Annual report

1 January - 31 December 2010

Participants at Chris Engelbrecht Summer School 2010 (read more on page 18).

Contents

Abbreviations

AIMS	African Institute for Mathematical Sciences	SU	Stellenbosch University
CoE	National Centre of Excellence	UCT	University of Cape Town
CSIR	The Council for Scientific and Industrial Research	UFH	University of Fort Hare
		UFS	University of the Free State
NMMU	Nelson Mandela Metropolitan University	UJ	University of Johannesburg
NRF	National Research Foundation	UKZN	University of KwaZulu-Natal
NWU	North-West University	UNIVEN	University of Venda
RFP	Request for Proposal	UP	University of Pretoria
RU	Rhodes University	UWC	University of the Western Cape
STIAS	Stellenbosch Institute for Advanced Study	WITS	University of the Witwatersrand

Director's Report

AFTER A PERIOD OF RAPID GROWTH IN 2009, stimulated by the deployment of several programmes to engage with the theoretical physics community, NITheP consolidated its position and developed medium to longer term strategies during 2010.

A key element of NITheP's long term success and sustainability is community participation in identifying medium and long-term goals for NITheP. To this end, the first NITheP staff and associate workshop was held in April 2010.

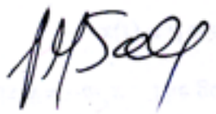
On this occasion, the vision and mission statements of NITheP were revisited, from which strategic goals, key performance areas and indicators were derived. This input formed the basis for the development of the next five-year plan. Overall, this was a highly successful exercise that will be annually repeated to ensure NITheP policies are informed by the needs of the community.

2010 also saw the first full-scale implementation of the request for proposal system under which associates can apply for support for international workshops, visitors and mobility. In addition to a number of schools, an impressive 14 workshops were held in 2010 and the programme supported three long-term international visitors. The bursary, travel and internship programmes for students were also continued and consolidated.

In 2010, the first step was taken to broaden NITheP's horizon to include other African countries with an exceptionally successful visit to the University of Mauritius. As an outflow of this, the first advanced course aimed at faculty development is likely to take place in 2011. Hopefully this can serve as a prototype for similar developments elsewhere in Africa.

On the research front, 2010 was extremely productive with a clear growth trend in research outputs.

The consolidation and strategy development accomplished during 2010 will hopefully form a platform for the systematic and structured growth of NITheP in the long term.



Frederik Scholtz

Visit to the University of Mauritius in July 2010

Introduction

NITHEP IS A GEOGRAPHICALLY DISTRIBUTED INSTITUTE with regional centres at the Stellenbosch Institute for Advanced Study (STIAS), University of Witwatersrand (WITS) and University of KwaZulu-Natal (UKZN). Stellenbosch University (SU) acts as the host institution and the regional centre at STIAS remains its headquarters.

The governance system is that of a national centre of excellence (CoE), which is subject to the notarisation of a binding contract between the granter, being the National Research Foundation (NRF), and the grantee, namely SU as the host institution of the NITheP headquarters.

NITheP continues to operate in an independent environment at STIAS, with SU providing administrative support. This is critical in the South African – and African – context to ensure non-alliance to a particular institute and to develop and retain an independent identity.

Interaction between the regional centres is governed by a consortium agreement between the hosts of the three regional centres, namely WITS, UKZN and SU.

The NITheP Mandate and Strategy

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 supporting scientific innovation, transformation and socio-economic development in South Africa.

Strategic goals

- TO IDENTIFY and pursue high-level research projects and expand existing expertise in the fields covered by theoretical physics in South Africa;
- To act as a national and African user facility for theoretical physics, which optimises communication and collaboration between the existing centres of expertise and stimulates joint initiatives in line with international developments;
- To promote equitable participation from all communities in South Africa in theoretical physics programmes and to strengthen ties with similar communities on the African continent; and
- To provide a source of expertise that can feed into broad national scientific policies and goals.

International school on Fundamental Subatomic Physics and its Applications (read more on page 17).

Governance and Structure

Governance

THE GOVERNANCE STRUCTURE, as set out in the governance document for a CoE, makes provision for the establishment of a Management Committee, Board of Directors and Scientific Advisory Committee.

The composition of these core governance committees on 31 December 2010 were as follows:

Board members:

- Prof A van Zyl (Vice Rector Research, SU)
- Dr A Kaniki (NRF)
- Prof J Rodrigues (Deputy Director, WITS)
- Prof F Petruccione (Deputy Director, UKZN)
- Prof N Chetty (UP)
- Prof P Ngoepe (University of Limpopo)
- Prof R de Mello Koch (WITS)
- Prof H B Geyer (STIAS)
- Prof T Hillie (CSIR)
- Prof F G Scholtz (Director)
- DST Representative

Scientific advisory committee:

- Sir P Knight (The Kavli Royal Society International Centre)
- Prof S J Gates (University of Maryland)
- Prof J Govaerts (Catholic University Louvain)
- Prof N Turok (Perimeter Institute)

Management committee:

- Prof F G Scholtz (Director, Chair)
- Prof J Rodrigues (Deputy Director, WITS)
- Prof F Petruccione (Deputy Director, UKZN)
- Prof R de Mello Koch (Elected Associate Representative)
- Mrs R Kotzé (Public Relations)
- Ms M Louw (Secretary)

Staff

THE STAFF PROFILE of NITheP as on 31 December 2010 is shown in Table 1.

