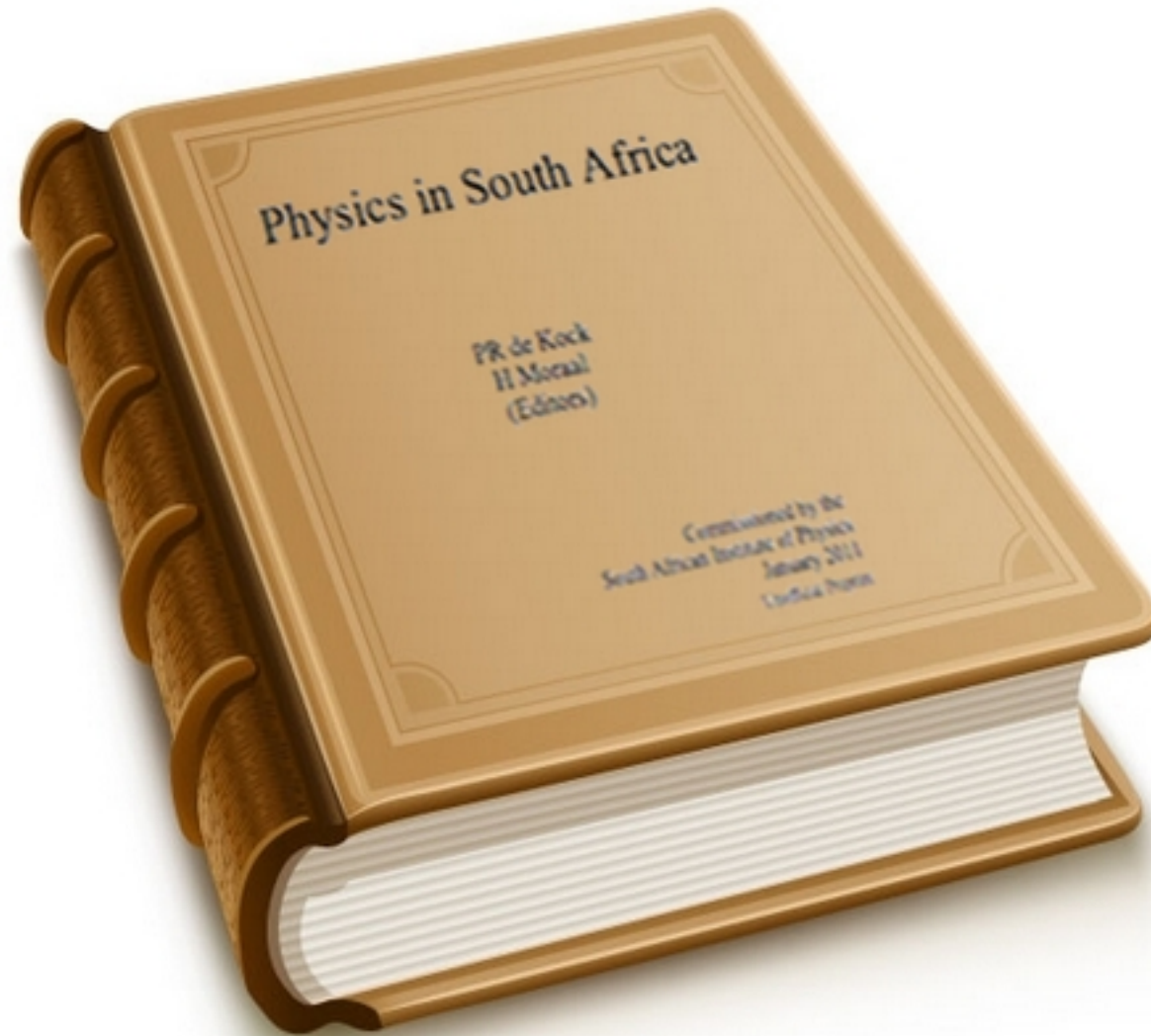


The Transformation and Re-shaping of Physics in SA



- Our foundations
- Recent history
- **“Shaping the Future of Physics”**
- Dawn of a new era
- Large Scale Facilities
- HEP and Astro
- Africa



SAIP 2012 – Foundations



- **Cradle of Mankind**
 - Example : 1.9 million year old *Australopithecus sediba* skull.
 - Analysed with X-ray micro-tomography at the ESRF in February 2010, soon after its discovery.
 - Evidence of brain imprint on sediment filling the skull.
 - An example of the most modern accelerator based science used to study ancient artefacts.

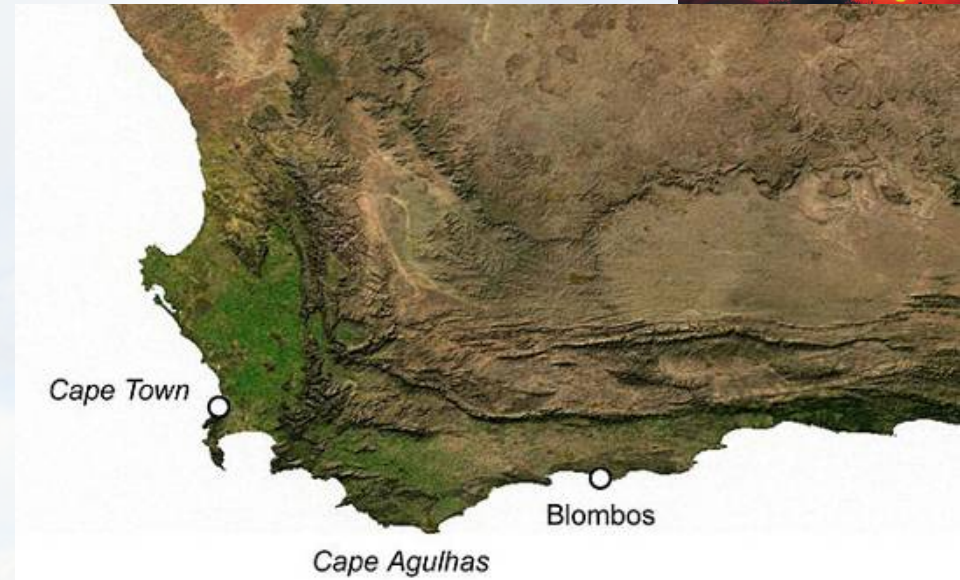


The first potential scientists

SAIP 2012 – Foundations



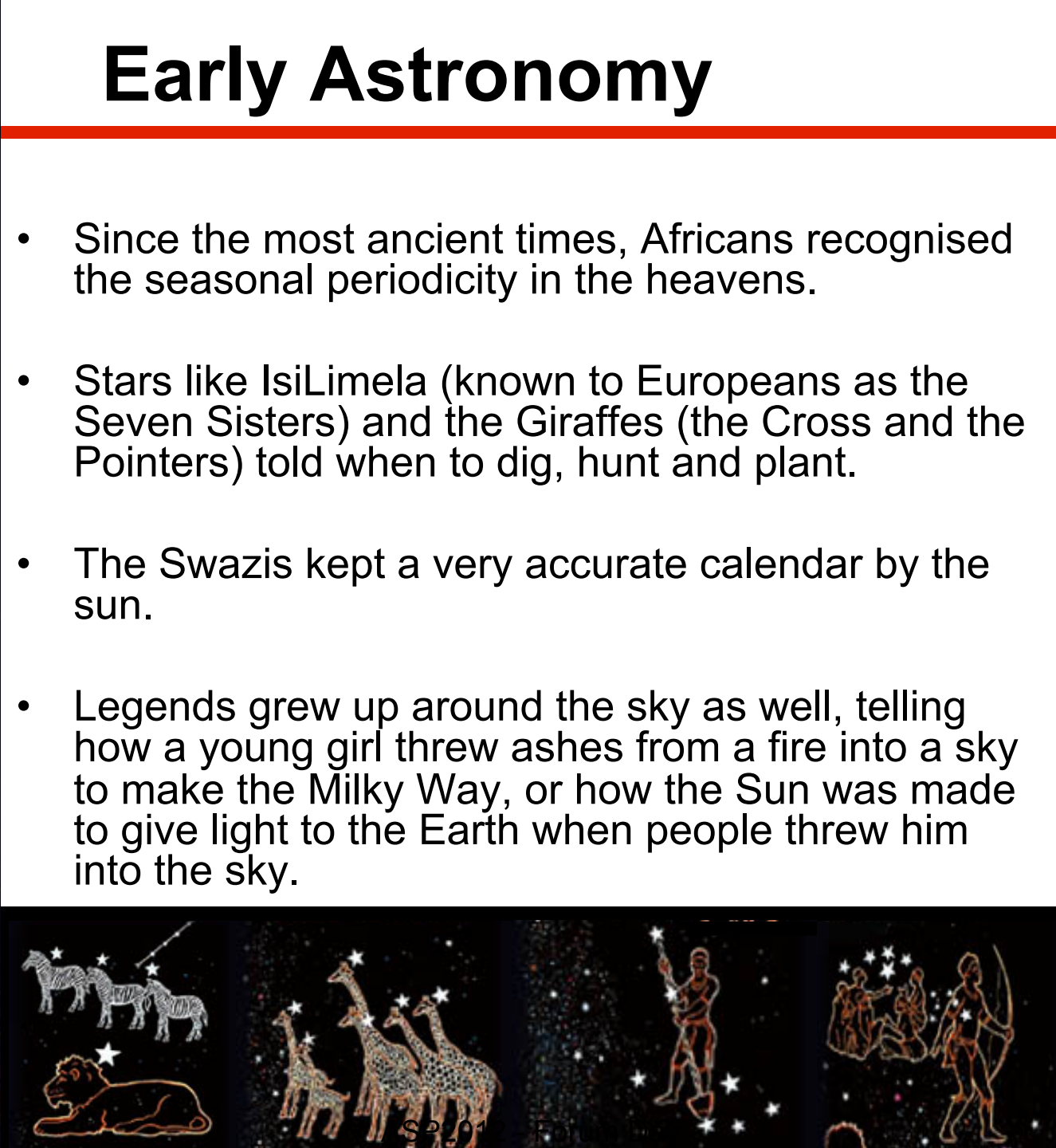
- Blombos Cave (140,000 – 80,000)
- Cognitively modern humans, abstract symbolism, syntactical language.
- Materials science - bone tools
- Engraved ochre, marine shell beads, ...
- Fishing



**The first symbolic thinking,
abstract ideas ...**

Early Astronomy

- Since the most ancient times, Africans recognised the seasonal periodicity in the heavens.
- Stars like IsiLimela (known to Europeans as the Seven Sisters) and the Giraffes (the Cross and the Pointers) told when to dig, hunt and plant.
- The Swazis kept a very accurate calendar by the sun.
- Legends grew up around the sky as well, telling how a young girl threw ashes from a fire into a sky to make the Milky Way, or how the Sun was made to give light to the Earth when people threw him into the sky.



