Annual report

1 January - 31 December 2015

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Attendees of the 3rd African School on Electronic Structure Methods and Applications (ASESMA), held at WITS in January 2015. For more information, please see page 10.

Contents

Abbreviations

AIMS	African Institute for Mathematical Sciences
CoE	Centre of Excellence
CPUT	Cape Peninsula University of Technology
CSIR	Council for Scientific and Industrial Research
DST	Department of Science and Technology
HartRAO	Hartebeesthoek Radio Astronomy Observatory
ICTP	International Centre for Theoretical Physics
iThemba LABS	iThemba Laboratory for Accelerator Based Sciences
MANCO	Management Committee
NASSP	National Astrophysics and Space Science Programme
NLC	National Laser Centre
NRF	National Research Foundation
NWU	North-West University
RFP	Request for Proposal
RU	Rhodes University
SAAO	South African Astronomical Observatory
SAASTA	South African Agency for Science and Technology Advancement
SAC	Scientific Advisory Council
SAIP	South African Institute of Physics
SARChI	South African Research Chairs Initiative
SKA	Square Kilometre Array
STIAS	Stellenbosch Institute for Advanced Study
SU	Stellenbosch University
TP	Theoretical Physics
UCT	University of Cape Town
UJ	University of Johannesburg
UKZN	University of KwaZulu-Natal
UL	University of Limpopo
UNISA	University of South Africa
UNIVEN	University of Venda
UNIZULU	University of Zululand
UP	University of Pretoria
UWC	University of the Western Cape
WITS	University of the Witwatersrand

Director's Report

2015 WAS AGAIN A YEAR MARKED BY GROWING TRENDS IN SOME OF NITHEP'S KEY PERFORMANCE AREAS, DESPITE NO REAL GROWTH IN RESOURCES. This is a remarkable consequence of the growing national and international network that NITheP represents. In particular, NITheP's publication output grew by 10% from 2014 with 66% of the outputs generated by the network of associates and visitors. The network of associates also showed a 4% growth from 2014. The extent of the network and its growing international profile is further demonstrated by the fact that 124 individual authors published under the NITheP affiliation in the period 2008 to 2014. Furthermore these authors originate from 36 different countries. From this data it seems reasonable to conclude that NITheP has achieved one of its major aims of establishing a national network in which members of the community find added value through association due to, amongst other reasons, its high level of international visibility.

Closely related to the above, one of NITheP's strategic goals is the enhancement of its international profile through a network of agreements with similar institutes elsewhere in the world. NITheP already has an exchange agreement in place with the Scuola Internazionale Superiore di Studi Avanzati (SISSA) since 2014 and a letter of understanding was also signed with the International Center for Theoretical Physics (ICTP) in 2015. The latter creates several opportunities for collaboration and exchange between these two institutes that promise to be beneficial to both parties.

Despite the successes above, there are also areas of concern. The most important and relevant of these, due the current political climate in the country, is the matter of financial support of students and transformation. The past two years have seen declining numbers of NITheP bursary holders, which was probably an unfortunate interplay of mismatching bursary values and the strong competition for the declining pool of students with strong skills in the mathematical and physical sciences. After a revision of NITheP bursary values, this situation seems to have largely normalised, judging by the applications for 2016 bursaries that were received by the closure date of 30 November 2015.

On the transformation front excellent progress was made at PhD level with 82% of bursary holders coming from the black community. At the lower levels, the success rate has been less spectacular with only 36% of bursary holders being black at MSc level. This skewing is a direct consequence of the profile of applicants and acceptance rates of bursary offers. Similarly, and for the same reasons, the gender profile of bursary holders is highly unsatisfactory. A change in these statistics is a priority for NITheP, but requires a concerted effort on several fronts that will only pay off in the longer term.

Overall NITheP is functioning well and experiences an increasing interest nationally and internationally as reflected by the growing national and international network. These strengths, and particularly the network, must be used to address the shortcomings identified above.

Frederik Scholtz

Introduction

NITHEP IS A GEOGRAPHICALLY DISTRIBUTED INSTITUTE with regional centres at the Stellenbosch Institute for Advanced Studies (STIAS), the University of the Witwatersrand (WITS) and the University of KwaZulu-Natal (UKZN). Stellenbosch University (SU) acts as the host institution, and the regional centre at STIAS is 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, the National Research Foundation (NRF), and the grantee, namely SU, as the host institution of the NITheP headquarters.

NITheP operates in an independent environment (STIAS), with SU providing administrative support. This is critical in the South African (and African) context to ensure non-alliance with a particular institution and to develop an independent identity. A consortium agreement between the hosts of the three regional centres, namely SU, WITS and UKZN, governs the interaction between the regional centres.

Mandate and Strategy

Vision

NITHEP'S VISION IS 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

NITHEP AIMS 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 rest of the African continent;

TO PROVIDE a source of expertise which can feed into broad national scientific policies and goals.

Governance and Structure

Governance

THE GOVERNANCE STRUCTURE, as set out in the governance document for a national Centre of Excellence, makes provision for the establishment of a Steering Committee, Scientific Advisory Committee and Management Committee. The composition of these core governance committees was as follows on 31 December 2015:

Steering Committee members:

- Dr Rob Adam (director of the Square Kilometer Array)
- Prof Eugene Cloete (deputy vice-chancellor: research, SU) (chair)
- Prof Barry Green (director of the African Institute for Mathematical Sciences)
- Dr Joseph Kirui (UV)
- Prof Azwinndini Muronga (UJ and director of the UJ Soweto Science Centre)
- Prof Francesco Petruccione (NITheP deputy director, UKZN; South African Research Chair in Quantum Information Processing and Communication)
- Dr Fernando Quevedo (director of the International Centre for Theoretical Physics)
- Prof João Rodrigues (NITheP deputy director, WITS; head: School of Physics)
- Prof Frederik Scholtz (NITheP director)
- Dr Nthabiseng Taole (programme director: Centres of Excellence, Knowledge Fields Development, NRF)
- Prof Amanda Weltman (UCT and South African Research Chair in Physical Cosmology)

Scientific Advisory Committee:

- Prof Sylvester James Gates (University of Maryland, USA)
- Prof Jan Govaerts (Catholic University Louvain, Belgium)
- Prof Sir Peter Knight (Imperial College of London, UK)
- Prof Frans Pretorius (Princeton University, USA)
- Prof Kennedy Reed (Lawrence Livermore National Laboratory, USA)
- Prof Shahin Sheikh-Jabbari (Institute for Research in Fundamental Sciences, Iran)
- Prof Neil Turok (Perimeter Institute, Canada)
- Prof Fernando Quevedo (International Center for Theoretical Physics, Italy)

Management Committee:

- Prof Alan Cornell (WITS)
- Prof Francesco Petruccione (NITheP deputy director, UKZN)
- Prof João A. P. Rodrigues (NITheP deputy director, School of Physics, WITS)
- Prof Frederik Scholtz (NITheP director; MANCO and SAC chair)

Staff

THE STAFF PROFILE OF NITheP as on 31 December 2015 is shown in Table 1.