Table 1: Staff profile on 31 December 2010

Position	Node	Number
Director	SU	1 (five-year contract)
Deputy Director	WITS/UKZN	2 (five-year contract)
Chief Researcher	SU	1 (five-year contract)
Senior Researcher	SU/WITS	2 (five-year contract)
Researcher	SU/UKZN	3 (two five-year and one one-year contracts)
Senior Admin. Officer	SU/WITS	3 (one full time, one 3/8, one 5/8; positions all five-year contracts)
Secretary	UKZN	1 (five-year contract)
Total		**13**

Postdoctoral fellows

THE POSTDOCTORAL FELLOWS per node as on 31 December 2010 are shown in Table 2. All positions comprise two-year contracts.

Table 2: Postdoctoral fellows

Node	NITheP funded	Outside funded
SU	2	1
WITS	1	0
UKZN	2	0
Total	**5**	**1**

Speakers and attendees at NITheP's gala evening of public talks (read more on page 17).

Participants at the active materials workshop (read more on page 19).

Service rendering

Marketing

AS NITHEP functions as a user facility, it is important to maintain a high level of visibility within the community. For this purpose, promotional material and a new website were developed in 2010.

An exhibition was also held at the annual conference of the South African Institute of Physics (SAIP) in October 2010.

All but two tertiary institutions were visited during 2009/2010. On these occasions, presentations were given on NITheP's services and the benefits of association with NITheP.

All tertiary institutions that do not offer formal programmes in theoretical physics, and where there is currently no NITheP presence, will be visited in 2011 with a view to exploring ways of building capacity in this field. As theoretical physics underpins all disciplines in physics, such capacity will generally enhance research and training in physics at these institutions.

Networking

Associate programme

To achieve NITheP's strategic goals, it is crucial to develop a national network. In 2010 our highly successful associate programme continued to grow. The current status of the network, which now comprises 38 individual and four institutional associates, is reflected in Table 3.

Associates have access to the NITheP visitor, mobility and workshop programmes through a request for proposal (RFP) system.

Table 3: Associates on 31 December 2009

INDIVIDUAL ASSOCIATES	
Prof Jacek Banasiak	University of KwaZulu-Natal
Prof Igor Barashenkov	University of Cape Town
Dr Bruce Bartlett	Stellenbosch University
Prof Bruce A Bassett	African Institute for Mathematical Sciences, South African Astronomical Observatory & University of Cape Town
Prof Moritz Braun	University of South Africa
Prof Erwin Brüning	University of KwaZulu-Natal
Prof Nithaya Chetty	University of Pretoria
Prof Jean Cleymans	University of Cape Town
Prof Robert de Mello Koch	University of Witwatersrand

INDIVIDUAL ASSOCIATES	
Prof Cesareo A Dominguez	University of Cape Town
Dr Rocco Duvenhage	University of Pretoria
Prof Hans Eggers	Stellenbosch University
Prof George Ellis	University of Cape Town
Prof Arthur Every	University of Witwatersrand
Dr Kevin Goldstein	University of Witwatersrand
Prof Dieter W Heiss	Stellenbosch University
Prof Manfred Hellberg	University of KwaZulu-Natal
Dr William Horowitz (1 Jan 2011)	University of Cape Town
Prof Daniel Joubert	University of Witwatersrand
Prof Steven Karataglides	University of Johannesburg
Prof Thomas Konrad	University of KwaZulu-Natal
Dr Mantile Lekala	University of South Africa
Prof Roy Maartens	The University of the Western Cape
Prof Sunil Maharaj	University of KwaZulu-Natal
Prof Oluwole Daniel Makinde	Cape Peninsula University of Technology
Prof Kavilan Moodley	University of KwaZulu-Natal
Prof Kristian Müller-Nedebock	Stellenbosch University
Dr Azwinndini Muronga	University of Johannesburg
Dr Jeff Murugan	University of Cape Town
Prof Andre Peshier	University of Cape Town
Dr Dimitri Polyakov	University of Witwatersrand
Prof Martin Porrmann	University of KwaZulu-Natal
Prof Marius Potgieter	North-West University
Prof Sergei Rakitianski	University of Pretoria
Dr Alessandro Sergi	University of KwaZulu-Natal
Dr Gary Tupper	University of Cape Town
Prof Raoul Viollier	University of Cape Town
Dr Amanda Weltman (1 Jan 2011)	University of Cape Town

INSTITUTIONAL ASSOCIATES	
Alice Group	University of Cape Town
Centre for Theoretical Physics	University of Cape Town
Cosmology Group	University of Cape Town
Centre for Space Research	North-West University

African development programme

Capacity development in Theoretical Physics in Africa is very much part of the NITheP mandate and agenda. The first step in this direction was taken in 2010 when a NITheP delegation visited the University of Mauritius to investigate possible modes of cooperation and capacity building.