Earliest physics building



- The Royal Observatory in the Cape started observing in 1828.



More recent astronomy



- SA strategic niche observing location
- Multi-wavelength capacity

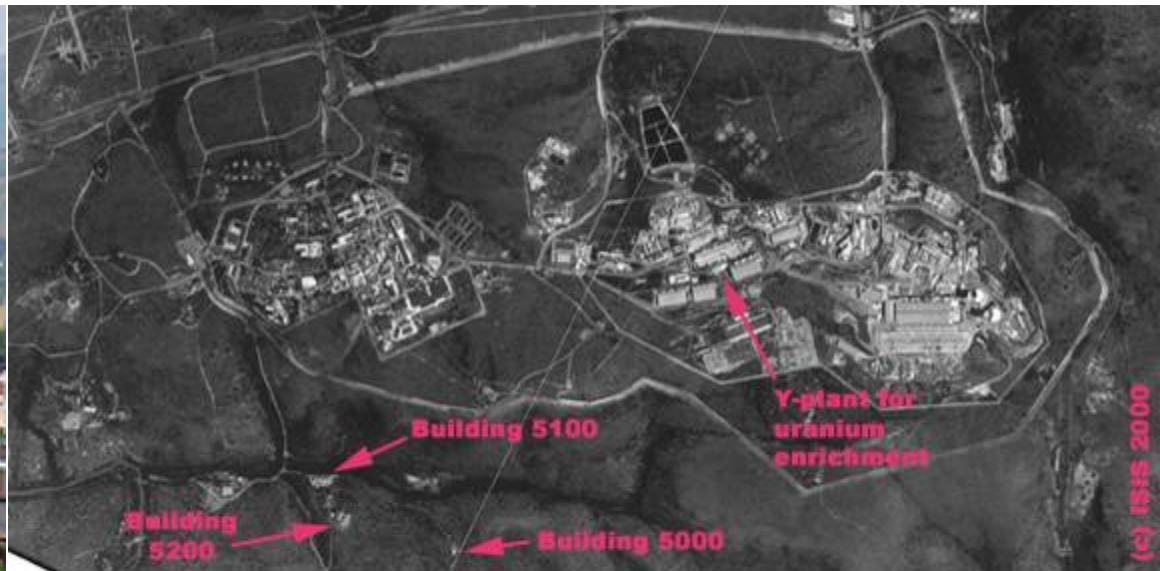
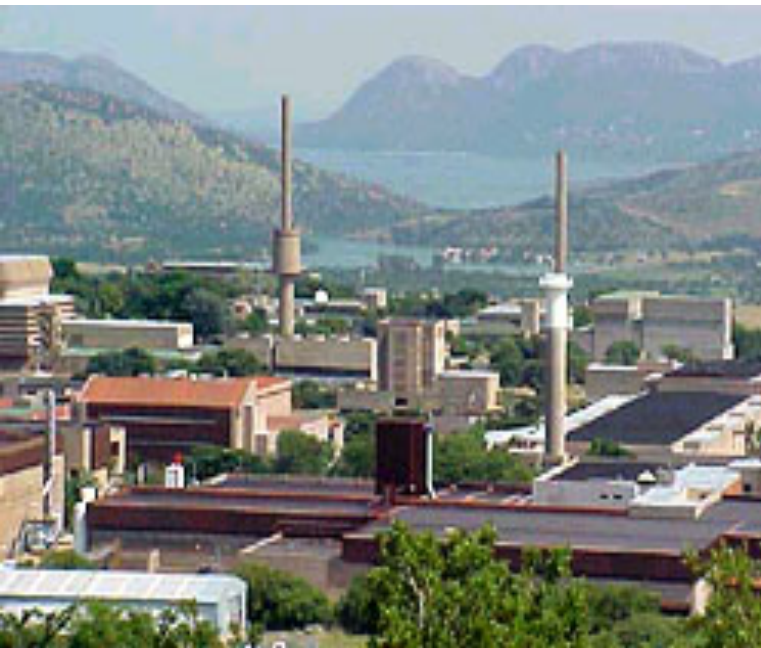


- South African Astronomical Observatory (SAAO)
- South African Large Telescope (SALT)
- Boyden Observatory
- Hartebeesthoek Radio Astronomy Observatory
- Hermanus Magnetic Observatory
- High Energy Stereoscopic System (HESS) in Namibia

Early Physics



- The first Universities were established in the late 1800' s.
- The Council for Scientific and Industrial Research established in 1945
- The Atomic Energy Board was established in 1950 – infamously developing several weapons.
- **The South African Institute of Physics was established in 1955.**
- The country became isolated politically and economically during the apartheid period, and much of the government initiated research had a military bias.



Significant former nuclear weapons related facilities at the Pelindaba-Valindaba Complex, near Pretoria, South Africa. December 1991 KVR-1000 image from www.terraserver.com.

First Accelerator Facilities



Some Accelerators in South Africa				
Organisation	Type	Date	Particle	Energy (MeV)
CSIR	Cyclotron	1956/60	H ₂ ⁺	5.8 - 15.2
			² H ⁺	11.5 - 17.3
			³ He ⁺⁺	18 - 39
			⁴ He ⁺⁺	23 - 34.6
SUNI / iThemba LABS	VdG	1964	p a.o.	6
NECSA	VdG	1962	p a.o.	4
University 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

Some notable contributions



BFJ (Sir Basil) Schonland - PhD degree in nuclear physics at the Cavendish Laboratory under the supervision of Sir Ernest Rutherford – Research on atmospheric electricity and the structure and mechanism of lightning. Founding director of CSIR. Knighted for his services to British Science.



Nature **416**, 478-479 (2002)

JPF (Friedel) Sellschop – (1965) co-identified the first neutrino found in nature, at a depth of 3 km in the ERPM mine near [Boksburg](#). Implemented a neutrino astronomy and looked at issues of neutrino physics and weak interactions.

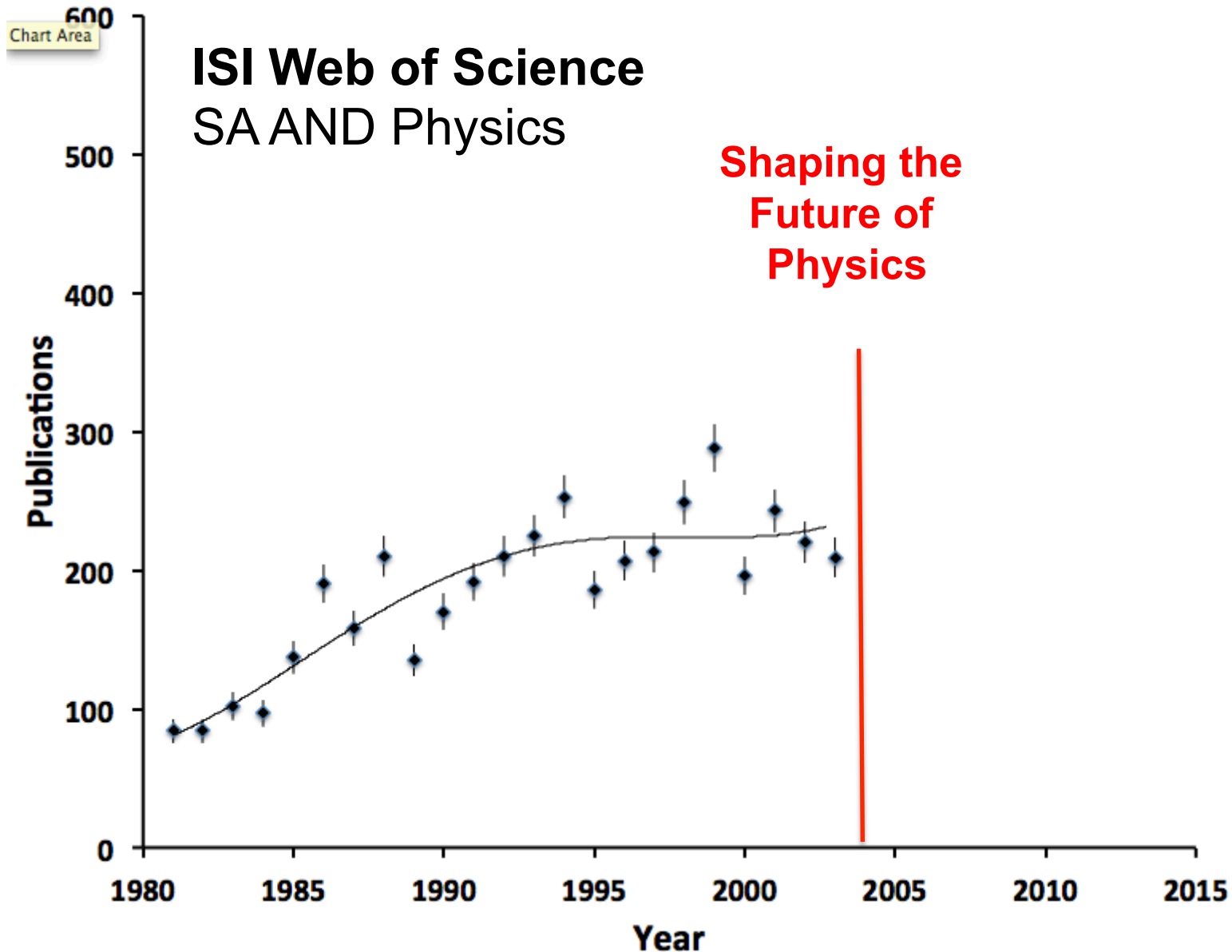
S.Afr.J.Sc. **95** (1999) 13-25

Politics of Science



- Exclusion of the majority of the population from the Science System
 - OR Tambo – Teacher, Lawyer, Freedom Fighter
- Isolation from world science
- Pockets of excellence
- Foundation of Research Development (FRD), CSIR
- **South Africa becomes a democracy in 1994**
- The period of isolation ends.
- A massive program to broaden opportunities for full participation in the science system to all South Africans begins.
- The FRD transforms to the current National Research Foundation (NRF) in 1999.
- However, ... world-wide ... growth slows ... and SA is not spared.

