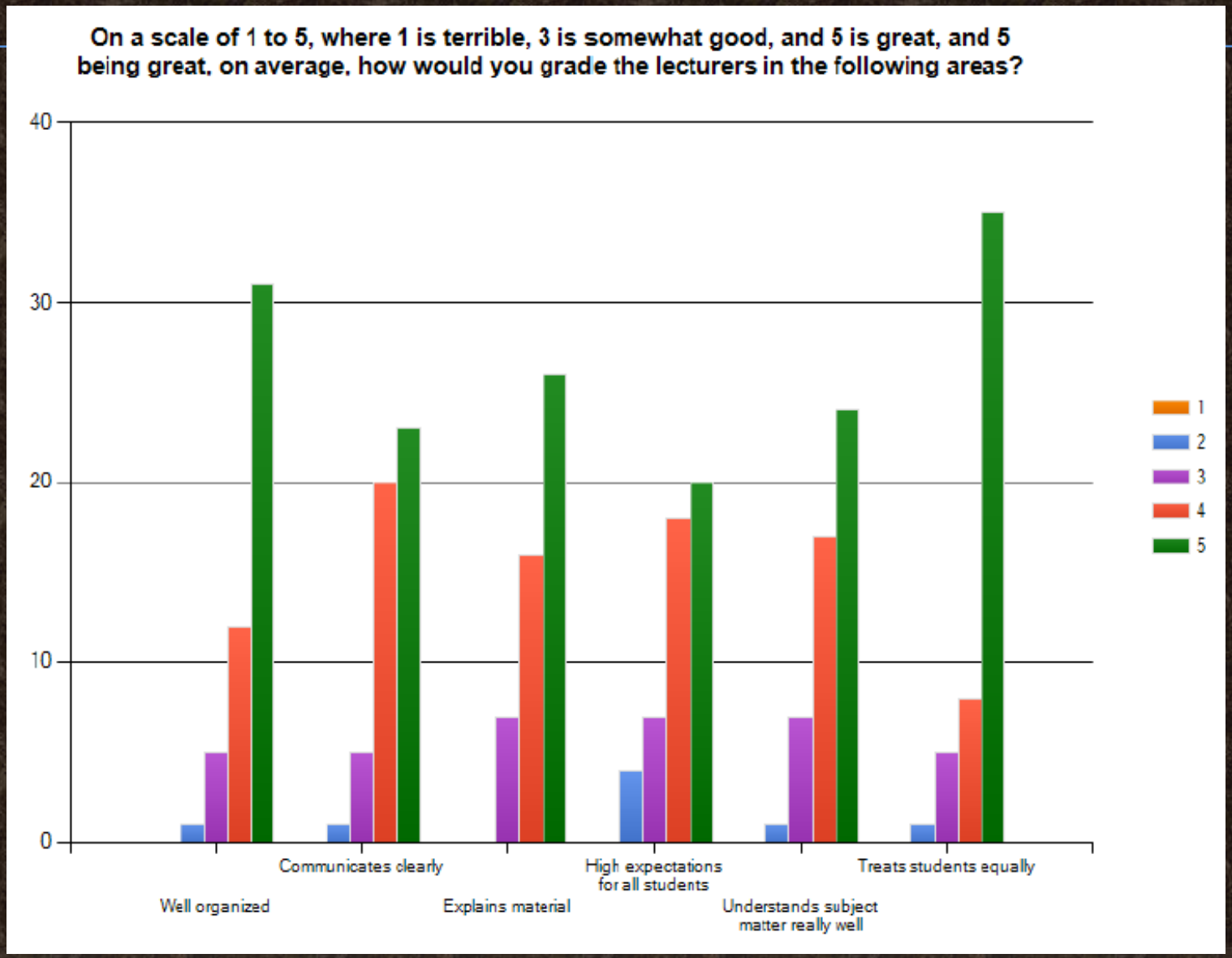
- Guided bus tour of the Cape Peninsula

- School banquet hosted by Stellenbosch Lodge
  complimentary wine and chocolate tasting