The visit was initiated by a request from Dr S Ramgoolam of Queen Mary University, London. Dr Ramgoolam will be actively involved in the training programmes aimed at capacity building in Mauritius.

The first of these training programmes will run in July 2011. It is planned to extend this initiative to other Universities in Africa, hopefully in collaboration with existing initiatives such as the African Institute for Mathematical Sciences (AIMS).

Request for Proposal (RFP) programme

NITheP gives associates and staff access to NITheP resources and, in particular, the mobility, long-term visitor, workshop and research programmes, via a competitive, proposal-driven system.

Table 4 summarises the support given to staff and associates under this programme during 2010. The individual activities listed below are reported on in detail under the appropriate headings.

Table 4: Proposals supported under the RFP programme in 2010

Activity	Number
Workshops	14
Schools	3
Long term visitors	3 (total of 15 months)
Mobility	0

Mobility

Under the mobility programme, support is provided for associates to travel between South African higher educational institutions, especially to the three nodal centres, namely WITS, UKZN and SU. Support is provided for up to two months per year and includes accommodation, subsistence and transport costs where strongly motivated and justified.

Although this programme was unfortunately underutilised in 2010, there has been a sharp increase in requests under this programme in 2011.

Visitors

A vibrant visitor programme is vital for NITheP's success. There are two mechanisms that attract visitors to NITheP.

The first is the long-term visitor programme, accessed through the RFP system. Under this programme, staff and associates can apply for support of longer-term visiting collaborators, typically for between one and six months.

This support covers accommodation and subsistence. Travel costs are covered only in exceptional cases.

NITheP also budgets annually for short-term visitors who typically spend less than a month at a NITheP centre or the tertiary institution of an associate.

Foreign researchers can apply for support under either of these programmes.

In 2010 the visitor programme was very active with a considerable number of often very high-profile visitors who passed through NITheP nodes and/or associate institutions. Table 5 summarises the long-term visitors supported under the RFP programme, while Table 6 reflects the short-term visitors supported under the regular NITheP visitor programme.

Table 5: Long-term visitors supported under the RFP programme in 2010

Visitor	Home institution	Host institution	Term
Prof R Maartens	University of Portsmouth	UCT	Jan to Sept
Prof J-P Uzan	Institut d'Astrophysique de Paris	UCT	Sep to Dec
Prof M Bucher	Laboratoire de Physique Théorique, Orsay	UKZN	Feb/Oct

Table 6: Short-term visitors supported under the regular visitor programme in 2010

Visitor	Home institution	Host institution
Prof B Chakraborty	S N Bose Centre, Kolkatta, India	SU
Prof A Fring	City University London	SU
Prof M Paranjape	University of Montreal, Canada	SU
Prof Y Meir	Ben Gurion University	SU
Prof Y Oreg	Weizmann Institute	SU
Dr J Greben	Council for Scientific and Industrial Research (CSIR) Pretoria	SU & WITS
Dr D Polyakov	WITS	SU
Dr J P Paz	Department of Physics, FCEyN, University of Buenos Aires, Argentina	SU
Dr S K Mkhonta	University of Swaziland	SU
Prof A V Nikolaev	Moscow State University	SU
Prof Y Kivshar	Nonlinear Physics Centre, Australian National University, Canberra	SU
Dr A Loginov	CERN	WITS
Prof J Ellis	CERN	WITS
Prof A Muronga	UCT (now based at UJ)	WITS
Dr I Sinayskiy	NITheP KwaZulu-Natal	WITS
Dr I Snyman	NITheP Stellenbosch	WITS
Prof F Petruccione	NITHeP KwaZulu-Natal	WITS
Dr C Pellegrini	University Paul Sabatier Toulouse, France	UKZN
Prof J McKenzie	University of Alabama, USA	UKZN
Prof U Jaekel	University of Applied Sciences, Koblenz, Germany	UKZN
Prof R Schlickeiser	Unversity of Ruhr, Bocum, Germany	UKZN
Prof O Onyejekwe	Florida Institute of Technology, USA	UKZN
Mr V Naicker	University of Cambridge	UKZN
Prof R Maartens	University of Portsmouth, UK	UKZN
Prof S Mukherjee	IUCAA Reference Centre, Kolkata, India	UKZN
Dr J Degorre	University of Singapore	UKZN
Prof J Paz	University of Buenos Aires, Argentina	UKZN
Prof S Attal	University of Lyon, France	UKZN
Dr T Marriage	University of Princeton, USA	UKZN
Mr M Christopher	University of Freiburg, Germany	UKZN
Dr C Rodger	University of Otago, New Zealand	UKZN
Prof M Fannes	University of Leuven, Belgium	UKZN
Dr M Landriau	Technical University of Denmark, Denmark	UKZN
Prof S R Valluri	University of Western Ontario, Canada	UKZN
Prof N Sane	University of Maryland, USA	UKZN
Dr S K Ramgoolam	University of London, UK	WITS
Prof A Jevicki	Brown University, USA	WITS
Prof A Dabholkar	CNRS/University of Paris, France	WITS
Prof S Sheik-Jabbari	IPM, Tehran & ICTP, Iran	WITS
Prof M Schnabl	Institute of Physics of the ASCR, Czech Republic	WITS
Prof R Alicki	University of Gdansk, Poland	UKZN
Dr R Migliore	Institute of Biophysics of the National Council, Palermo, Italy	UKZN
Mr N van Ryn	University of Leuven, Belgium	UKZN
Prof A Messina	University of Palermo, Italy	UKZN
Prof R Brunetti	University of Trento, Italy	UKZN
Prof D Buchholz	University of Göttingen, Germany	UKZN
Dr C Dappiaggi	University of Hamburg, Germany	UKZN
Dr G Lechner	Institute for Mathematical Physics, Vienna, Austria	UKZN
Prof Moretti	University of Rome, Italy	UKZN
Dr N Pinamonti	University of Rome, Italy	UKZN
Dr K Sanders	University of Göttingen, Germany	UKZN
Prof M Wald	University of Chicago, USA	UKZN
Dr T Hack	University of Hamburg, Germany	UKZN
Prof E Morales	Institute for Mathematical Physics, Vienna, Austria	UKZN