Shaping the Future of Physics



Shaping the Future of Physics



- **Shaping the Future of Physics**
 - Born from pessimism in the community – up to 2004
 - DST-NRF-SAIP Project
 - Upward trajectory after this process
 - 14 Recommendations most implemented

Primary and Secondary Education

Undergraduate and Postgraduate Education

Marketing of Physics in Industry

Public Understanding

Human Resource Development

Research Information Network

National Research Digital Library

Flagship Projects

Long-term Strategy

Small Science

Infrastructure and Equipment

Theoretical Physics

Technological Spin-off

SAIP Office

NO

Review

Physics500

Outreach Co-ordinator + budget

Review

SANReN

Several projects in Progress

iThemba, Laser, Astronomy,

SKA

NEP

NEP

NITheP

Innovation

Established

The new SAIP



- **The SAIP Office**
 - Tackle projects as contracts
 - **EO : Brian Masara**
 - Secretariat – Lynette White
 - Outreach – vacant
 - **Projects**
 - Physics Graduate Database
 - Physics 500 Database
 - Physics Comment Magazine
 - Conferences
 - SAIP, S@S, ICWIP2010, Entrepreneurship
 - FET project, Physics Curriculum Project
 - Member Benefits
 - Discipline Benefits
- **Introduce New Constitution - 2011**
 - Democratise, transparency, modernise, scalable
- **Science budget quadrupled over this period**
 - **Tax status (Income Tax and VAT Registration – turn over > R1M)**

SAIP Annual Conference Banquet



**Celebration of student participation : Awards Program
Recognising student excellence**




[General](#)
[News and Events](#)
[Members](#)
[Projects](#)
[Careers](#)
[Outreach](#)
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- ▶ [Council - Past](#)

- ▶ [Council - Current](#)

- ▶ [Services](#)

- ▶ [Affiliates](#)

- ▶ [Links](#)

- ▶ [Contact SAIP Office](#)

Latest News

- ▶ [1st SA PostDoc and PhD](#)

South African Institute of Physics



Home

Created on Thursday, 03 February 2011 Last Updated on Thursday, 08 December 2011
Written by Roelf Botha

Welcome to the South African Institute of Physics!

Our Mission: To be the voice of Physics in South Africa

On these pages you will find information on what the institute does, how to become a member, jobs in physics in South Africa and career information for young scientists.

Some links of interest:

- [SAIP2011 Proceedings](#)
- [SAIP2012 Annual Conference 9 - 13 July 2012](#)
- [South African Physics Graduates Database](#)
- [SAIP Shop](#)
- [Biophysics Project](#)

DEC
05
2010**» Lectures to be presented by Prof Kip Thorne**

Please view the attached pdf document for more information.

[DOWNLOAD
PDF FILE](#)**OCT**
11
2010**» Celebrating 50 years of the Laser**

Four world renowned physicists will be giving public lectures at the Lanzerac Hotel in Stellenbosch on the 11th of October. Please view the attachment for more information.

[DOWNLOAD
PDF FILE](#)**AUG**
17
2010**» NITheP Annual report 1 January - 31 December 2009**

To view the NITheP Annual report, please see down-loadable PDF Document

[DOWNLOAD
PDF FILE](#)[More](#)

PHYSICS WORLD NEWS FEED

- » [Medical isotope shortages could become commonplace](#)
- » [Nanotube rubber stays stretchy at extreme temperatures](#)
- » [Secret of diamond polishing revealed](#)
- » [Spin ices slip into ground state](#)
- » [Super-Earth's atmosphere comes into view](#)
- » [Questions raised about giant piezoresistance](#)
- » [Fear rises among Iranian physicists](#)
- » [New particle links dark matter with missing antimatter](#)
- » [Guest molecule builds 3D nanostructures](#)
- » [Graphene supercapacitor breaks storage record](#)

VISION

To be Africa's leading and an internationally competitive research and training institute in theoretical physics, a discipline that provides the conceptual framework for the natural sciences.

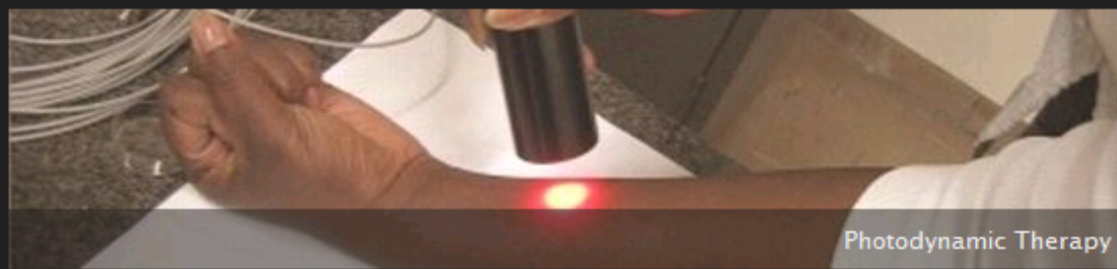
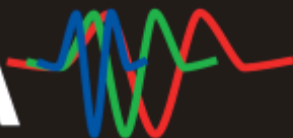
MISSION

To sustain a stimulating theoretical physics research and user facility that links South Africa internationally through excellence in research and training thereby



PISA

PHOTONICS INITIATIVE OF SOUTH AFRICA



Photodynamic Therapy

About PISA

The South African Photonics Initiative (PISA) aims to ensure that South Africa is able to harness the potential presented by photonics to develop human capital, stimulate multidisciplinary basic and applied research, as well as create economic benefit and job creation for South Africa. To achieve these objectives significant investment and a conscious effort based on an integrative effort comprising all the relevant stakeholders is required. [The Department of Science and Technology](#) is supporting the development of a national strategy on photonics, which should inter alia present a roadmap for the future of photonics in the country.

What is Photonics?

Photonics investigates the manipulation of photons, mainly in the ultraviolet, visible and infrared region of the electromagnetic spectrum. These photons can be directed towards several applications in chemistry, physics, materials science, biology, medicine etc. The multidisciplinary nature of photonics, makes it highly pervasive and as such finds application in light detection, illumination and displays, communication, surgery, data storage and processing, materials processing, medical diagnostics and surgery, security and defence etc. Photonics forms an integral part of many technologies and is embedded in everyday products such as printers, scanners, displays, lights and CD / DVD players. This field is one of the most promising scientific endeavours in the 21st century and could change the face of science and technology. Globally, there are numerous initiatives aimed at coordinating programmes in photonics at national or international level, amongst these is [the Photonics 21](#) of the EU. While Europe, Asia and North America will lead in this area, developing countries such as SA need to ensure that they develop a niche.

How to get involved...

As a start, please register at this website by clicking [here](#).

A steering committee consisting of key decision-makers in academia, public and private sectors has been setup. This is supported by working groups whose role is to gather detailed information on the local and international landscape. The working groups will contact researchers and institutions that are involved in the field. A National Consultative Workshop will be held during the first quarter of 2008. This will be an excellent opportunity for you to contribute directly towards the strategy and ensure that you are part of this groundbreaking initiative! Contact [Dr. Thulani Dlamini](#) for further details.

News

- [New webmaster](#) (admin - Oct 29, 2008)

- [PISA features in "Engineering News"](#) (Jan Dam - Nov 16, 2007)

Main Pages

- » [Home](#)
- » [Photonics Cluster](#)
- » [Vision & Mission](#)
- » [Participants](#)
- » [How to get involved...](#)
- » [Articles](#)

Discussion Topics

- » [Life Sciences \(2\)](#)
- » [News \(3\)](#)

Archives

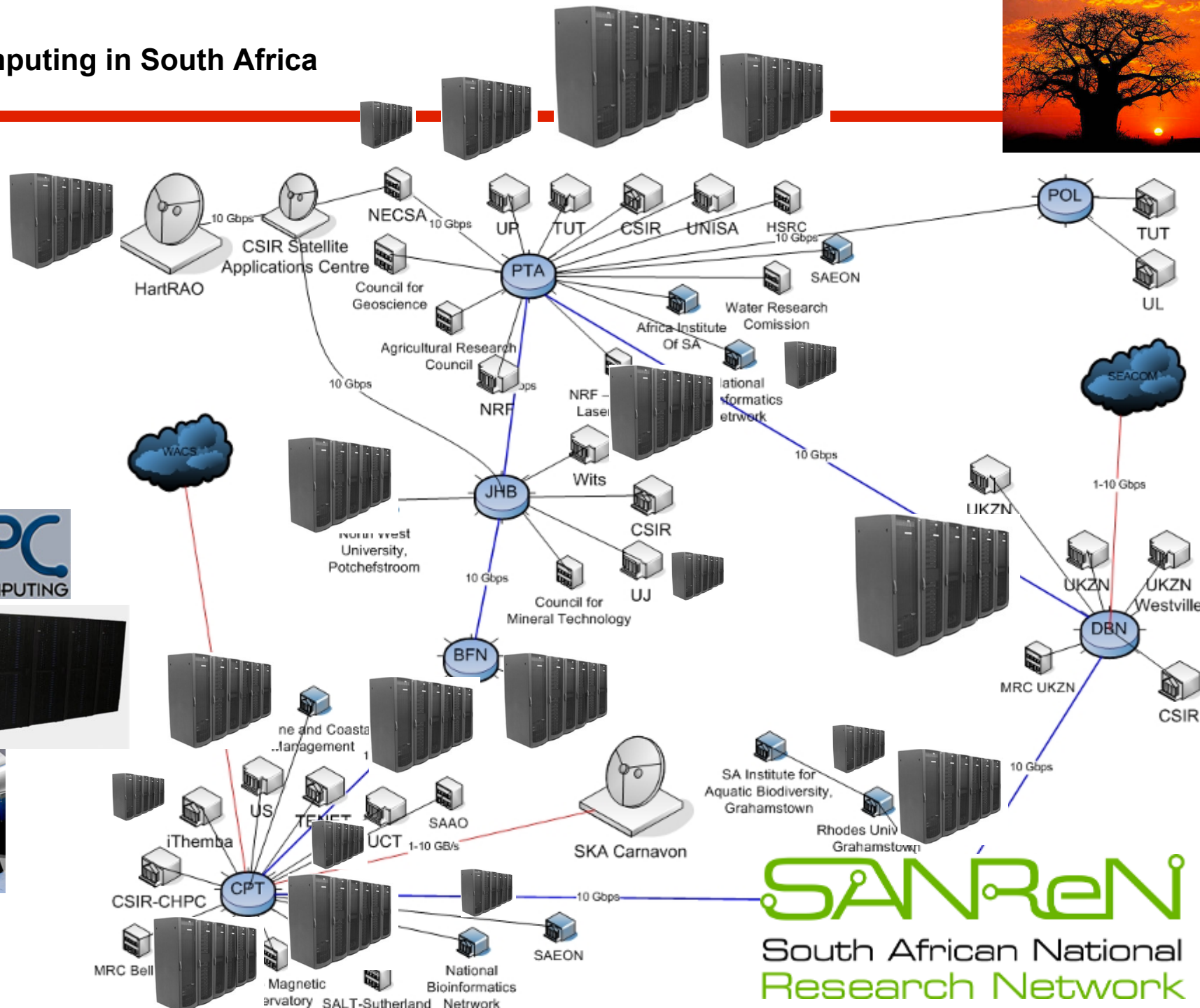
- » [March 2009](#)
- » [October 2008](#)
- » [March 2008](#)
- » [November 2007](#)
- » [October 2007](#)
- » [September 2007](#)

Misc.