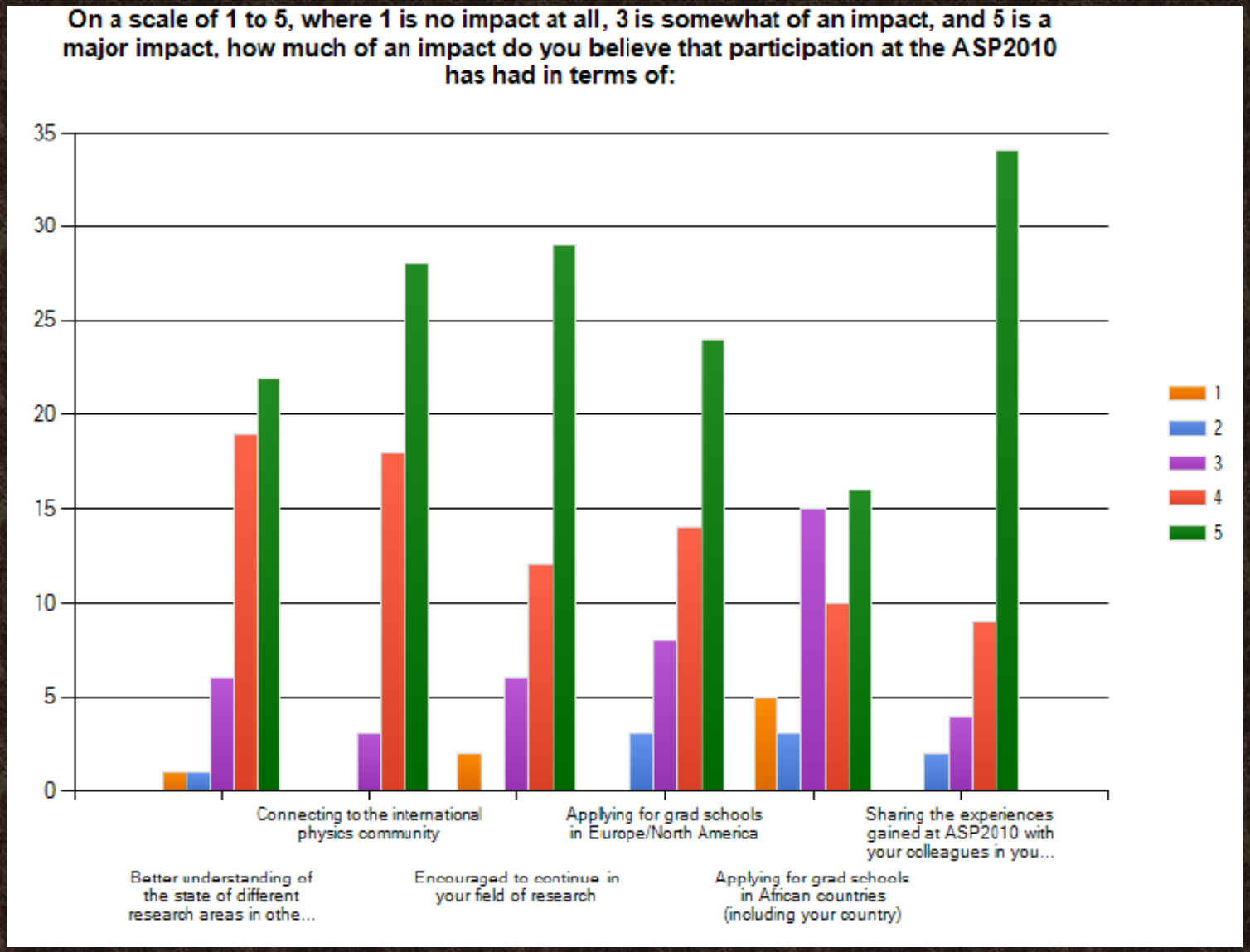
- Dinner and Western Cape Jazz band
  creating a relaxed and warm atmosphere.

- During the evening, students representing each of their countries, made heartfelt speeches, introducing themselves, their countries and expressed their experiences of the school thus far.