Bursaries

A total of 70 bursaries were awarded in 2010. The total actual amount paid out was R3,694,500. The bursaries awarded are summarised in Table 7.

Table 7: Bursaries awarded in 2010

Level	Number	Amount allocated per bursary	Budgeted cost
Hons.	18	R 40 000	R 720 000
M.Sc.	30	R 55 000	R 1,650,000
Ph.D.	22	R 75 000	R 1,650,000
Total	**70**		**R 4,020,000**

The bursary holders per institution and degree are shown in Table 8. This programme showed considerable growth in 2010 due to the participation of previously disadvantaged institutions.

Table 8: Bursary holders per institution in 2010

Institution	Hons.	M.Sc.	Ph.D.	Total
NMMU	2	0	0	2
SU	0	6	1	7
UCT	7	8	9	24
UFH	1	0	0	1
UFS	1	0	0	1
UJ	0	1	0	1
UKZN	4	4	2	10
UNIVEN	0	2	0	2
UP	2	2	4	8
UWC	0	0	2	2
WITS	1	7	4	12
Total	**18**	**30**	**22**	**70**

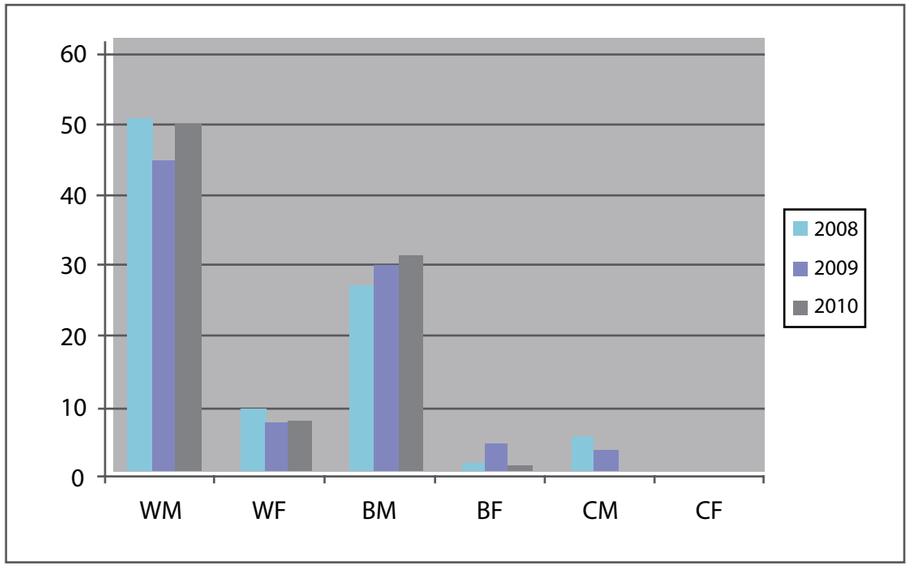
Table 9 indicates the race and gender of the bursary holders. The bursary profile still does not reflect satisfactory demographics, particularly in terms of gender, but it must be kept in mind that theoretical physics is a non-traditional line of study for many underrepresented groupings and it will take some time to reach a more acceptable demographic profile.

A very positive development is the strong growth in black participation on the Ph.D. level, where by far the majority of bursary holders was black males. The change in demographic profile from 2009 to 2010 is reflected in Figure 1.

Table 9: Bursary holders by race and gender in 2010

Degree	White		Black		Coloured		Indian	
	Male	Female	Male	Female	Male	Female	Male	Female
Hons.	13	0	2	0	0	0	0	2
M.Sc.	15	4	8	1	0	0	2	1
Ph.D.	8	0	13	0	0	0	1	0
Total	**36**	**4**	**23**	**1**	**0**	**0**	**3**	**3**

Figure 1: Demographic profile of bursary holders from 2008 to 2010



Internships

The internship programme, launched in 2009, was continued in 2010. Applications for internships were invited during the first half of 2010.