Table 1: Staff profile as at 31 December 2015

Position	Node	Number of positions (appointment)
Director	SU	1 (five-year contract)
Deputy director	WITS/UKZN	2 (five-year contracts, 25%)
Chief researcher	WITS/SU	3 (five-year contracts)
Researcher	SU/UKZN	2 (five-year contracts)
Senior administrative officer	SU	2 (five-year contracts)
Secretary	UKZN	1 (five-year contract)
Total		**11**

Postdoctoral fellows

THE POSTDOCTORAL FELLOWS per node as on 31 December 2015 are shown in Table 2. All positions comprise two-year contracts.

Table 2: Postdoctoral fellows as at 31 December 2015

Node	NITheP funded	Externally funded
SU	2	3
UKZN	2	2
WITS	2	5
Total	**6**	**10**

Service rendering

Marketing

AS NITHEP FUNCTIONS AS A user facility, it is important to maintain a high level of visibility within the community. Marketing has been emphasised since the inception of NITheP and 2015 was no exception.

NITheP has continued to deliver a service to the theoretical physics community by acting as the communication channel for various parties within the field. In this capacity information is disseminated within the local theoretical physics community and two way communication is facilitated between South Africa and the international theoretical physics community. Job and study opportunities in South Africa and abroad have been channelled to the South African theoretical physics community, and local theoretical physics workshops have been advertised abroad.

Website: www.nithep.ac.za

When 'Theoretical Physics' is searched from a South African IP address, the website comes up directly after the Wikipedia definition of theoretical physics. The average hits on the website are 583 per month.

It appears the platform on which the website was built in early 2010 is becoming dated, so an upgrade will be considered during 2016 to keep up with advances in technology.

Participation at SAIP conference

NITheP attends the annual SAIP conference on a bi-annual basis. NITheP places an advertisement on the back page of the *SAIP Book of Abstracts*. On a bi-annual basis NITheP hosts an exhibition stand to provide a public relations and communication service to the theoretical physics community, as well as facilitate networking among members.

E-mail newsletter

The 280 subscribers on our distribution list receive our newsletter, which includes information on regional seminars, workshops, bursaries, internships, employment and study opportunities, as well as general news pertaining to the theoretical physics community.

Presence in the social media

- *Facebook: www.facebook.com/NITheP*

  The NITheP Facebook page has almost 520 'Likes' with an average post reach of 327 per week and some six new page 'Likes' per week. It enjoys post engagement with an average of 127 people per week.

- *Twitter: @NIThePSA*

  NITheP tweeted 161 times during 2015 and has grown its followers to 98.

- *LinkedIn: https://za.linkedin.com/in/renekotze*

  NITheP communications officer René Kotzé is connected with 675 persons in the South African and international theoretical physics community, including NITheP bursary alumni.

Networking

Associates

To achieve NITheP's strategic goals, it is crucial to maintain a national network throughout South Africa. In 2015, the number of NITheP associates continued to grow. The network, which now consists of 77 associates (two junior, 66 individual, four institutional and five strategic associates), is shown in Table 3. Associates have access to the NITheP Visitor, Mobility and Workshop programmes through a Request for Proposal (RFP) system.

Table 3: Associates as at 31 December 2015

JUNIOR ASSOCIATES (2)	
Dr Eric Maluta	UNIVEN
Dr Thuto Mosuang	UL
INDIVIDUAL ASSOCIATES (66)	
Prof Jacek Banasiak	UKZN
Prof Igor Barashenkov	UCT
Dr Bruce Bartlett	SU
Prof Bruce Bassett	AIMS, SAAO, UCT

Prof Nigel Bishop	RU
Prof Moritz Braun	UNISA
Dr Jeandrew Brink	SU
Prof Erwin Brüning	UKZN
Prof Nithaya Chetty	UP, NRF
Dr Cynthia Chiang	UKZN
Dr Chris Clarkson	UCT
Prof Jean Cleymans	UCT
Prof Sergio Colafrancesco	WITS
Prof Alan Cornell	WITS
Prof Robert de Mello Koch	WITS
Prof Cesareo Dominguez	UCT
Prof Peter Dunsby	UCT
Dr Rocco Duvenhage	UP
Prof Hans Eggers	SU
Prof George Ellis	UCT
Prof Arthur Every	WITS
Dr Kevin Goldstein	WITS
Dr Filippo Giraldi	UKZN
Prof Dieter Heiss	SU
Prof Manfred Hellberg	UKZN
Dr Gregory Hillhouse	UNIZULU
Dr William A Horowitz	UCT
Prof Vishnu Jejjala	WITS
Prof Daniel Joubert	WITS
Prof Steven Karataglidis	UJ
Prof Thomas Konrad	UKZN
Dr Julien Larena	RU
Prof Mantile Lekala	UNISA
Prof Richard Lemmer	WITS
Prof Roy Maartens	UWC
Prof Richard Mace	UKZN
Prof Sunil Maharaj	UKZN
Prof Daniel Makinde	CPUT
Dr Joseph Medved	RU
Dr Shazrene Mohamed	SAAO
Prof Kavilan Moodley	UKZN
Prof Kristian Müller-Nedebock	SU

Prof Azwinndini Muronga	UJ
Prof Jeff Murugan	UCT
Dr Giuseppe Pellicane	UKZN
Prof André Peshier	UCT
Dr Denis Pollney	RU
Prof Marius Potgieter	NWU
Prof Alex Quandt	WITS
Prof Sergei Rakitianski	UP
Dr Stef Roux	CSIR
Prof Pavlo Selyshchev	UP
Dr Alessandro Sergi	UKZN
Dr Jonathan Shock	UCT
Prof Jonathan Sievers	UKZN
Dr Izak Snyman	WITS
Prof Mark Tame	UKZN
Dr Gary Tupper	UCT
Dr Hermann Uys	NLC, CSIR
Prof Raoul Viollier	UCT
Prof André Weideman	SU
Prof Herbert Weigel	SU
Prof Heribert Weigert	UCT
Prof Amanda Weltman	UCT
Prof Konstantinos Zoubos	UP
Dr Caroline Zunckel	UKZN
INSTITUTIONAL ASSOCIATES (4)	
UCT-CERN	UCT
Centre for Theoretical Physics	UCT
Cosmology Group	UCT
Centre for Space Research	NWU
STRATEGIC ASSOCIATES (5)	
Prof Barry Green	AIMS
Prof Lesley Cornish	DST/NRF CoE in Strong Materials
Prof Ludwig Combrinck	HartRAO
Dr Zeblon Vilakazi	iThemba LABS
Dr Joseph Kirui	University of Venda

Recognition / awards for NITheP associates

NITheP is very proud of our associates for being nominated and recognised for their work.

Prof Azwinndini Muronga (UJ, director of Soweto Science Centre)

Prof Muronga, NITheP associate and steering committee member, started his term as SAIP president during 2015.

Prof Amanda Weltman (UCT)

Prof Weltman, NITheP associate and steering committee member, was awarded the South African Research Chair in Physical Cosmology during 2015.