- » [Login / Register](#)
- » [Subscribe via RSS](#) rss

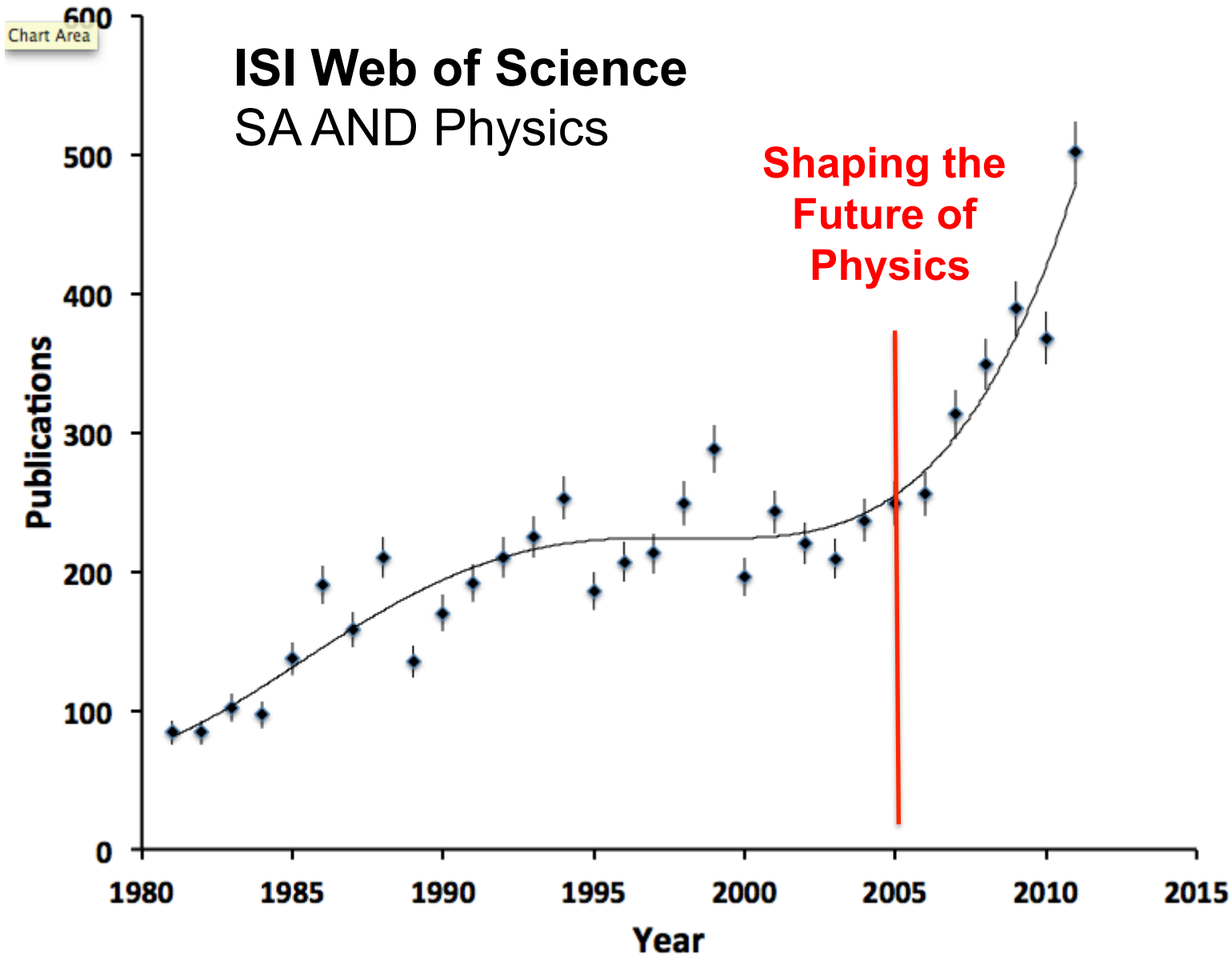


Computing in South Africa



SANREN
South African National
Research Network

Shaping the Future of Physics



SAQA : Prof Body, Designation



- Minister – DHET roadshow – May 2011
- SAQA roadshow August 2011
 - PB : DHET partnership
 - Promote a massive enhancement of the development of skills without compromising quality
 - PBs : data gathering
 - PBs broaden access to training
 - Standard setting, programme accreditation and professional registration
- Explicit reference to funding via the SETA's
- SAIP develops a Professional Designation with CPD
- Registration → regulation, but with enhanced role, opportunities.

SAIP-CHE Review of Physics



- 2008 Annual Conference – complaint : input standards too low
- **Develop the Review of Physics training Project**
 - DST funding
 - Transparent, consultative review leading to Recommendations
- **SAIP developed a Draft Benchmark Statement**
 - Accepted by all University departments
- **SAIP-CHE partnership in the Review ... started 18 June 2012**
 - CHE wanted to review a Discipline (.... normally a Programme)
 - Adapt the tool “Criteria and Minimum Standards”
 - First, community hones the tool
 - Then the self review (by March 2013)
 - Next : Professional analysis
 - Finally : Recommendations (with funding)
- **SAQA see the involvement in the Review as a PB quality.**

South African Science at external Large Scale International Facilities



Astronomy : SALT, MeerKAT,

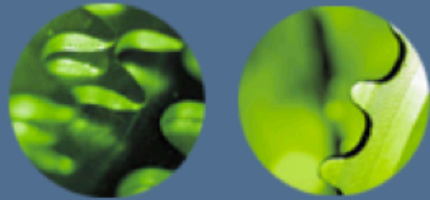
Nuclear : iThemba, ...

Other :

HEP/Nuclear : CERN, JINR

Interdisciplinary : Synchrotrons

Astronomy : HESS, CTA, LIGO

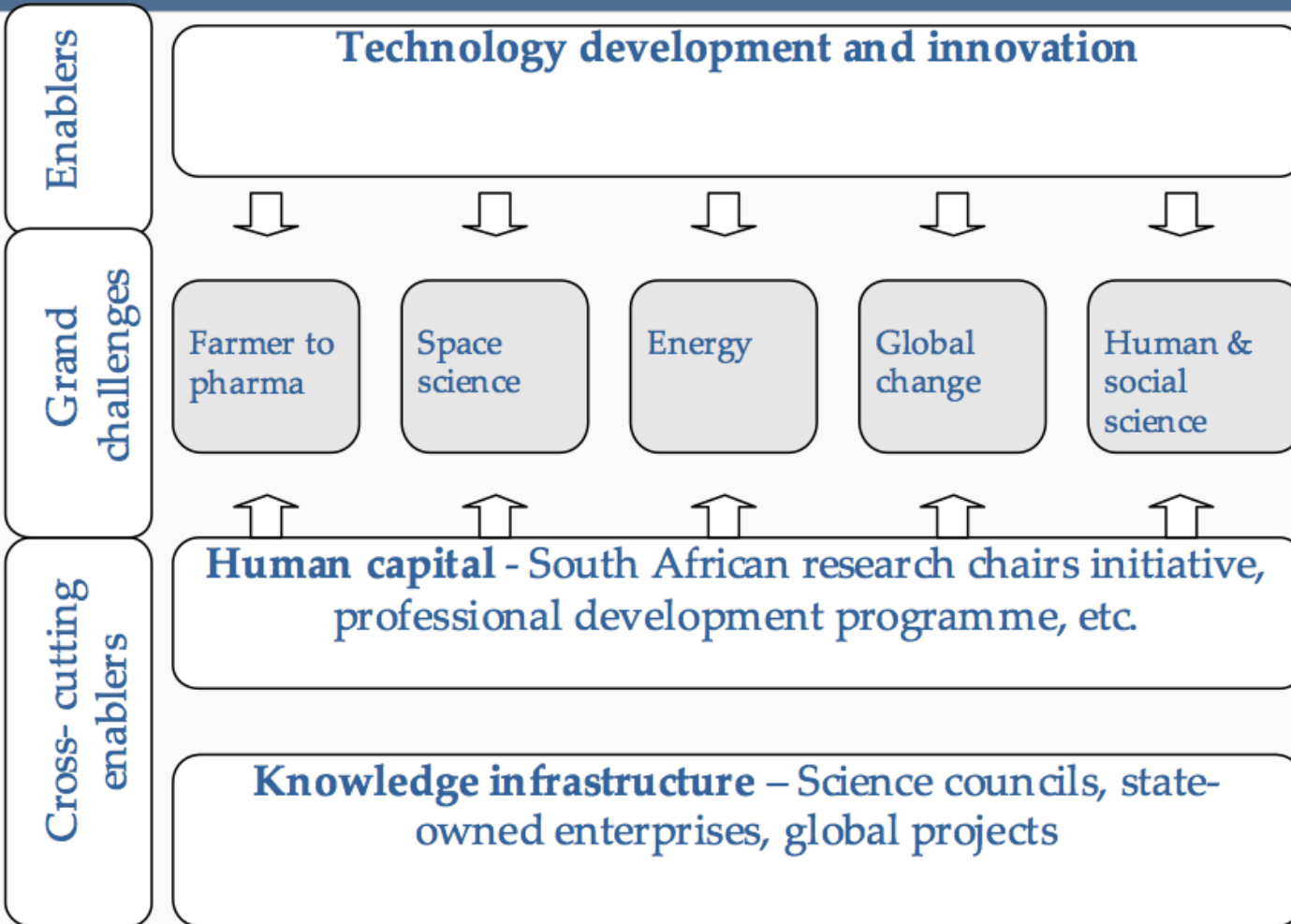


Towards a Knowledge Economy

- Economic growth is driven by Innovation
- Knowledge is the basic form of capital for Innovation
 - Knowledge generation, accumulation and exploitation
 - Key driver for Innovation is “high-end” human capital: PhD
 - PhD as the key foundation for achieving the objectives of the National System of Innovation (NSI)