This programme has two components. The first enables students at an Honours or M.Sc. level to join NITheP workshops and complete a small research project, typically on the scale of an honours project, under the supervision of an invited workshop participant. The supervisor and an independent local examiner, normally from the student's home institution, evaluate the project. Marks can be used for credits, if the home institution approves.

The second component makes provision for students, mainly at an Honours level or beginning Masters, to join NITheP staff or associates during recess periods to complete a research project. Once again, the supervisor and an independent examiner, usually from the student's home institution, evaluate these projects. The marks can be used for credits if the home institution approves.

NITheP thus provides a training opportunity for students, often under the guidance of a leading researcher, alleviates the pressure of project supervision on departments. Typically, NITheP supports students who pass the screening process with accommodation, subsistence and travel.

Table 10: Internship statistics for 2010

Student's home institute (host institute)	Number of students	Number of students earning credits
WITS (WITS)	1	1
UCT (UJ)	1	1
RU (UKZN)	1	0
NWU (UJ)	1	0
UNIVEN (NITheP)	2	2
UWC (NITheP)	1	1
Total	**10**	**5**
UKZN (UKZN)	3	0
Total	**10**	**5**

Travel grants

NITheP also offers support to enable students to travel to international and national conferences and schools. Support is only given if the student delivers a presentation or poster or, in the case of schools, if a supervisor strongly motivates for the student's attendance.

Support is limited to R15 000 for international conferences and R5 000 for national conferences. Table 11 indicates the travel grants allocated during 2010.

Table 11: Travel grants allocated in 2010

Institution	International	National
SU	R 32,663.35	R 31,955.00
UKZN	R 2,806.00	
UWC	R 9,000.00	
WITS	R 30,000.00	
UCT	R 15,000.00	R 6,000.00
Total	**R 89,469.35**	**R 37,955.00**

Outreach, community service and the popularisation of science

Part of NITheP's outreach is to popularise science. To help achieve this aim, NITheP presented a gala evening of public talks at the Lanzerac Hotel in Stellenbosch on 11 October 2010, in collaboration with the iThemba Laboratory for Accelerator-Based Sciences and the Laser Research Institute at SU. The latter institute also performed a laser demonstration to celebrate the 50th anniversary of the discovery of lasers.

Schools in the Stellenbosch vicinity were invited to send learners to attend the event. iThemba provided transport for learners where assistance was required. Attendance was excellent and the audience included some 200 learners, students and members of the public.

Speakers at the event were:

- *Uncle Albert's unfinished symphony,* Prof Jan Govaerts, Catholic I University of Louvain.
- *Lasers at 50*, Prof Peter Knight, Imperial College.
- *What banged?*, Prof Neil Turok, Perimeter Institute.
- *Is reality a matrix?*, Prof Jim Gates, Maryland.

In 2010, NITheP sponsored a mathematics and physics prize at the national ESCOM science expo.

Furthermore, NITheP delivered a talk highlighting theoretical physics at the University of the Free State's annual Science Adventure Camp. This event for top achievers in grade 12 was held at the Boyden Observatory and Science Centre near Bloemfontein.

Science Adventure Camp for grade 12 achievers.

Activities in 2010

Research and training

Research focus

NITHEP'S CLEAR RESEARCH focuses are derived from existing research capacity at the nodal centres and strategic priorities. With the appointment of associates, the research focus includes existing research capacity outside these centres.

The current core research activities are centred along the following themes:

- Statistical and Condensed Matter Physics (SU, WITS)
- Quantum Information and Computation (UKZN)
- High Energy Physics
  - String Theory and Matrix Models (WITS, UCT)
  - Phenomenology (WITS, UCT)

A researcher in the field of gravitational waves was appointed on a temporary one-year basis starting on 1 November 2010. This appointment aims to achieve closer linkage with the astronomical and SKA communities.

Schools, workshops and short research programmes under RFP programme

NITheP's workshop and short research programme allows for the support of workshops and research programmes organised at NITheP nodal centres or the home institution of an associate. Workshops typically span three to five days and research programmes a period of one to three months. Often these activities may also be combined. These programmes are accessed through the RFP system.

NITheP's flagship training programme is the annual Chris Engelbrecht Summer School series. This is a proposal-driven programme in which any member

of the theoretical physics, or broader physics, community may propose a topic, speakers and organising committee for the school.

In 2010 the following schools, workshops and short research programmes were supported through the RFP programme (details of the South African and African participants are in some cases an approximation, as the reporting system was not geared to collect this information. However, the total number of participants is accurate. The 2011 Annual Report will contain the exact figures of South African and African participants in all NITheP supported workshops):

Schools

1. The 21st Chris Engelbrecht Summer School: *Quantum Optics*. This school took place from 17 to 28 January 2010 at the Wallenberg Research Centre in Stellenbosch. The invited speakers were Profs Helmut Zacharias (University of Münster), Andreas Zumbusch (University of Konstanz), Andreas Wipf (University of Jena), Pierre Meystre (University of Arizona), Jason Twamley (University of Macquarie) and Sir Peter Knight (Imperial College). A total of 76 participants, including the seven speakers, attended the school.