Associate Workshop

The annual NITheP Associate Workshop, held at the NITheP offices in Stellenbosch on 1 and 2 October 2015, was attended by 28 associates.

The workshop started as usual with a focus on general matters, followed by the annual meeting. The second day's programme consisted of with three one-hour talks on science related topics by Dr Jeandrew Brink (SU), Dr Joey Medved (RU) and Dr Shazrene Mohamed (SAAO).

At the workshop, Prof Alan Cornell (WITS) was elected as the new associate representative to serve on the NITheP MANCO. Prof Cornell replaces Prof Kevin Goldstein (WITS) who served a three-year term in this capacity.

International linkage

A NITheP delegation visited the ICTP and SISSA in Trieste, Italy, in 2015, comprising Prof Frederik Scholtz (NITheP director), Prof Francesco Petruccione (NITheP deputy director, UKZN) and Prof Kevin Goldstein (NITheP associate representative, WITS).

Very good discussions took place between the NITheP, ICTP and SISSA delegations. The outcome of the visit was a formal agreement with ICTP, which details several areas of cooperation and exchange. Cooperation with SISSA under the existing exchange agreement was reconfirmed.

African development programme

ASESMA 2015

The 3rd African School on Electronic Structure Methods and Applications (ASESMA) was planned to take place in Nigeria during 2014. Due to the very unfortunate incident regarding the abduction of school girls, the event was postponed until 19 January 2015 and hosted at WITS.

The ASESMA schools take place on a biennial basis until 2020. The schools emphasise the theory and computational methods for predicting and understanding properties of materials through calculations at the fundamental level of electronic structure. Previous schools were held in Cape Town (2010) and Kenya (2012).

NITheP / AIMS partnership

NITheP and AIMS have collaborated for the past five years on various fronts, be it shared seminar speakers, collaboration on workshops or joint outreach activities. NITheP, AIMS and the Perimeter Institute agreed to co-host an exceptional Nigerian postdoctoral fellow during 2015 and 2016. He already spent six months at Perimeter and AIMS respectively in 2015 and will spend another six months at Perimeter and NITheP respectively in 2016.

Request for proposal (RFP) system

This is a competitive, proposal driven programme through which NITheP gives associates and staff access to NITheP resources and includes the mobility, long-term visitor, workshop and research programmes.

Table 4 summarises the support given to staff and associates under the RFP system during 2015. Greater detail on each activity is listed further below under the appropriate headings.

Table 4: Summary of proposals supported under the RFP system in 2015

Type of activity	Number of proposals
Long-term visitors	13 (21 visitor months)
Mobility	2
Schools	2
Capacity development workshops	2
Research workshops	5

Mobility

Under the mobility programme, support is provided for associates to travel between South African higher educational institutions and, in particular, to the three nodal centres situated at SU, WITS and UKZN. Support is given for a period of up to two months per year and includes accommodation, subsistence and, in cases that are strongly motivated and justified, transport costs. Two proposals were supported under this programme in 2015.

Visitors

A vibrant visitor programme is vital for the success of NITheP. Visitors are attracted to NITheP by means of two mechanisms. The first is the long-term visitor programme, accessed through the RFP system. Under this programme, staff and associates can apply for support for longer-term visiting collaborators, typically for a period of one to six months. This support covers accommodation and subsistence and, only in exceptional cases, travel costs.

NITheP also budgets annually for short-term visitors who typically spend less than a month at a NITheP centre or tertiary institution of an associate. Foreign researchers may apply for support under both of these programmes through their South African NITheP associate collaborator.

The NITheP short-term visitor programme supported 48 visitors during the year, and the details are indicated in Table 5.

Table 5: Short-term visitors who visited NITheP in 2015

NITheP node	Short-term visitors
SU	16
UKZN	15
WITS	17
Total	**48**

Visitors from 2009 until 2015

- Average number of short-term visitors per annum: 53,5
- Total number of short-term visitors: 321

Table 6 summarises the details of the long-term visits that were supported under the RFP system, which totalled 18 visitor months.

Table 6: Long-term visits supported under the RFP system in 2015

Visitor	Home institute/affiliation	Country	Host (affiliation)	Term (month)	Publica-tion
Dr Ken Ganga	Laboratoire Astropartcule et Cosmologie, Université Paris 7	France	Dr Cynthia Chiang (UKZN)	2	1
Prof Alejandro Ayala	National University of Mexico	Mexico	Prof Cesareo Dominguez (UCT)	0,5	1
Prof Sven Aberg	Mathematical Physics Division, Lund University	Sweden	Prof Dieter Heiss (SU)	1,5	1
Prof Günter Wunner	1st Institute for Theoretical Physics, University of Stuttgart	Germany	Prof Dieter Heiss	1,25	1
Dr Cyril Matti	City University London	UK	Prof Vishnu Jejjala	1,25	0
Prof Sandra Klevansky	Heidelberg University	Germany	Prof Richard Lemmer	1	0
Prof Martin Bucher	Laboratoire Astropartcule et Cosmologie, Université Paris 7	France	Prof Kavilan Moodley	3	1

Prof Subhash Chaturvedi	University of Hyderabad	India	Prof Francesco Petruccione	2	1
Dr Changhyoup Lee	Centre for Quantum Technologies, National University of Singapore	Singapore	Prof Mark Tame	0,5	0
Dr Şahin Özdemir	Washington University in St. Louis	USA	Prof Mark Tame	0,5	0
Prof Joseph Indekeu	University of Leuven	Belgium	Prof Hugo Touchette	1	1
	0	UK	Prof Vishnu Jejjala	1,25	0
Dr Dimitrios Giataganas	University of Athens	Greece	Prof Konstantinos Zoubos	1	1
Total: 12 visitors		**10 countries represented**	**10 NITheP associates hosted visitors**	**16.75**	**8**

Capacity development workshops

Capacity development in theoretical physics in South Africa is very much part of the NITheP mandate and agenda as prescribed by the NRF and DST. This involvement continued in 2015 with two workshops: one on computational physics held in Stellenbosch, and the other on high energy physics held at WITS. Both workshops focused on basic skills development in these areas and were aimed at third and honours year students.

Bursaries

A total of 29 bursaries were awarded in 2015. The total actual amount paid out was R2 190 000.

The bursaries awarded are summarised in Table 7.

Attendees of the bursary holder workshop.

Prof F.G. Scholtz with prize winners from the bursary holder workshop: Hector Dlamini (left) and Yannick Mvondo-She (right).

Table 7: Bursaries awarded in 2015

Level	Number	Amount allocated per bursary (R)	Actual cost (R)*	Budgeted cost (R)*
Honours	4	R 50 000	R 200 000	R 200 000
MSc	14	R 80 000	R 890 000	R 1 120 000
PhD	11	R 100 000	R 1 100 000	R 1 100 000
Total	**29**		**R 2 190 000**	**R 2 420 000**

NITheP bursary holders per institution and degree are shown in Table 8.