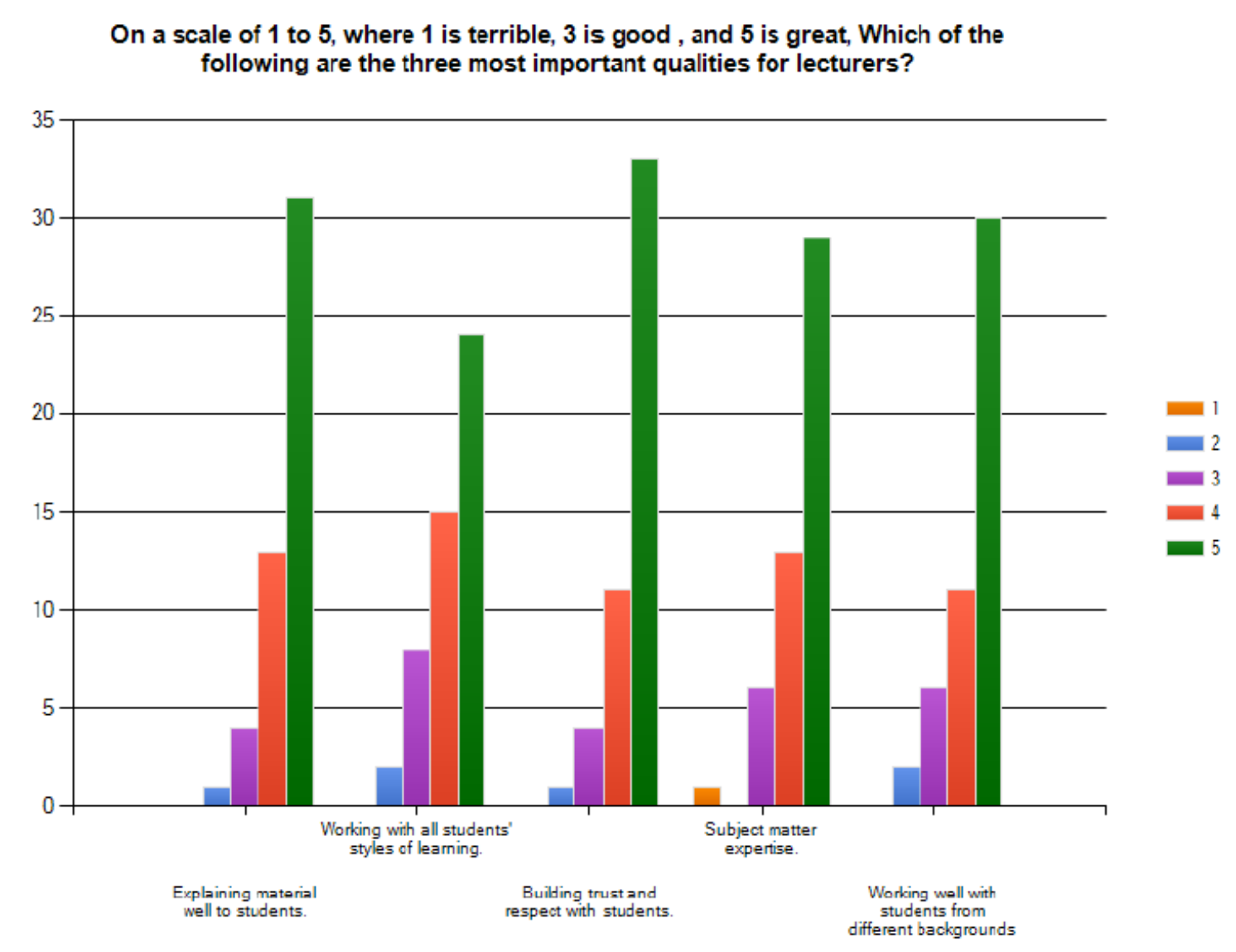
# Student Feedback



# Student Feedback



# Student Feedback



# Maintaining Contacts with Students

Track various training opportunities are available (email, facebook or by web page):

* Summer studentships at CERN funded by US Foundation & CERN itself
  - 2 months of lectures & research experience
  - Suitable for advanced undergraduates, Masters students

* Possibilities for co-supervised Masters / PhD theses
  - e.g., in France, at Jefferson Laboratory in US

* Postdoctoral fellowships at FNAL

➔ Please propose fellowships to our rising stars ..

# Outlines

- Mission of the African School of Fundamental Physics and its Applications

- Stakeholders:
  - ✓ Students
  - ✓ Founding Agencies, Institutes and Universities
  - ✓ The committees
  - ✓ The lecturers

- The first edition: South-Africa – August 2010

- The second edition: Ghana – July 2012

# ASP 2012 – Ghana – Kumasi


KWAME NKRUMAH
UNIVERSITY OF SCIENCE AND TECHNOLOGY

Modeled after the ASP 2010 agenda

Additional topics:

- ➔ Digital library
  CERN-KNUST agreement
- ➔ OSG Grid Workshop
  Connection to ASP 2012, a dedicated Grid School will follow on Aug. 6-8 2012

# Ghana Atouts

Local expertise

Students housing

Ghana Atomic Energy Commission

Lecture hall

# Ghana - Infrastructure

Physics classes-room

Radiation laboratory

Computing room

Engineering School: solar panels


MISSION STATEMENT
College of Science provides high quality teaching, research, and entrepreneurship training and service in the pure and applied sciences for the sustainable industrial and socio-economic development of Ghana and Africa.
CORE VALUES
• Excellence
• Teamwork
• Dedication to duty
• Discipline
VISION STATEMENT
Producing high caliber Science graduates to support and sustain the industrial and socio-economic development of Ghana and Africa.

# Further Contacts in Ghana

- Meeting in ACCRA Legon University
  - Prof. George Nkrumah, **Head of the Physics Dep. U. of Accra Legon**
  - Prof. Yaa Ntiamoa-Baidu, Vice-chancelor

- Meeting with Govemement officials
  - Prof. Mahama Duwiejua (Exec. Secretary of the Nat. Council for Tertiary Education, NCTE)
  - Prof. Dontwi **(Director, National Institute for Mathematical Sciences)**

- Contacts with the Embassies of France and of the US

# For more information visit
# http://africanschoolofphysics.web.cern.ch