2. The Inaugural *African School on Electronic Structure Methods and Applications* (ASESMA) took place at AIMS in Muizenberg from 19 to 30 July 2010. The school was overseen by a 25-strong international advisory panel (including two Nobel laureates). A total of 19 South African and 19 African participants attended, many of which were PhD students at an advanced stage of their studies. Some were young faculty members and some were in the process of setting up their own research groups and supervising students at their home institutions.

3. International school on *Fundamental Subatomic Physics and its Applications*. The first biennial African school on this topic, organised by CERN and hosted by NITheP, took place at STIAS from 1 to 21 August 2010. A total of 59 South African and African students attended, of which 19 were South African.

Workshops

1. International Workshop on *Correlation Functions and the AdS/CFT Correspondence*. This workshop was held at WITS from 26 to 30 April 2010. Organised by Prof Robert de Mello Koch (WITS), the workshop was attended by 21 local participants, 12 international visitors and eight local experts.

2. International workshop on *Quantum Field Theory on Curved Spacetime from the Algebraic Approach to Covariance*. This workshop, arranged by Prof M Porrmann (UKZN) and Prof F Petruccione (UKZN), was held at the School of Physics, UKZN, from 23 to 27 August 2010. A total of 20 senior researchers attended.

3. International workshop on *Kinetic Theory and Multiscale Phenomena: Modelling, Analysis, Computational Methods and New Applications*. The School of Computational and Applied Mathematics, WITS, organised the workshop in collaboration with members of the University of Kaiserslautern and the University of Ferrara. The workshop brought together leading experts from various fields to discuss recent approaches and challenges related to kinetic theory and multi-scale phenomena. In all, 12 international experts presented to about 20 attendees, comprising postgraduate and postdoctoral students and industrial partners.

4. *International workshop on Quantum Africa 2010:* Recent progress in the Theoretical & Experimental foundations of Quantum Technology. This workshop, organised by Prof F Petruccione (UKZN), took place at the Oyster Box Hotel in Umhlanga, Durban, from 20 to 23 September 2010.

5. International Workshop on *Quantum Resonances in Nuclear, Molecular and Solid-State Physics*. This workshop was organised by Prof S Rakitianski (UP) and took place at the UP from 22 to 24 September 2010. There were five South African participants and six international participants.

6. International Workshop on *Non-equilibrium Quantum Many-particle Correlated Systems*. Dr A Avdeenkov (NITheP, Stellenbosch) held this workshop at STIAS from 4 to 8 October 2010 for 23 international and local attendees.

7. International Workshop on *The Physics of Exceptional Points*. Prof D W Heiss (SU) organised this workshop at STIAS from 2 to 5 November 2010. A total of 12 international and five local researchers attended, together with 10 South African students.

8. International Workshop on *Active Materials*. Dr KK Müller-Nedebock (SU) held this workshop at STIAS from 17 to 19 November 2010. Attendance comprised 22 international and national researchers, five international invited speakers, nine South African and three African students.

9. International Workshop on *Discovery Physics at the LHC*. This workshop, organised by Dr A Cornell (WITS), T Vickey (WITS) and Prof S Connell (UJ), took place from 5 to 10 December 2010 at Protea Hotel Kruger Gate and was attended by 18 international participants and 13 NITheP sponsored students.

10. International workshop on *Non-Markovian Unravelling for Open Quantum Systems*. Arranged by Prof F Petruccione (UKZN), this workshop took place at the School of Physics, UKZN, from 13 to 17 December 2010.

11. *Beyond 2010*. Prof R Violier (UCT) held this workshop from 1 to 7 February 2010 at UCT. A total of 34 international participants attended.

12. International Workshop on *High Density Nuclear Matter*. This workshop, organised by Prof J Cleymans (UCT), was held from 12 to 16 April 2010 at STIAS. A total of 34 international and local researchers attended.

13. International workshop on *Non-linear Aspects of Quantum Electrodynamics*. Arranged by Prof C Dominguez (UCT), this workshop was held from 3 to 15 January 2011 at UCT and five international researchers attended. Although this workshop took place in 2011, the budget allocation was from 2010 and is thus reported here.

14. International workshop on *Convective processes in stars*. Organised by Dr F A M Frescura (WITS) and Dr C A Engelbrecht (UJ), with much assistance from Prof Medupe and Dr Olivier, this eight-day workshop on Convection in Stars was hosted in Council Chambers at UJ during the first two weeks of January 2011.

The workshop turned out to be a master class in the theory of convection and turbulence in stellar plasmas, thanks to the remarkable series of lectures prepared and delivered by uncontested luminaries in the field of stellar convection: Emeritus Professor Douglas Gough (University of Cambridge), Prof Vittorio Canuto (Columbia University and NASA Goddard Institute of Space Studies), Prof Jørgen Christensen-Dalsgaard (Århus University, Denmark) and Dr Günter Houdek (Institute for Astronomy, University of Vienna).

The workshop drew 31 participants, of whom 16 were students. Funding was received from

NITheP and WITS. Although this workshop was held in 2011, the budget allocation was from 2010 and hence it is reported here.