Table 8: Bursary holders per institution in 2015

Institution	Honours	MSc	PhD	Total
RU	0	2	0	2
SU	0	2	2	4
UCT	4	4	2	10
UJ	0	1	0	1
UKZN	0	1	2	3
UP	0	2	1	3
WITS	0	2	4	6
Total	**4**	**14**	**11**	**29**

* Actual cost and budgeted cost are separated, as in some years the two are not identical due to top-ups etc.

Universities represented

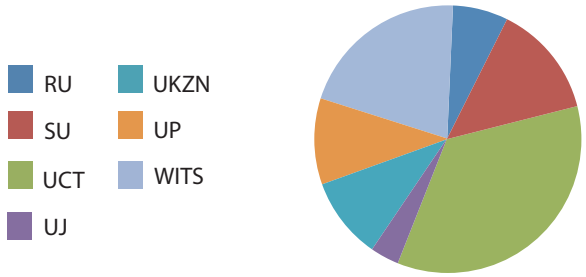


Table 9 shows the details of bursary holders by race and gender. The bursary demographic profile shows an encouraging trend in that it is now dominated by bursary holders from previously disadvantaged communities i.e. 62% of NITheP bursary holders are Black, Indian and/or female. This indicates that the sustained efforts of NITheP over the past five years of engaging with these communities and encouraging increased participation in the mathematical sciences is beginning to bear fruit. It is important to note that the gender profile remains skewed, as are global figures, with low levels of female participation in the mathematical sciences. This is particularly pressing in the black and coloured communities.

The number of bursary holders in 2015 remained low due to a lower than expected uptake of bursaries, but represents an increase on the low point of 2014. This is probably still an artefact of the mismatch in NRF and NITheP bursary values that occurred in 2013, especially as the indication for 2016 is a reverse of this trend with an intake of around 40 bursary holders.

Figure 1: Change in composition of bursary pool in the period 2008 – 2015

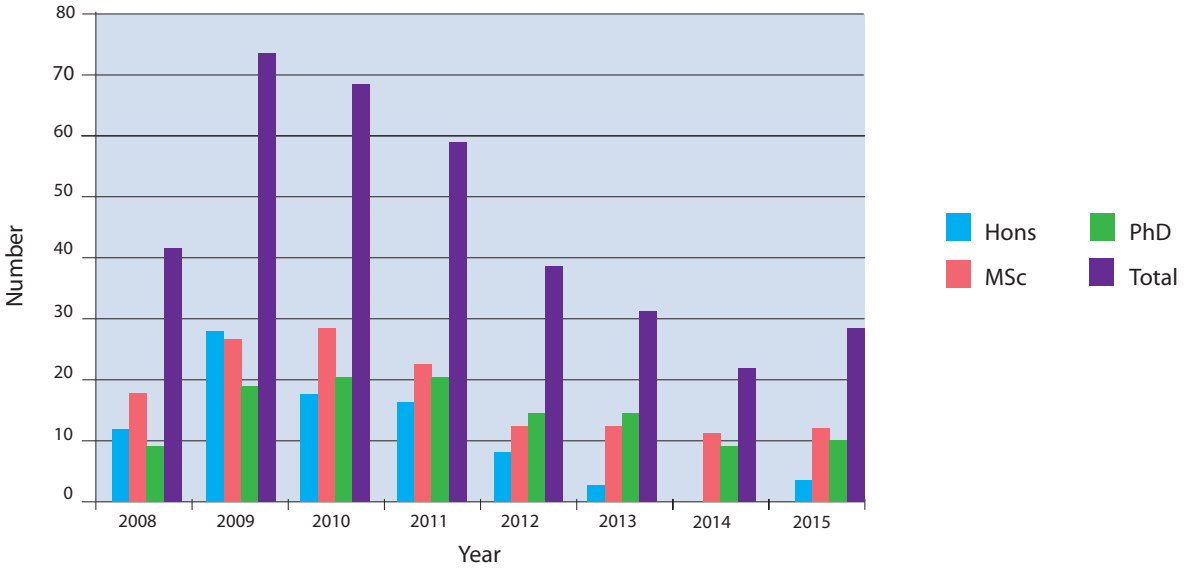
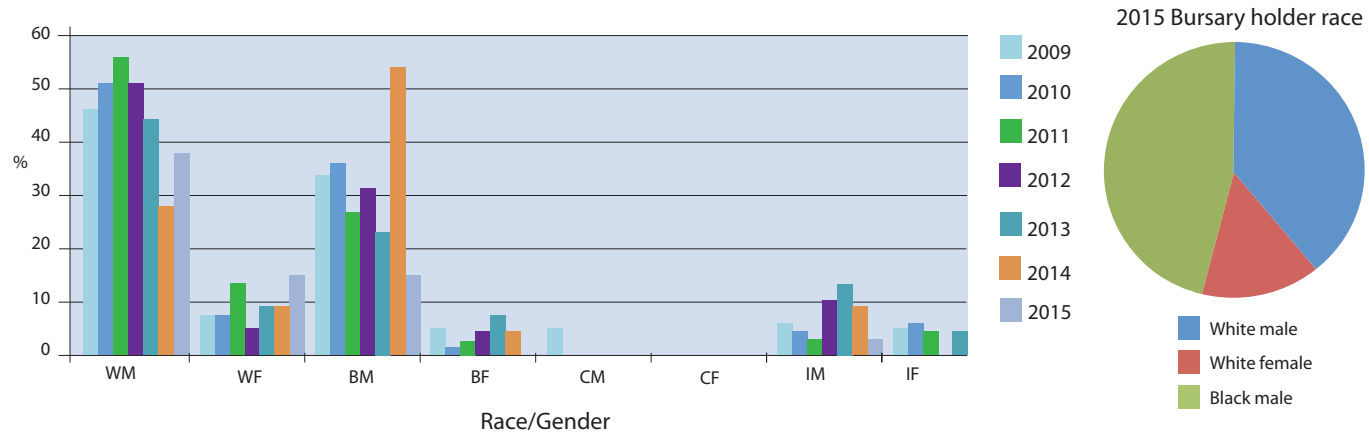


Table 9: Bursary holders per race and gender in 2015

Degree	White		Black		Coloured		Indian		Total
	Male	Female	Male	Female	Male	Female	Male	Female	
Honours	4	0	0	0	0	0	0	0	4
MSc	6	3	5	0	0	0	0	0	14
PhD	1	1	8	0	0	0	1	0	11
Total	**11**	**4**	**13**	**0**	**0**	**0**	**1**	**0**	**29**

The change in demographic profile from 2009 to 2015 is reflected in Figure 2.

Figure 2: Demographic profile of bursary holders in the period 2009 to 2015 (represented as a %)



Bursary holder workshop

The third NITheP annual bursary holder workshop was held at the NITheP offices in Stellenbosch on 11 and 12 November 2015, where 18 MSc and PhD students presented 20-minute talks on their current research / project.

Attendance is compulsory for all bursary holders, and the supervisors of the students involved and NITheP associates and staff may also attend.

The students are not only challenged to present their work to their peers, but also have the opportunity to network and discuss in depth the various topics covered in their work.