Knowledge Generation

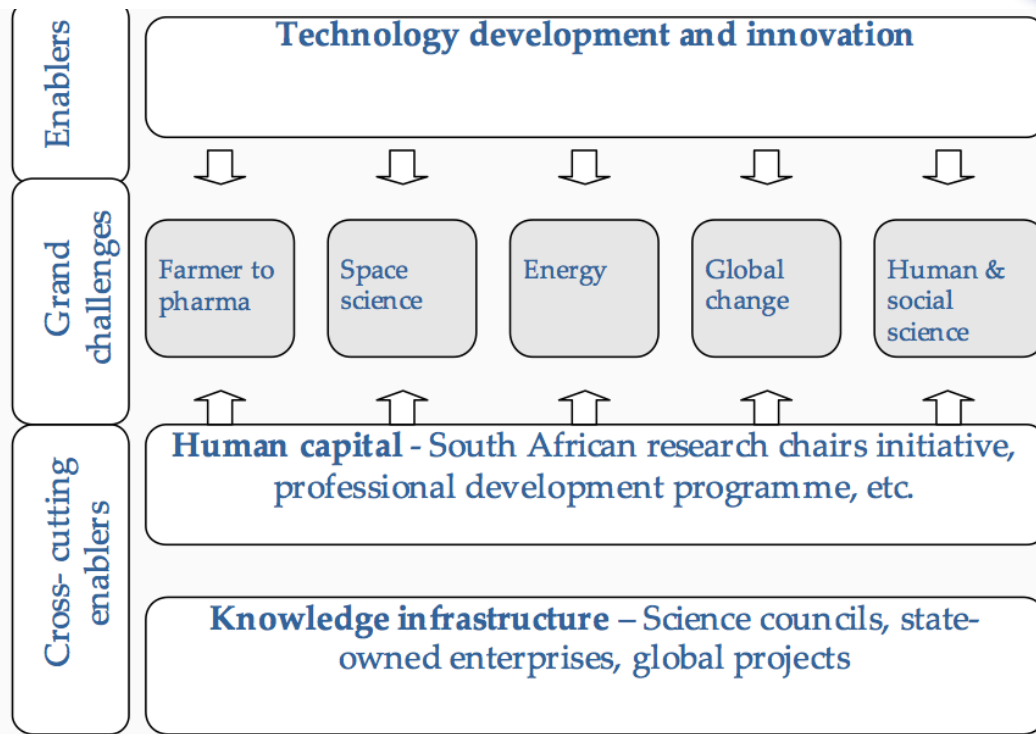


Good research

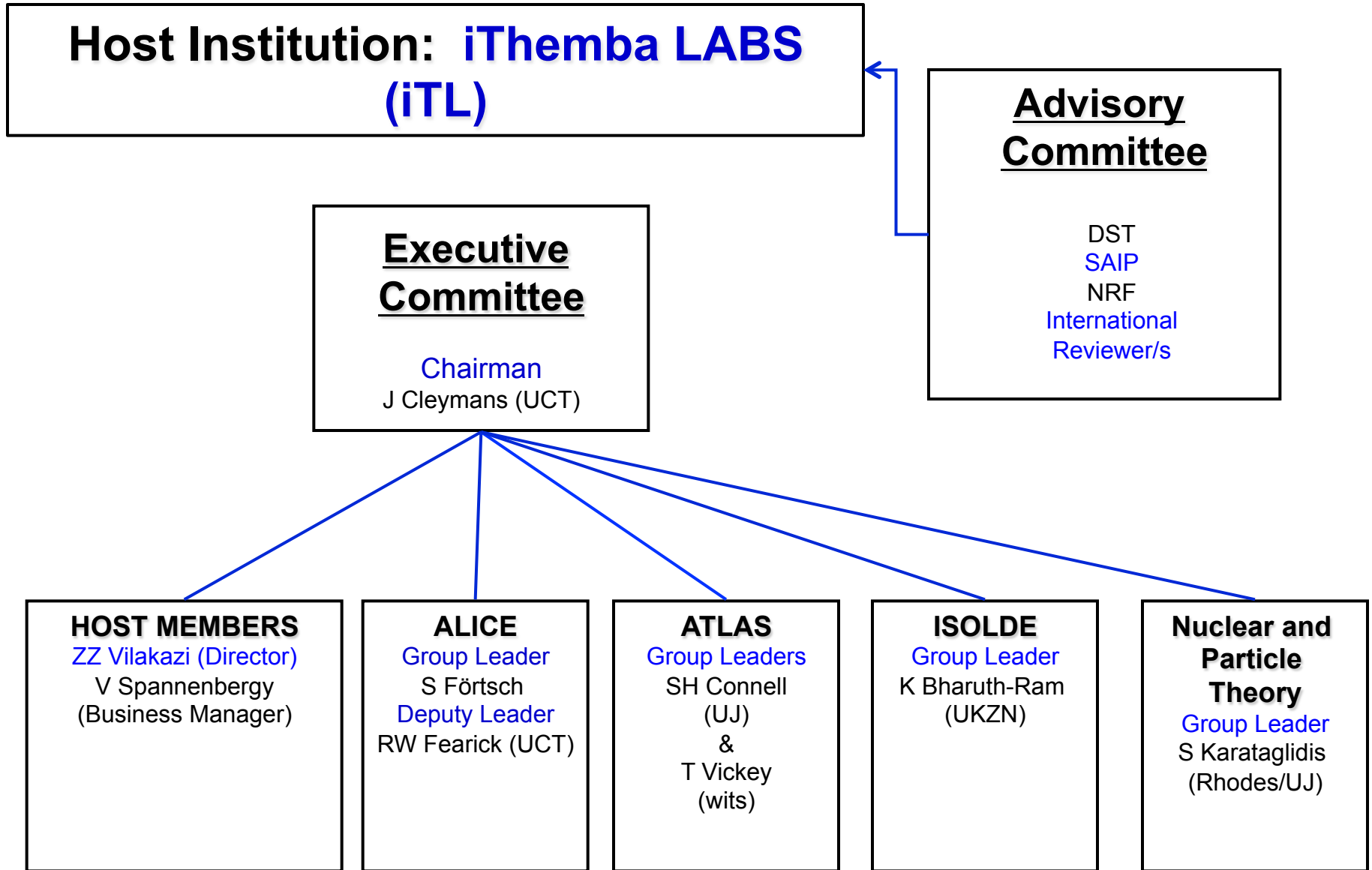
Capacity development

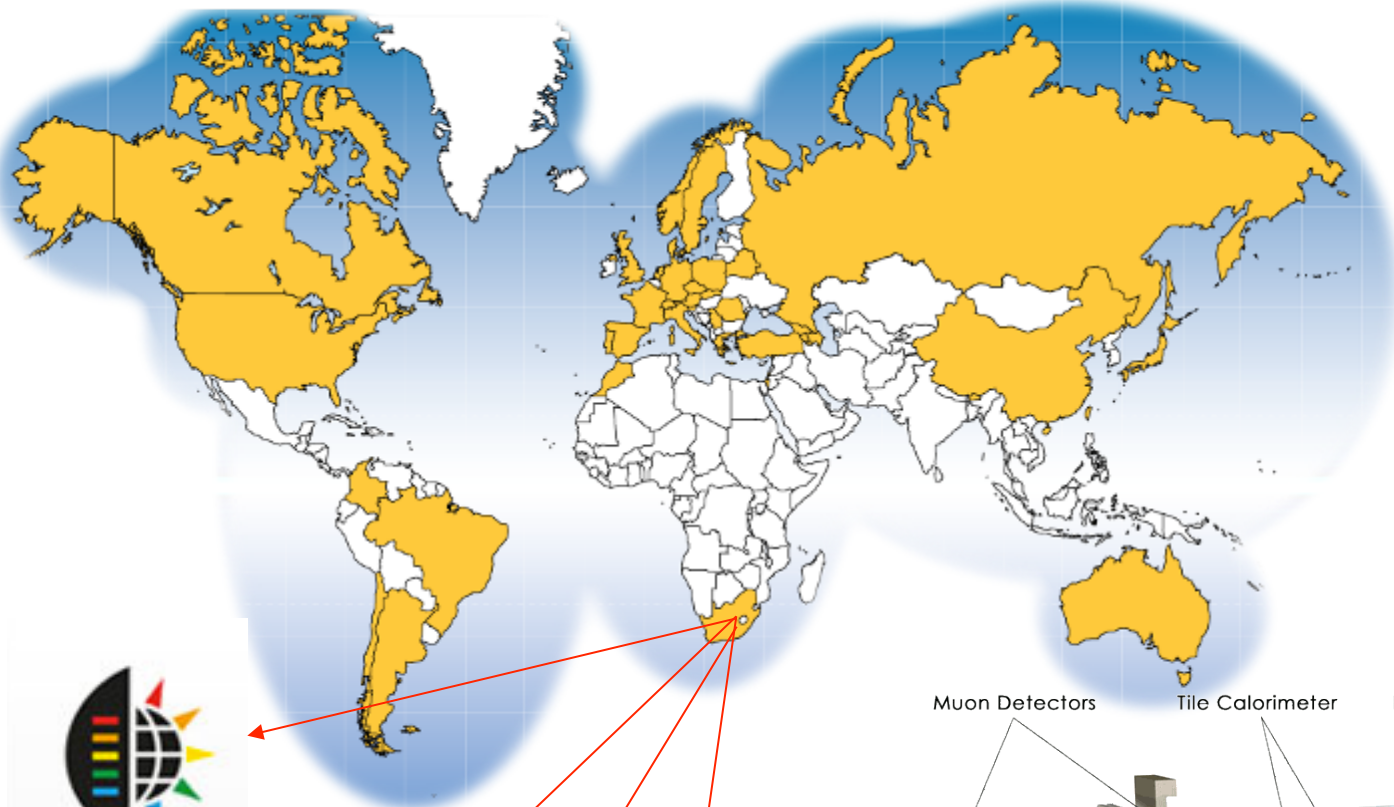
Outreach

Innovation

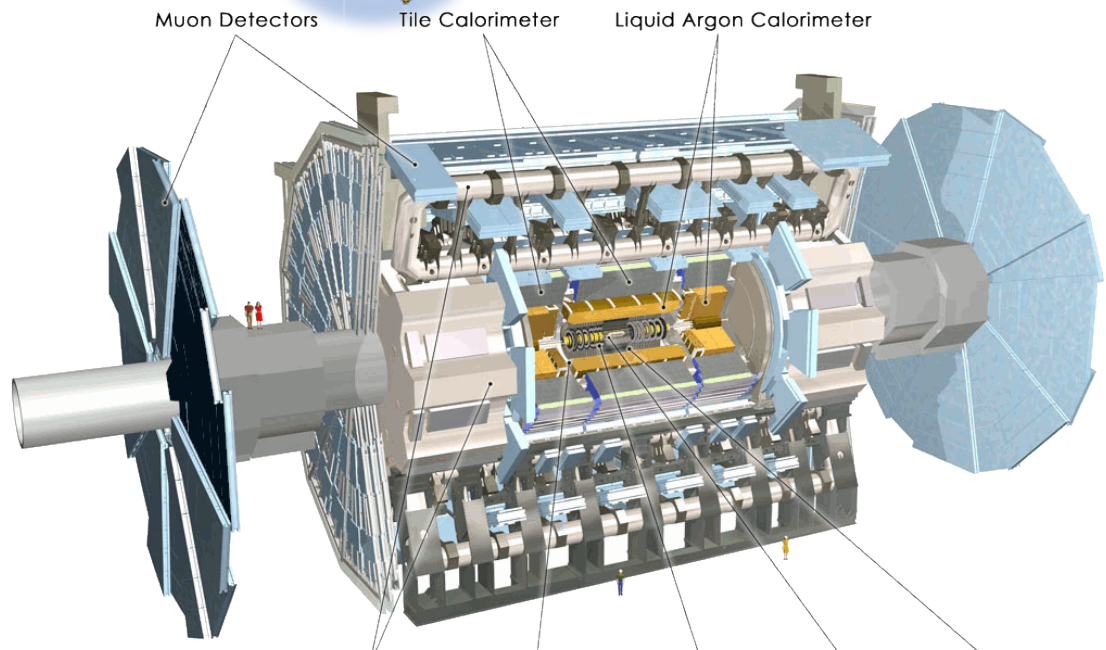


High Energy Physics → SA-CERN Program





UNIVERSITY OF JOHANNESBURG



ALICE Collaboration

~ 1000 Members

(63% from CERN MS)

~30 Countries

~100 Institutes

~ 150 MCHF capital cost
(+ 'free' magnet)

A brief history of ALICE

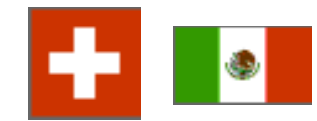
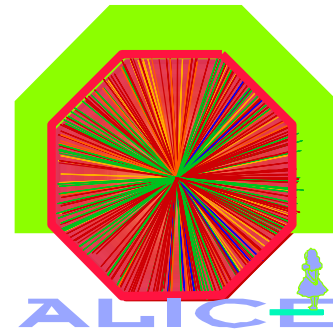
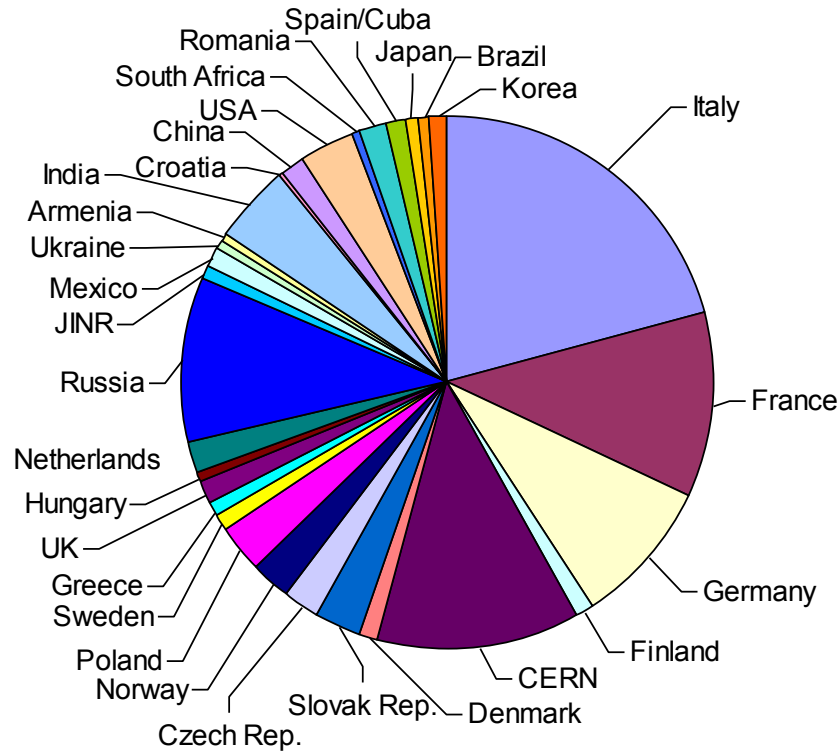
1990-1996: Design

1992-2002: R&D

2000-2010: Construction

2002-2007: Installation

2008 -> : Commissioning



SA-CERN Theory

Theory in SA-CERN covers a variety of topics in both Nuclear and Particle Physics:

- LHC: Higgs phenomenology (Rhodes), Relativistic Heavy-Ion Physics (U CapeTown, U Johannesburg)
- ISOLDE: Nuclear structure, reactions, astrophysics (U Johannesburg);
- nTOF: neutron reactions (U Johannesburg).

Personnel:

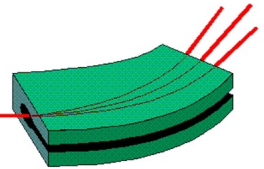
- S. Karataglidis (Chair, U Johannesburg)
- A. Muronga (U CapeTown, U Johannesburg)
- J. Williams (Rhodes U)

ISOLDE/CERN with collaborators

From South Africa: D. Naidoo,
K. Baruth-Ram, H. Masenda,
W. Dlamini, W. N. Sibanda



ISOLDE
CERN



HZB Helmholtz
Zentrum Berlin





SA-CERN Spin-Off Innovation – High Performance Computing

Former students roll-out the Grid in SA - To find out more : <http://www.sagrid.ac.za>

SOUTH AFRICAN NATIONAL GRID

Contact us | Login | Site Map | Register

search...

HOME | RESEARCH | SUPPORT | JRU | CA | EVENTS | DOCUMENTS | SAGRID WIKI | MONITORING

- Overview
- What is the grid?
- Middleware
- Collaborations and projects ▶
- Regional e-Infrastructure ▶
- Become a User
- Become a Site
- In the News
- Important Links ▶
- Grid Events

Home

Welcome to the South African National Grid Portal

South African National Grid |

facebook Name: South African National Grid
 Status: is participating to the African School of Physics...