15. *Relativistic Quantum Information.* Prof F Petruccione (UKZN) organised this workshop, which took place from 7 to 11 March 2011 at UKZN. Although it was held in 2011, the budget allocation was from 2010 and it is thus reported here.

The participation of local and African students in these training events is summarised in Table 12.

Table12: Student participation in NITheP training programme events

Event	SA participants	African participants
SCHOOLS		
21st Chris Engelbrecht Summer School: Quantum Optics	38	3
African School on Electrodynamic Structure Methods and Applications	19	19
International school on Fundamental Subatomic Physics and its Applications	20	37
WORKSHOPS		
Correlation Functions and the AdS/CFT Correspondence	19	2
Quantum Field Theory on Curved Spacetime from the Algebraic Approach to Covariance	2	3
Kinetic Theory and Multiscale Phenomena: Modelling, Analysis, Computational Methods and New Applications	3	4
Quantum Africa 2010: Recent Progress in the Theoretical and Experimental Foundations of Quantum Technology	8	6
Quantum Resonances in Nuclear, Molecular and Solid-state Physics	5	0
Non-equilibrium Quantum Many-particle Correlated Systems.	5	0
The Physics of Exceptional Points	13	2
Active Materials	9	3
Discovery Physics at the LHC	11	2
Non-Markovian Unravelling for Open Quantum Systems	5	6
Beyond 2010	6	5
Workshop on High Density Nuclear Matter	6	2
Non-linear Aspects of Quantum Electrodynamics	1	0
Convective Processes in Stars	13	3
Relativistic Quantum Information	7	5
Total	**190**	**102**
Overall total	**292**	

Teaching and postgraduate supervision

NITheP's mandate clearly states an involvement of staff members in teaching and postgraduate supervision. Table 13 shows the 2010 involvement of NITheP staff in teaching, while Table 14 displays the number of Honours (projects), M.Sc. and Ph.D. students under NITheP staff supervision.

Table 13: Teaching (hours) by NITheP staff in 2010

Node	Undergraduate (Hours)	Honours (Hours)	Advanced (M.Sc./Ph.D.) (Hours)	Total
SU	0	92	45	137
WITS	62	55	0	117
UKZN	0	96	0	96
Total	**62**	**243**	**45**	**350**

Table 14: Postgraduate supervision in 2010

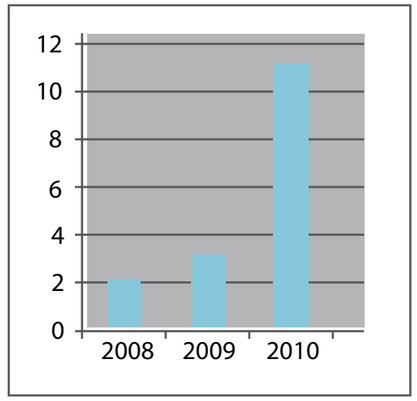
Node	Honours (projects)	M.Sc.	Ph.D.	Total
SU	0	4	0	4
WITS	3	1	3	7
UKZN	6	6	11	23
Total	**9**	**11**	**14**	**34**

The number of M.Sc. and Ph.D. students under the supervision of NITheP staff who graduated in 2010 is displayed in Table 15. There is a clear growing trend in comparison with 2009 as shown in Figure 2.

Table 15: M.Sc. and Ph.D. students who graduated in 2010

Node	Students
SU	3
WITS	2
UKZN	6
Total	**11**

Figure 2: Postgraduate students who graduated in the period 2008 to 2010



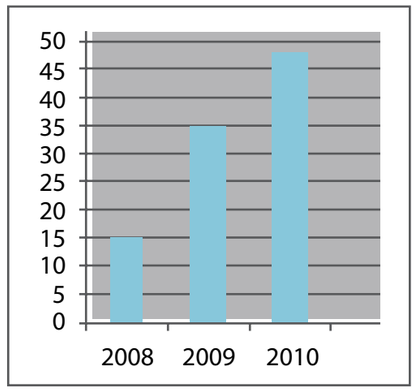
Publications

The publication statistics are shown in Table 16, while Figure 3 summarises the trend in the period 2008 to 2010

Table 16: 2010 publication statistics (for NITheP staff)

Node	Publications
SU	17
WITS	15
UKZN	12
Other NITheP supported	4
Total	**48**

Figure 3: Publication trend for the period 2008 to 2010



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2. *Two dimensional one-component plasma on a Flamm's paraboloid*, R Fantoni, G Tellez, Statphys24, Cairns, Australia, 19 to 23 July 2010.

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4. *Engineering inverse power law decoherence of a qubit*, F Giraldi and F Petruccione, Statistical Physics of Quantum systems, Tokyo, 2 to 4 August 2010. (http://looper.t.u-tokyo.ac.jp/spqs2010/abstracts.pdf)

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2010 Financial Statements

The statement of income and expenditure, cash flow and balance sheet for 2010 are shown below. It is important to note that NITheP's financial year, which runs from 1 January to 31 December, is out of phase with that of its funders, the National Research Foundation and Department of Science and Technology, which runs from 1 April to 31 March. The practical implication of this is that NITheP receives its grants only in June and November of the financial year. For this reason it is important that NITheP ensures a reserve equal to the bursary values (to be paid in the first semester) plus 50% of salaries and running costs is available at the end of the financial year on 31 December. This reserve is reflected in the statements below.