At the workshop it became apparent that the quality of talks has improved, and the highest level of talks in the past three years was delivered at the 2015 workshop.

The students who deliver the best presentations win a prize. The 2015 winners, both of whom are supervised by Prof Konstantinos Zoubos (UP), are:

- R3 000 prize for best MSc presentation: Hector Dlamini (UP)
- R4 000 prize for best PhD presentation: Yannick Mvondo-She (UP)

A number of NITheP associates will be invited to evaluate and adjudicate the 2016 winners.

Internships

The internship programme was continued in 2015. This flagship programme has two components. The first enables students at Honours or MSc level to join NITheP workshops and to complete a small research project, typically on the scale of an honours project, under the supervision of an invited workshop participant. The second component makes provision for students, mainly at Honours or early MSc level, to join NITheP staff or associates during June/July or November/December to complete a research project.

In both instances, the supervisor and an independent local examiner usually from the student's home institution, evaluate the project. Students may use the marks generated in this way for credits at their home institution, if the home institution approves of this in advance.

In this way, NITheP provides a training opportunity, often under the guidance of a leading researcher, which alleviates the pressure of project supervision on departments. Typically NITheP supports the students who pass the screening process for this programme in terms of travel, accommodation and subsistence costs. There were 31 internship topics available to prospective internship students. The full list can be viewed on the NITheP website under the Students tab.

Table 10 summarises the details regarding the internship programme during 2015. Particularly encouraging is the considerable number of interns who continue with a higher degree in theoretical physics.

Table 10: Internship statistics for 2015

Student's home institute (host institute)	Number of students	Number of students earning credits	Students who continued with higher degree in theoretical physics
UCT (SU)	2	0	2
UCT (UJ)	1	1	1
UKZN (SU)	1	0	1
UKZN (SU)	1	1	1
UKZN (UCT)	1	0	1
UL (UJ)	1	0	1
UNIVEN (UJ)	1	0	1
UNIVEN (UL)	2	2	2
UNIVEN (WITS)	1	1	0
UNIZULU (UJ)	1	0	0
UWC (UJ)	2	1	1
WITS (NITheP/SU)	1	1	1
WITS (UJ)	1	0	1
Total	**16**	**7**	**13**

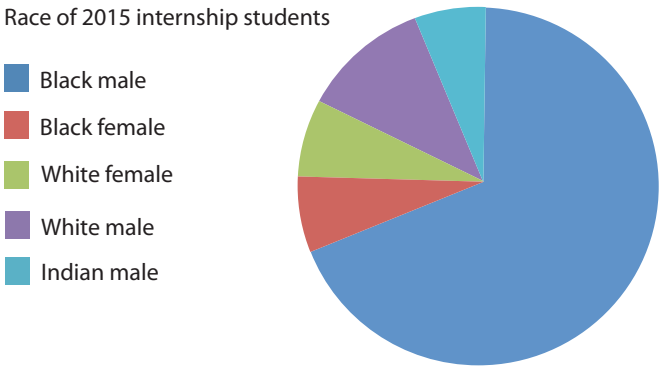
Table 11 indicates demographics of the NITheP internship students.

Table 11: Internship students per race and gender 2015

Student	White		Black		Coloured		Indian	
	M	F	M	F	M	F	M	F
Daniel Adamiak (UCT)	1	0	0	0	0	0	0	0
Steve Dima (UNIVEN)	0	0	1	0	0	0	0	0
Hazmatally Hossen Goolam (UKZN)	0	0	0	0	0	0	1	0
Nemudzivhadi Hulisani (UNIVEN)	0	0	1	0	0	0	0	0
Thato Manamela (UL)	0	0	1	0	0	0	0	0
Thabelo Mahandana (UNIVEN)	0	0	1	0	0	0	0	0
Happiness Mthembu (UNIZULU)	0	0	0	1	0	0	0	0
Ndinannyi Mukwevhi (UWC)	0	0	1	0	0	0	0	0
Sakhile Msibi (WITS)	0	0	1	0	0	0	0	0
Edgar Mudau (WITS)	0	0	1	0	0	0	0	0
Lizelle Niit (UCT)	0	1	0	0	0	0	0	0
Thembalethu Nogwanya (UWC)	0	0	1	0	0	0	0	0
Alex Freeman (UNIVEN)	0	0	1	0	0	0	0	0
Lance Oom (UKZN)	1	0	0	0	0	0	0	0
Khanyisa Sowarzi (UWC)	0	0	1	0	0	0	0	0
Issac Sihlangu (UCT)	0	0	1	0	0	0	0	0
Total	**2**	**1**	**11**	**1**	**0**	**0**	**1**	**0**

Demographics summary:

- 100% of NITheP internship students were South African
- Total female ratio: 12.5%
- Total black ratio: 81.25%



Travel grants

In addition to the bursary and internship programmes, NITheP also offers support to students to enable them to travel to national and international conferences and schools. Support is only provided if the student gives a presentation or poster or, in the case of schools, if the supervisor strongly motivates attendance. Support is limited to R5 000 for national conferences and R15 000 for international conferences.

Table 12 indicates the statistics for travel grants allocated in 2015.

Table 12: Travel grants allocated in 2015

Institution	National	International
SU	R 0	R 15 000
UCT	R 0	R 37 000
Total	**R 0**	**R 52 000**

Outreach, community service and the popularisation of science

Public talks

NITheP's outreach activities include the popularisation of science. In this regard, NITheP hosts and supports a programme of public talks in the theoretical physics community. These are normally aimed at the general public, students and high school learners.

NITheP collaborated with iThemba LABS to host monthly public talks throughout 2015. NITheP generally assisted with the provision of speakers when required, while iThemba LABS provided transport and refreshments to approximately 70 Grade 11 and 12 learners. These learners mostly come from schools in Khayelitsha and surrounding informal settlement areas. As from 2016 NITheP is no longer involved in this programme, in order to pursue other outreach and theoretical physics related activities.

Eskom Expo for Young Scientists, national finals in Johannesburg

For the fifth year in a row, NITheP sponsored two prizes of R2 000 each at the Eskom Expo Gala dinner. The prizes were for the Best Physics and the Best Mathematics projects. NITheP researchers adjudicated the projects and found the level of this year's entries to be higher again than those of previous years.

Stellenbosch University Physics Department student outreach annual road trip

In collaboration with the following sponsors, NITheP has sponsored this outreach event for the past five years:

- Optical Society of America
- The Dean's Office for the Faculty of Natural Sciences, SU
- Department of Physics, SU
- iThemba LABS

NITheP supported five postgraduate students from the Laser Research Institute, the Institute for Theoretical Physics and the greater part of the department's student body on an outreach road trip. The aim of the trip was to visit 10 schools in underprivileged communities in the Eastern Cape. Some 675 learners were reached.

Popular physics demonstrations were given and learners were informed about options available to them with mathematics and physics as a career path. Students explained the basic philosophies of mathematical modelling of physical systems and experimental physics. The feedback received was overwhelmingly positive.