This is the public portal of the South African National grid, a resource for the general public and day-to-day users of grid services in South Africa. This is a project to deploy a national grid infrastructure based on the gLite middleware from EGEE at several universities and national laboratories. Follow the links on the left to find out more about the general information regarding grid computing in South Africa and the world. For a description of the project, see "Overview" and for a description and links to the middleware and technology, see "Middleware".

If you're interested in becoming a user of the grid, or providing resources at your institute, please use the relevant links to the left to know more.

LATEST DEVELOPMENTS >>

SAICSIT workshop

Tutorial : Introduction to South African National Grid

where should we have the next event ?

- Bloemfontein
- Potchefstroom
- Stellenbosch
- Pretoria
- Durban

VOTE



News from the Grid World

International Science Grid This Week



- Link - What are the odds?
- Image - Beware of grids
- Feature - CLARIN: A project that enable to you

<<	August 2010							>>
S	M	T	W	T	F	S		
1	2	3	4	5	6	7		
8	9	10	11	12	13	14		



Grenoble Test Source 2 (GTS2) at iThemba LABS

iThemba LABS has assembled an electron cyclotron resonance ion source (ECRIS GTS2) that was designed by CEA in Grenoble, France, but not manufactured by them, because that division closed down.

iThemba LABS bought the design drawings of the source from them.

This source is the only other source that is based on the same design as the heavy-ion ECRIS used at the Large Hadron Collider (LHC) facility at The European Organization for Nuclear Research (CERN) facility in Europe, and subsequently a collaboration agreement been signed with CERN.

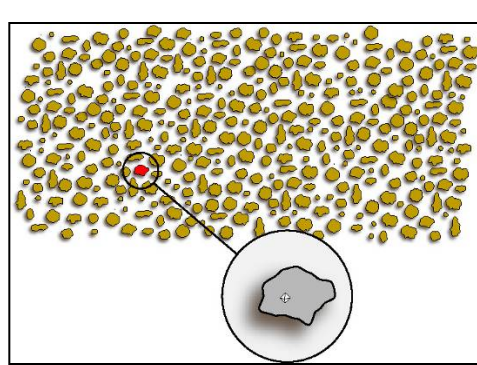
This involves the initial commissioning of the GTS2 ECRIS at iThemba LABS, followed by the study of specific heavy-ion beams as requested by the fixed target experiment (NA61) group at CERN.

The aim is to find the optimal source settings and to characterize the source behavior for these specific ion species.

The results are scheduled for delivery later in 2012.