Balance Sheet at 31 December 2010

	2010	2009
ASSETS	**R**	**R**
NON-CURRENT ASSETS	72 397.61	112 701.58
Computers and office equipment	56 056.94	83 062.55
Intangible assets	16 340.67	29 639.03
CURRENT ASSETS	7 543 431.48	9 352 565.98
Other receivables	734 620.23	314 605.79
Petty cash	1 000.00	1 000.00
Stellenbosch University	6 807 811.25	9 036 960.19
TOTAL ASSETS	**7 615 829.09**	**9 465 267.56**
EQUITY AND LIABILITIES		
CAPITAL AND RESERVES	7 413 749.63	9 385 962.43
Accumulated funds	7 413 749.63	9 385 962.43
CURRENT LIABILITIES	202 079.47	79 305.13
Trade and other creditors	202 079.47	79 305.13
TOTAL FUNDS AND LIABILITIES	**7 615 829.10**	**9 465 267.56**

Income Statement for the year ended 31 December 2010

	2010	2009
	R	**R**
INCOME	10 995 954.79	18 555 959.84
National Research Foundation grant	10 963 000.00	18 520 000.00
Interest income	9 018.95	-
Contribution from Stellenbosch University	23 626.56	34 498.90
Exchange rate gain	309.28	1 460.94
EXPENDITURE	12 968 167.59	8 101 308.67
Advertisements	12 807.65	15 396.36
Audit fees	166 654.32	-
Affiliation and registration	850 425.62	90 803.75
Amortisation of intangible assets	13 298.35	8 154.09
Bursaries - postgraduate	4 462 325.19	3 346 950.00
Computer materials and software	120 502.26	2 940.86
Conference fees	212 522.56	-
Consultation	156 299.70	41 040.00
Consumables	13 319.32	17 495.46
Contribution to Summer School Theoretical Physics	-	3 820.00
Contribution to Department of Physics: 3D project	3 603.04	5 876.21
Copying and stationery	48 233.19	34 099.86
Depreciation	47 495.98	44 023.88
Entertainment	151 430.35	170 218.01
Furniture and equipment less than R2 000	28 770.62	1 545.17
Levies	156 355.94	-
Marketing and promotions	31 193.32	-
Office administration	9 631.17	18 498.05
Postage, telephone and fax	80 658.74	75 677.23
Prizes and medals	2 300.00	-
Rent paid for facilities	212 773.97	180 000.00
Repairs and maintenance	650.00	5 059.38
Salaries	3 917 680.50	2 619 413.45
Sponsorship and donations	5 000.00	-
Sundry expenses	8 149.90	34 437.49
Translation work	6 622.40	-
Travel and accommodation	2 249 463.50	1 385 859.42
SURPLUS/(SHORTAGE) FOR THE YEAR BEFORE TRANSFERS	**(1 972 212.80)**	**10 454 651.17**
TRANSFERS BETWEEN NODES	-	-
Transfer to KwaZulu-Natal	(2 208 748.00)	(760 405.80)
Transfer to Gauteng	(1 919 275.40)	(617 125.00)
Transfers from Stellenbosch	4 128 023.40	1 377 530.80
SURPLUS/(SHORTAGE) FOR THE YEAR	**(1 972 212.80)**	**10 454 651.17**

Cash Flow Statement for the year ended 31 December 2010

	2010 R	2009 R
CASH FLOW FROM OPERATING ACTIVITIES		
Surplus/(shortage) for the year	(1 972 212.80)	10 454 651.17
Adjustment for:		
Interest received	(9 018.95)	-
Depreciation and amortisation	60 794.33	52 177.97
Operating profit before working capital adjustments	(1 920 437.42)	10 506 829.14
Working capital adjustments	(297 240.10)	253 865.70
(Increase)/decrease in trade and other receivables	(420 014.44)	263 700.97
Increase/(decrease) in trade and other payables	122 774.34	(9 835.27)
Cash utilised in operations	(2 217 677.52)	10 760 694.84
Interest received	9 018.95	-
NET CASH FLOW FROM OPERATING ACTIVITIES	(2 208 658.57)	10 760 694.84
CASH FLOW FROM INVESTMENT ACTIVITIES		
Computers and office equipment purchased	(20 490.37)	(14 790.00)
Intangible assets purchased	-	(19,159.74)
Decrease/(increase) in amount owed by Stellenbosch University	2 229 148.94	(10 726 745.10)
NET CASH FLOW FROM INVESTMENT ACTIVITIES	2 208 658.57	(10 760 694.84)
NET INCREASE IN CASH AND CASH EQUIVALENTS	-	-
CASH AND CASH EQUIVALENTS AT BEGINNING OF YEAR	1 000.00	1 000.00
CASH AND CASH EQUIVALENTS AT END OF YEAR	1 000.00	1 000.00