Job shadowing

Three job shadowing opportunities were organised during July 2015. For each, NITheP collaborated with iThemba LABS as well as the SU Physics Department to give the learners an opportunity to experience theoretical and experimental environments.

Research and training

Research focus

NITheP has a clear research focus, derived from existing research capacity at the nodal centres and strategic priorities. With the appointment of associates, the research focus includes 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)

Schools, workshops and short research programmes under RFP system

NITheP supports workshops and research programmes organised at its nodal centres or an associate's home institution. Programmes are accessed through the RFP system. Workshops typically span three to five days and research programmes a period of one to three months. These activities are often combined.

NITheP's flagship training programme, the Chris Engelbrecht Summer School series, runs annually. This proposal-driven programme enables any member of the theoretical physics or broader physics community to propose a topic, speakers and organising committee for the school.

In 2015 the following schools, workshops and short research programmes were supported under the RFP system. In addition to the grants made by NITheP, an additional amount of R1 601 529 was leveraged through these workshops/conferences.

Schools

The 26th Chris Engelbrecht Summer School, titled *Physics of the LHC*, took place from 12 to 23 January 2015 at UCT.

Topics:

Electroweak Symmetry In and Beyond the Standard Model; Experimental Aspects of Heavy Ion Collisions; Experimental Aspect of Electroweak Symmetry Breaking; Gauge Theories of Quantum Chromodynamics; Hydrodynamics of Heavy Ion Collisions; and QCD, Jet Physics and Event Generation at the LHC.

Speakers:

Prof John Ellis (King's College, London), Prof Reinhard Stock (Goethe Universitat, Frankfurt), Prof Aleandro Nisati (INFN, Sezione di Roma), Prof Miko Laine (University of Bern), Prof Derek Teaney (Stony Brook University) and Prof Bryan Webber (University of Cambridge).

Organisers:

Dr Andrew Hamilton (UCT) Chair, Dr Will Horowitz (UCT), Prof Heribert Weigert (UCT), Prof Andre Peshier (UCT), Prof Bruce Mellado (Wits) and Dr Thomas Dietel (UCT).

Workshops

1. ***Quantum Physics: Foundations and Applications***, sponsored by NITheP, was held from 3 to 13 February 2015 at STIAS in Stellenbosch.

   Topics:

   Open Systems: topics included decoherence, irreversibility and entropy; composite systems, separability and entanglement; scattering theory, stochastic evolution and entropy generation.

   Matrix-Valued Differential Operators: this included discussion of Generalized Laplacians and Dirac operators, with applications to Edge States, YM theories and Spintronics.

   Speakers:

   Manolo Asorey (Zaragosa), A. P. Balachandran (Syracuse), Luis Velazquez Campoy (Zaragoza), Elisa Ercolessi (Bologna), Paolo Facchi (Bari), Fernando Falceto (Zaragosa), Alberto Ibort (Madrid), Andre Reyes Lega (Bogota), Giuseppe Marmo (Naples), Pramod Padmanabhan (Sao Paolo), Juan-Manuel Perez-Pardo (Madrid), Sachin Vaidya (Bangalore), Franco Ventriglia (Naples), Patrizia Vitale (Naples) and Allesandro Zampini (Luxembourg).

   Organisers:

   Prof F.G. Scholtz (NITheP), Prof S. Vaidya (IIS, Bangalore, India), Prof A. P. Ballachandran (IIS, Bangalore, India) and Prof G. Marmo (University of Naples).

2. ***Nonequilibrium physics of driven-dissipative many-body systems***, sponsored by NIThep and the Centre for Quantum Technology (UKZN), was held from 21 to 25 September 2015 at Palm Dune Beach Lodge in KwaZulu-Natal.

   This workshop brought together a select group of leading experimentalists and theorists in the field to exchange results from state-of-the-art research and provided opportunities for discussions and new collaborations on this important topic.

   Topic:

   In recent years, there has been much progress in realising systems with many degrees of freedom, and in which matter can be strongly coupled to light. This has been achieved in several experimental setups: ultracold atoms in optical lattices, Bose-Einstein condensates (BEC), semiconductor quantum wells, arrays of microcavities or trapped ions, and optomechanical systems. Such systems share certain important properties. First, they can be driven far out of equilibrium by applying coherent electromagnetic

fields. Second, these systems can undergo coherent and dissipative dynamics on similar time scales. Both aspects render theoretical studies of these systems challenging and have spurred important efforts to develop new approaches.

Speakers:
Dr Peter Kirton (University of St Andrews, UK), Lesanovsky (University of Nottingham, UK), Dr Davide Rossini (Scuola Normale Superiore, Pisa, Italy), Prof Hakan Tureci (Princeton University, USA) and Dr Hendrik Weimer (Leibniz Universitat Hannover, Germany).

Organisers:
Prof Francesco Petruccione (UKZN and NITheP) (Chair), Prof Jens Koch (Northwestern University, USA) and Dr Ilya Sinayskiy (UKZN and NITheP).

3. ***Computational Methods in Physics***, sponsored by NITheP, was held from 6 to 17 July 2015 at SU.

This winter school offered a basic introduction to computational and simulation methods used in physics based on the Matlab programming language. The school was aimed at 3rd year, honours level and MSc students starting in physics or applied mathematics with little or no programming experience. Lectures on the computational methods were complemented by hands-on computer lab sessions for an effective learning experience.

Topics:
Introduction to Matlab, Dynamical Systems, Numerical Linear Algebra, Chaotic Dynamics, Random Numbers, Stochastic Processes and Monte Carlo Methods.

Speakers:
Dr Florian Angeletti, Dr Fabio Cinti, Dr Analabha Roy and Prof Hugo Touchette (NITheP SU node), Prof Alan Cornell and Prof Kevin Goldstein (NITheP WITS node).

Organisers:
Dr Fabio Cinti, Prof F.G. Scholtz and Prof Hugo Touchette (NITheP SU node), Prof Azwinndini Muronga (UJ and NITheP board member).

4. ***Joburg Workshop on Gravitational Aspects of String Theory,*** sponsored by NITheP and Wits, was held from 31 August to 12 September 2015. The School for postgraduate students was held from 31 August to 4 September at the School of Physics, WITS, followed by the Scientific Workshop held from 6 to12 September at the WITS Rural Facility.

Topic:
The workshop's aim was two-fold. It firstly sought to expose postgraduate students to exciting recent developments in understanding the degrees of freedom in gravitational systems with emphasis on exploring the physics of black holes and singularities. Secondly, it aimed to stimulate discussion and interaction that would result in new research directions and collaborations.

The first week of the workshop focused on giving students basic skills. The second goal was achieved during the second week of the workshop by bringing together experts.

Speakers:
Antal Jevicki (Brown), Charlotte Kristjansen and Niels Obers (Niels Bohr Institute), Sanjaye Ramgoolam and Rodolfo Russo (Queen Mary).

Organisers:
Vishnu Jejjala, Robert de Mello Koch, Kevin Goldstein, Shinji Hirano and Joao Rodrigues (WITS), and Konstantinos Zoubos (UP).