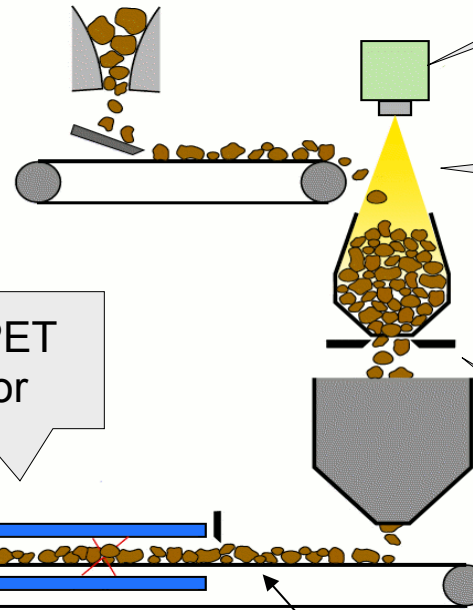


SA-CERN Spin-Off Innovation – Min-PET



coarse crush

Sorting barren from
diamondiferous
kimberlite



gamma
beam

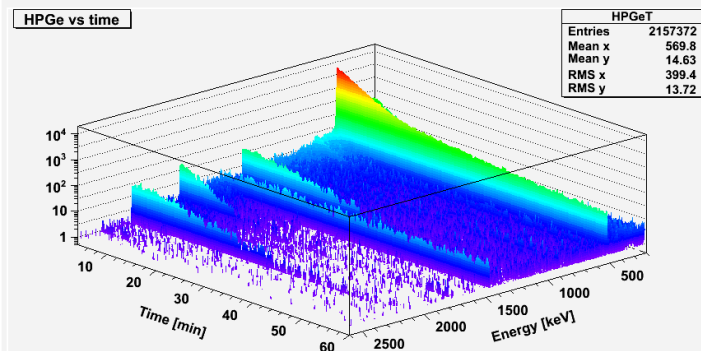
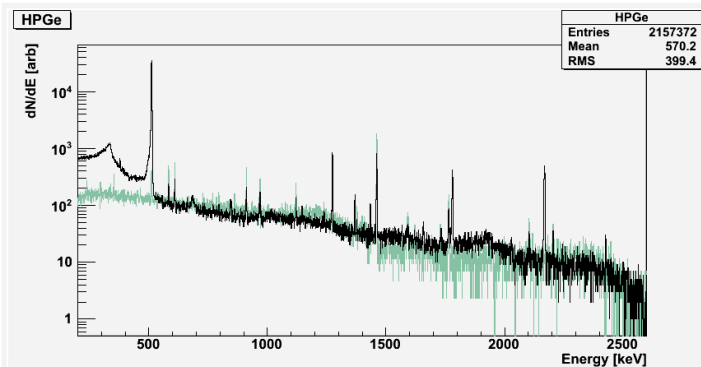
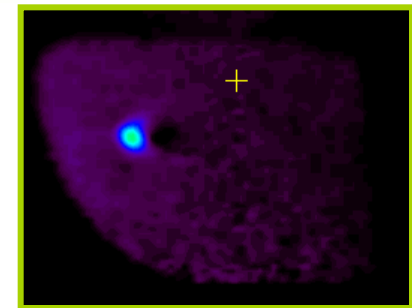
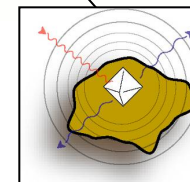
$^{12}\text{C}(\gamma, n)^{11}\text{C}$

irradiation
hopper

hold hopper
(20min)

planar PET
detector

ejection flaps



Main

Science at Synchrotrons in SA - Notices and Download pages

News

- 13 January 2012 : The "Strategic Plan for Synchrotron Science in SA" is complete. It is not yet a public document, but requests to the SRRIC Chair, Tshepo Ntsoane (tshepo.ntsoane at necsa.co.za), will be considered
- 1-2 December 2011 : The "Science @ Synchrotrons - Business Plan and Strategic Plan" Workshop.

Actions and Downloads

- Download the Report for the "**Science at Synchrotrons - 2009**" from February 2009
- Join the mailing list for "**Science at Synchrotrons in SA**"
- Download the Report for the "**Series of Four Meetings on Science at Synchrotrons**" from February 2007
- Download the "**Science at Synchrotrons - Roadmap**" from August 2007
- Download the "**SA Beamline Feasibility Study**" from November 2007
- Download the "**User Statistics Questionnaire**" from August 2008, **due date 30-Aug-08**

In Preparation in 2012

- S@S 2012 - date to be set.
- Finalisation of the Business Plan for the Synchrotron Roadmap - to be carried out by Sekazi Mtingwa (MIT and ALC) and Bryan Masara (SAIP - EO)
- Application for a targeted Research Chair in Synchrotron Science - awaiting call from NRF
- Discussing the possibility of a "Hercules" type school as a S@S replacement for one year (offer from ESRF and SOLEIL)

News archive

- [SRRIC Circular June 2008](#)
- [SRRIC Circular August 2008](#)
- [News up to 2010](#)

Science at Synchrotrons in South Africa

- ✓ [home](#)
- ✓ [Mailing list](#)
- ✓ [Contact details](#)

SRRIC circulars

- ✓ [June 2008](#)
- ✓ [August 2008](#)

Past events

- ✓ [Science at Synchrotrons 2007](#)
- ✓ [Science at Synchrotrons 2009](#)

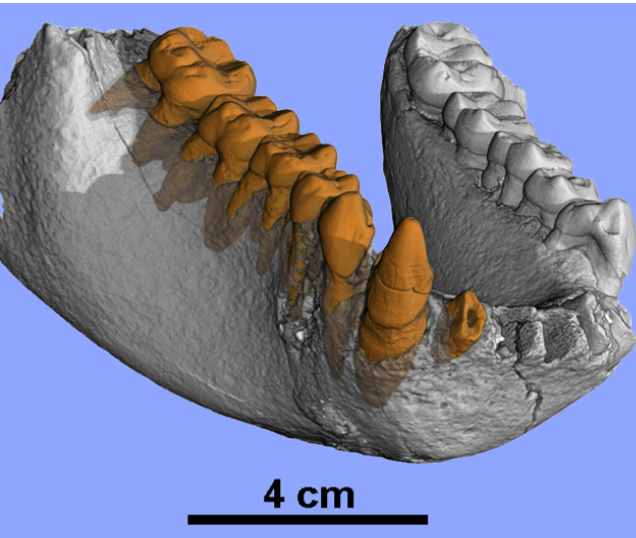
SRRIC Documents :

Protected

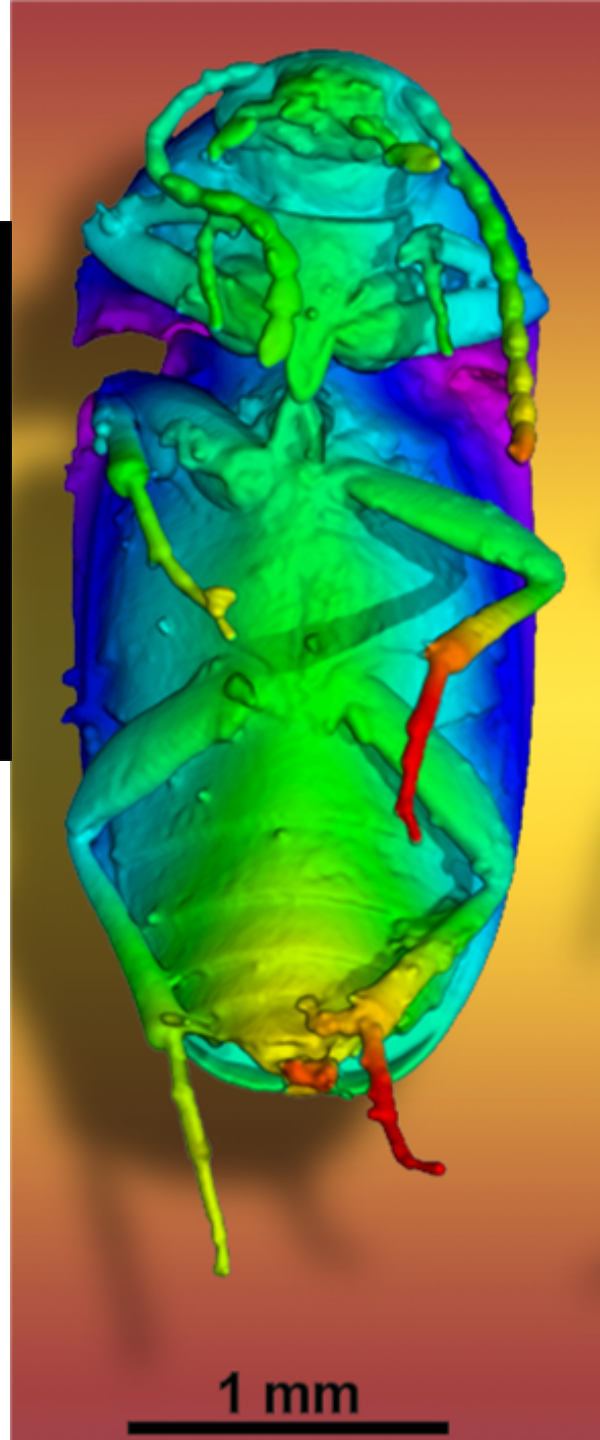
- ✓ [Developing the Business Plan](#)



High performance Computing for Palaeontology



1. 3D quantitative imaging
2. Non Destructive
3. Objects up to 30 cm diameter
4. Resolutions down to $0.25 \mu\text{m}$
5. Sino-gram data size up to 10 TB
6. 3D image > 10 GB
7. **Challenge** to do image retrieval
8. **Challenge** to do image segmentation



**STRATEGIC PLAN FOR
SYNCHROTRON SCIENCE IN SOUTH AFRICA**

**This Strategic Plan was Informed by the Outputs from a Workshop
Convened by the
Synchrotron Research Roadmap Implementation Committee (SRRIC)**

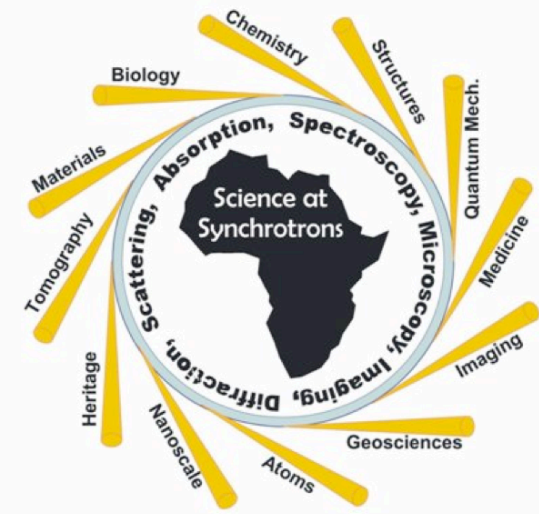
**Supported by the
Department of Science and Technology (DST)
And the
National Research Foundation (NRF)**

**on
1-2 December 2011
Pretoria, South Africa**

Date of Last Modification: 02 February 2012

SA Synchrotron Community Decisions

1. Mobility funds
2. Local Enabling Infrastructure
3. Capacity Building funds (Schools, trainees .
4. ESRF Scientific Associate
5. **A Light Source for Africa !**





Two significant science announcements in 2012

Leads to very high profile for Physics in the Media

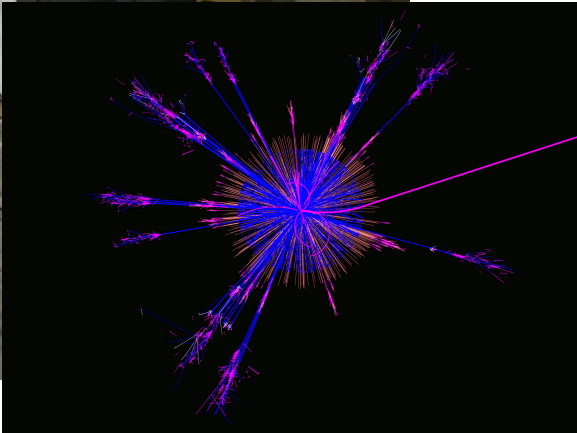
1. Newspaper articles,
2. Talk Shows,
3. TV appearances,
4. Public lectures,
5. Follow-up events,
6. Currently National Science week



- At around 100 times more sensitive than any comparable existing facility, the SKA giant radio telescope will be the most powerful ever built (US\$2.09-billion).
- Consisting of about 3 000 parabolic antennae with a total collecting area of around 100ha, or a square kilometre, SKA will construct images of the universe from radio waves.
- South Africa and Australia are in the race for the privilege of hosting this key scientific facility, with the winning nation to be announced in late 2011 or early 2012.
- The MeerKAT is the precursor to the Square Kilometre Array (SKA), funded by the Department of Science and Technology.