5. ***Quantum Many-Body Systems Far From Equilibrium: Quench dynamics, thermalisation, and cold-atom experiments,*** sponsored by NITheP and SFB FoCuS (Sondeforschungsbereich Foundations and Applications of Quantum Science), was held from 9 to 13 March 2015 at STIAS, Stellenbosch. An additional workshop week followed with a limited number of participants from 16 to 20 March 2015.

Topic:
Recent progress in manipulating cold atoms and ions has brought the study of non-equilibrium behavior of isolated quantum systems into the focus of research. This workshop aimed at bringing together researchers from a variety of fields related to this topic, including quantum information, statistical physics, mathematical physics, cold atoms and condensed matter physics.

Speakers:
Alexander Altland, Sebastian Diehl, Jens Eisert, Thomas Gasenzer, Christian Gross, Corinna Kollath and Ulrich Schollwöck (Germany), Cheng Chin, Alexey Gorshkov, Kaden Hazzard, Chris Monroe, Steven Moses and Anatoli Polkovnikov (USA), Andrew Daley and Igor Lesanovsky (UK), Florian Meinert, Christian Roos and Jörg Schmiedmayer (Austria), Alessandro Silva (Italy), Dirk Schuricht (Netherlands), Izak Snyman and Hermann Uys (South Africa) and Luca Tagliacozzo (Spain).

Organisers:
Prof Michael Kastner (NITheP, Stellenbosch node) and Prof Hanns-Christoph Nägerl (University of Innsbruck, Austria).

6. ***Cosmology on Safari,*** sponsored by UKZN, UCT and the Astrophysics and Cosmology Research Unit (ACRU), was held from 26 to 30 January 2015 at Bonamanzi, KwaZulu-Natal.

Topics:

The conference focused on the interplay between cosmological models and data, with emphasis on the challenges that remain in cosmology. Topics covered included constraints on primordial perturbations, dark radiation, gravitational waves and inflationary models from the cosmic microwave background, constraints on dark energy, dark matter and theories of gravity.

Speakers:

Henk Hoekstra (Leiden), Markus Boettcher (North West University), Marc-Antoine Miville-Deschenes (Institut Astrophysique Spatial, Universite Paris-Sud), Neal Dalal (University of Illinois), Romeel Dave (UWC), Jack Hughes (Rutgers), Lyman Page (Princeton University) and J. Richard Bond (CITA).

Organisers:

Cynthia Chiang, Matt Hilton, Kavilan Moodley, Jonathan Sievers and Sahal Yacoob (UKZN) and Amanda Weltman (UCT).

7. ***ASESMA 2015, 3rd African School on Electronic Structure Methods and Applications***, was held from 19 to 30 January 2015 at WITS.

Topics:

Basic methodological aspects such as density functional theory, pseudopotentials, plane waves and iterative diagonalisation methods, as well as the application of electronic structure methods to the mechanical, dynamical, electronic, and magnetic properties of materials. This school focused in particular on:

- Optical properties with time-dependent DFT and GW methods
- Quantum Monte Carlo methods
- Molecular Dynamics

Organisers:

O. Akin-Ojo and W. Soboyejo (AUST, Abuja), G.O. Amolo (Chepkoilel Univ., Eldoret), N. Chetty (UP), D. Joubert (WITS, local organiser), R. Martin (Univ. Illinois and Stanford University), D. Moeketsi (CHPC, Cape Town), B. M'Passi-Mabiala (UMN Brazzaville), S. Narasimhan (JNCASR, Bangalore), A. Quandt and R. Warmbier (WITS), S. Scandolo (ICTP, Trieste), N. Spaldin (ETH Zürich).

Sponsors:

Centre for Doctoral Training on Theory and Simulation of Materials (TSM) - Imperial College London; Centre for High Performance Computing (CHPC); DST-NRF Centre of Excellence in Strong Materials (COE-SM); International Union for Pure and Applied Physics (IUPAP); Materials for Energy Research Group (MERG); NITheP; Swiss National Center for Computational Design and Discovery of Novel Materials (NCCR MARVEL); Thomas Young Centre; WITS; US Liaison Committee for IUPAP; Centre for Research on Adaptive Nanostructures & Nanodevices (CRANN); and Trinity College Dublin.

8. ***Workshop on High Energy Particle Physics***, was held from 11 to 13 February 2015 at IThemba LABS North.

Topics:

With the discovery of the Higgs boson two years ago, the particle content of the Standard Model appears to be complete. However, many problems remain, such as why there is more matter than anti-matter, better determining the still poorly measured parameters of the strong force, explaining possible sources for dark matter, naturalness... etc. While the newly discovered Higgs boson seems to be compatible with the Standard Model, current experimental accuracy is far from providing a definitive statement with regards to the nature of this new particle. There is a lot of room for physics beyond the Standard Model to emerge in the exploration of the Higgs boson. Recent measurements in high-energy heavy ion collisions at the LHC have shed light on the complex dynamics that govern high-density quark-gluon interactions. An array of results from the ALICE collaboration has been highlighted in a recent issue of CERN courier. The physics program of high-energy heavy ion collisions promises to further unveil the intricacies of high-density quark-gluon plasma physics.

Speakers:

Alan Cornell (NITheP, WITS), Tom Dietl (UCT), Deepak Kar (Glasgow/WITS), Simon Mullins (iThemba North), Azwinndini Muronga (UJ).

Organisers:

Zinhle Buthelezi (iThemba LABS), Alan Cornell (co-chairman) (NITheP WITS), Andrew Hamilton (UCT), Deepak Kar (Glasgow/WITS), Bruce Mellado (co-chairman) (WITS), Elias Sideras-Haddad (WITS), W.A. Horowitz (UCT), Sahal Yacoob (UKZN).

Participation in these events is summarised in Table 13.

Table 13: Participation in NITheP-organised events in 2015

Event	Student participants (including postdocs)				Ordinary participants				Invited speakers (local & international)	Total participants	Grant received from NITheP (R)	Funds leveraged from other sources
	South African	Other African countries	International	**Total**	South African	African	International	**Total**				
SCHOOLS												
26th Chris Engelbrecht Summer School: *Physics of the LHC* (Andrew Hamilton)	42	3	5	**50**	0	0	0	**0**	6	56	R 300 000	R 97 500
CAPACITY DEVELOPMENT WORKSHOPS												
6th Joburg Workshop on Gravitational Aspects of String Theory: School for Post-graduate Students (Vishnu Jejjala)	13	1	0	**14**	0	10	0	**10**	5	29	R 125 000	R 0
NITheP School on *Computational Methods in Physics* (Hugo Touchette and Fabio Cinti)	22	3	3	**28**	0	0	0	**0**	4	32	R 137 000	R 0
RESEARCH WORKSHOPS												
ASESMA 2015 (Nithaya Chetty)	21	13	0	**34**	3	4	0	**7**	11	52	R 200 000	R 575 000
6th Joburg Workshop on Gravitational Aspects of String Theory: Scientific workshop (Vishnu Jejjala)	0	0	0	**0**	4	0	10	**14**	5	19	R 125 000	R 133 100
Quantum Physics: Foundations and Applications (FG Scholtz)	4	0	1	**5**	1	0	4	**5**	11	21	R 125 000	R 30 000
Nonequilibrium Physics of Driven-Dissipative Many-Body Systems (Ilya Sinayskiy)	4	1	3	**8**	1	3	5	**9**	5	22	R 125 000	R 23 330
Quantum Many-Body Systems Far From Equililbrium (Michael Kastner)	8	4	21	**33**	3	0	7	**10**	22	65	R 125 000	R 165 929
Cosmology on Safari (Kavilan Moodley)	9	2	8	**19**	1	1	21	**23**	8	50	R 100 000	R 900 000
Workshop on High Energy Particle Physics	24	4	0	**28**	4	0	0	**4**	5	37	R 125 000	R 0
Total	147	31	41	**219**	17	18	47	**82**	**77**	**383**	**R 1 487 000**	**R 1 924 859**