SA-CERN Discovery, spinoffs



28 July 2012

ASP2012 - Forum Day



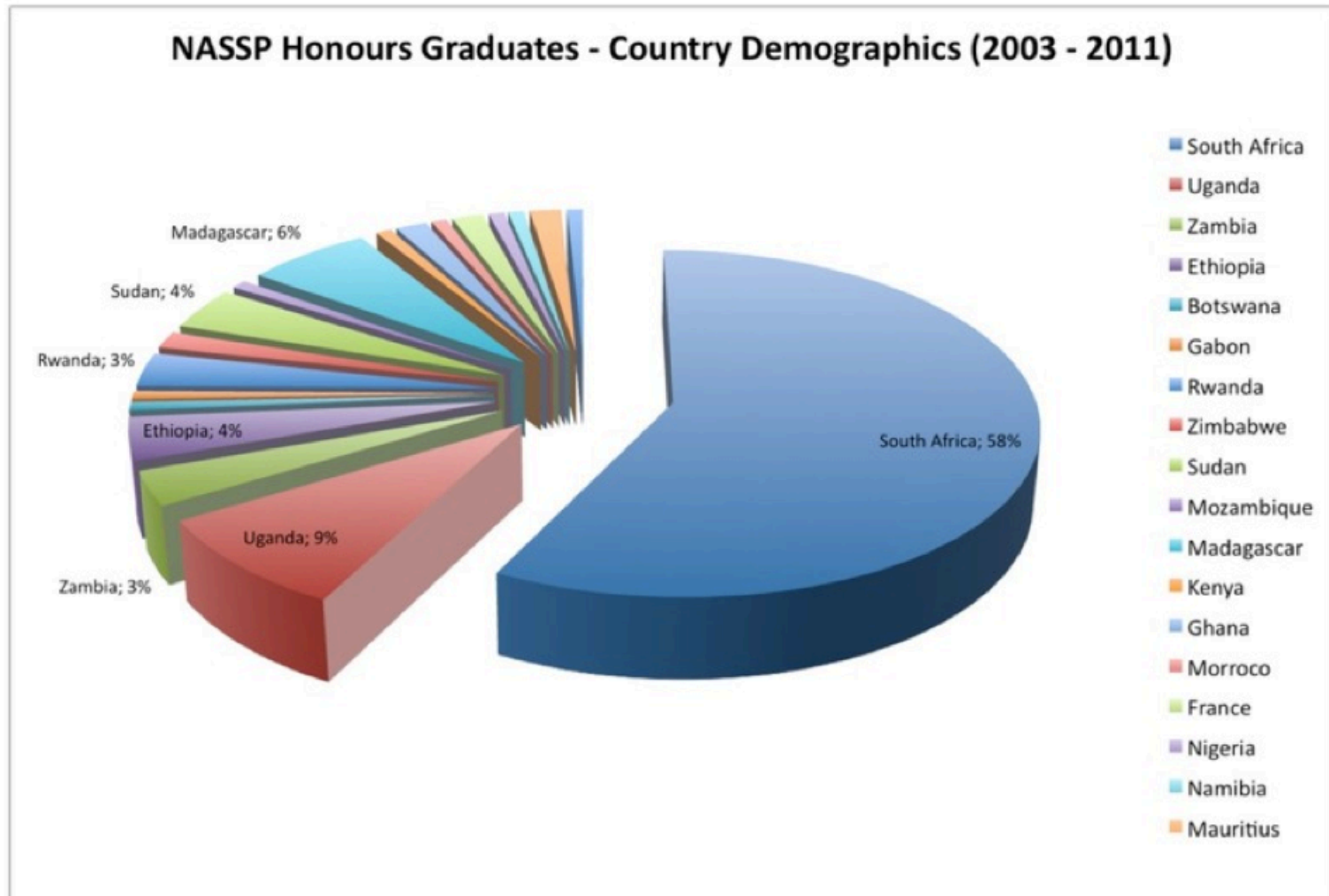
Can HEP learn anything from Astro ?

1. What did they do right ?
2. What did they do wrong ?
3. What can be done together ?
4. The Pan-African connection ?

Multi-wavelength Astronomy in South Africa

Human Capacity Development Programmes in Astronomy

NASSP



Multi-wavelength Astronomy in South Africa

Human Capacity Development Programmes in Astronomy

NASSP

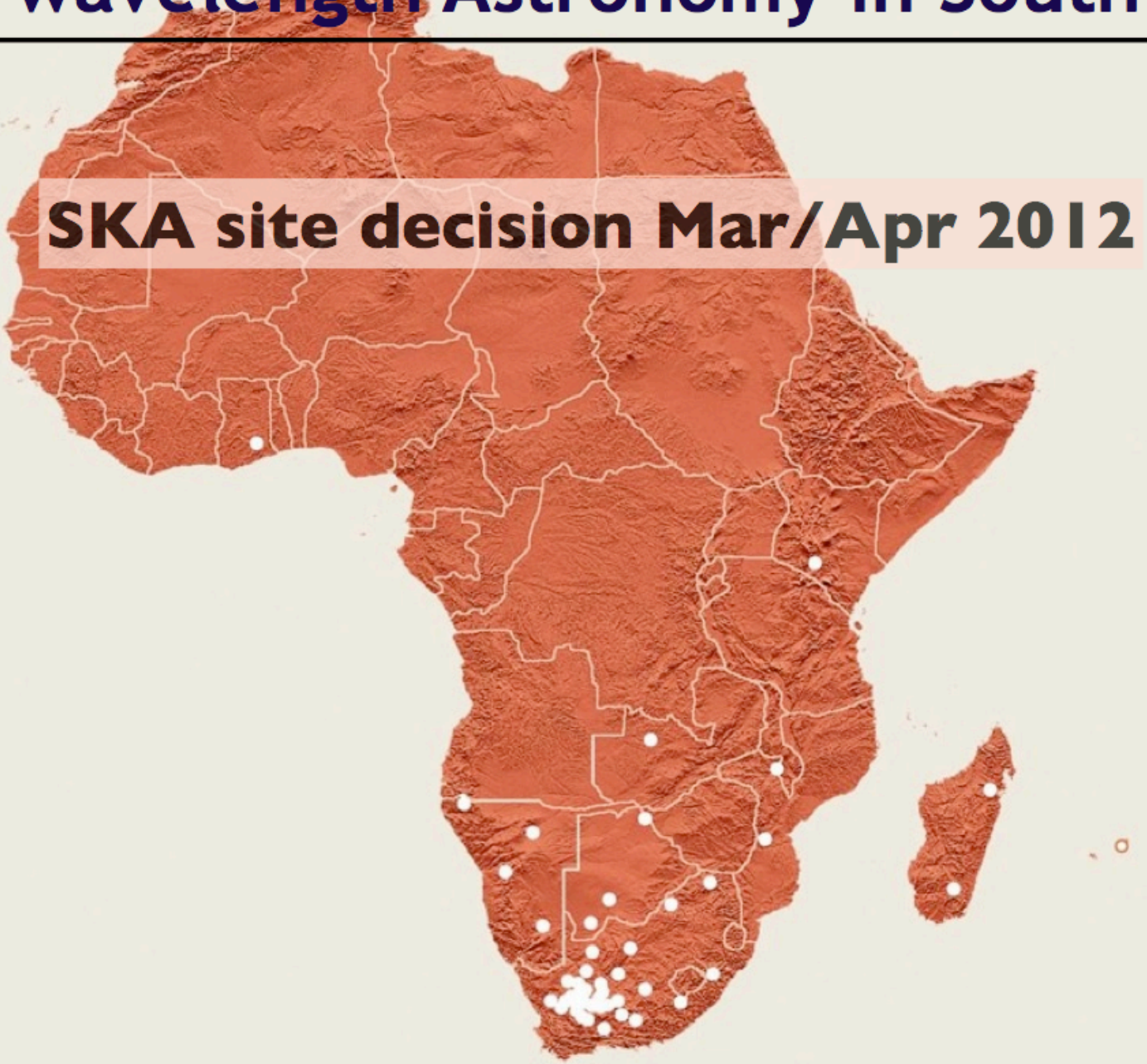
Typical enrollment:

- 20 BSc Hons students per year
- 20 MSc students per year

Initially a large fraction of students from across Africa, now more and more South African (~75-80%) and mostly black (South) African students (~75%).

Training cohort of SA students to pursue career in Astrophysics (since 2008, 16 PhD students graduated).

Multi-wavelength Astronomy in South Africa



Multi-wavelength Astronomy in South Africa

Growth of the Astronomy community in South Africa

Institute	2006	2010	SARChI (2012)
UCT/ACGC	11	29	2
SAAO	25	25	.33
UWC	0	8	1.33
NWU	3	7	1
HartRAO	5	7	
MeerKAT	0	6	0.5
UKZN	4	6	
Wits	3	4	1
UJ	2	3	
UFS	1	2	
UNISA	3	2	
Rhodes	1	1	0.5
UZ	1	1	

PhD astronomers at SA universities and research facilities

Multi-wavelength Astronomy in South Africa

Summary

Creation of world-class facilities and excellent HCD programmes have led to a phenomenal growth of multi-wavelength Astronomy in South Africa

South Africa plays a central role in the development of Astronomy in other African countries (e.g. SA SKA partner countries, and those where former NASSP students have become staff members in the various Physics Departments)

Examples: Kenya, Uganda, Sudan, Ethiopia, Mozambique

Establishment in 2011 of the African Astronomical Society and the International Office of Astronomy for Development.



The Transformation and Re-shaping of Physics in SA

- Excellent foundations
- Reshaped
- Transformed
- New projects, optimism
- Reverse the brain drain
 - Excellent hires
 - Returning diaspora
- Progress Science in South Africa and Africa