Faculty development

NITheP has embarked on an initiative to engage with faculties and students at more remote centres to enhance research and training in theoretical physics at these centres. In 2015 the following workshop was held as part of this initiative:

NITheP Board member Prof Azwinndini Muronga chaired the HDM workshop that took place during November 2015 at NWU. The HDM series is held every second year and plays an important role in developing students and faculty, particularly at previously disadvantaged universities.

Teaching and postgraduate supervision

NITheP's mandate clearly states an involvement of NITheP staff members in teaching and postgraduate supervision.

Table 14 shows the 2015 involvement of NITheP staff in teaching, while Table 15 displays the number of Honours (projects), MSc and PhD students under NITheP staff supervision.

Table 14: Hours of teaching by NITheP staff in 2015

Node	Undergraduate (hours)	Honours (hours)	Advanced (MSc/PhD) (hours)	Total
SU	0	150	0	150
UKZN	0	108	0	108
WITS	126	45	0	171
Total	**126**	**303**	**0**	**429**

Table 15: Postgraduate supervision in 2015 (figures in brackets denote the number of NITheP bursary holders in the preceding figure)

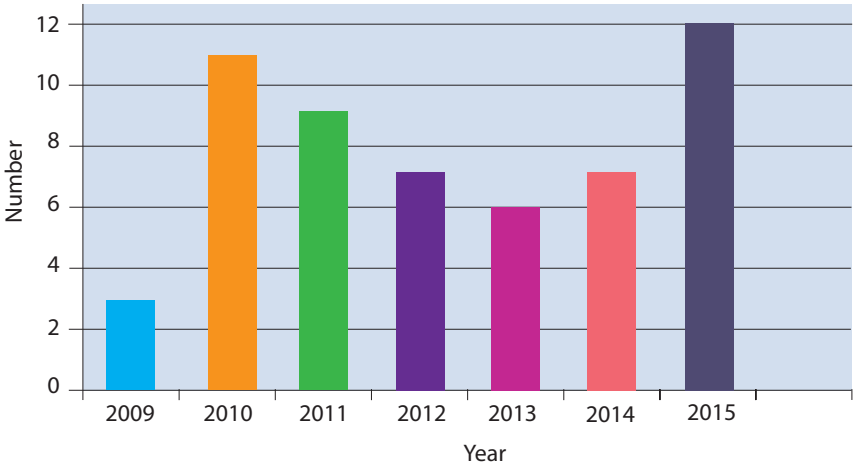
Node	Honours (projects)	MSc	PhD	Total
SU	1	3 (1)	5 (2)	9 (3)
UKZN	2	8	13 (1)	23 (1)
WITS	2	3	4 (1)	9 (1)
Total	**5**	**14 (1)**	**22 (4)**	**41 (5)**

The number of MSc and PhD students under NITheP staff supervision who graduated in 2015 is displayed in Table 16.

Table 16: MSc and PhD students under NITheP supervision who graduated in 2015 (figures in brackets are NITheP bursary holders)

Node	Students	
	MSc	PhD
SU	3 (1)	2 (1)
UKZN		4 (1)
WITS	1	2
Total	**4 (1)**	**8 (2)**

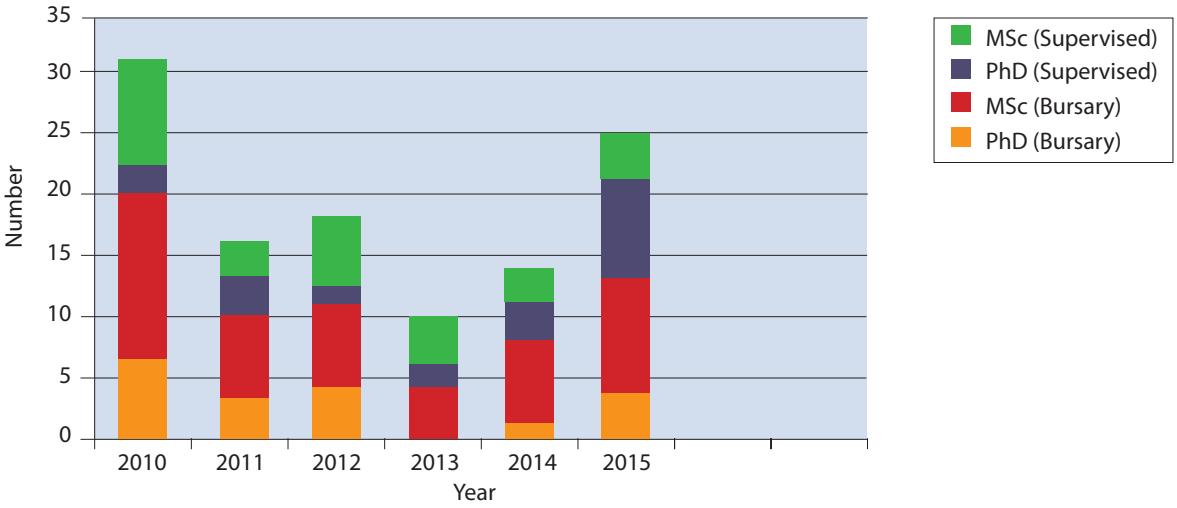
Figure 3: MSc and PhD students under NITheP supervision who graduated in the period 2009 to 2015



The total output of MSc and PhD students who were under NITheP supervision and participated in the bursary programme for the period 2010 to 2015 is shown in Figure 4.

The decline in the number of graduations over the past five years must be correlated with the decline in the number of bursary holders as displayed in Figure 1.

Figure 4: MSc and PhD students under NITheP supervision and in NITheP's bursary programme who graduated in the period 2010 to 2015



Publications

The publication outputs are shown in Table 17, while Figure 5 summarises the trend for the period 2007 to 2015.

Figure 5 shows the citation record for the corresponding period and Figure 6 shows the contribution of the core staff and postdoctoral fellows to the total research outputs for the period 2009 to 2015.

This shows a decline, indicating a greater contribution from the NITheP network of associates and visitors to the output from NITheP. It also shows that the NITheP model of a national network of researchers is functioning well. The sharp decline in 2015 does not indicate lower productivity of NITheP staff or postdoctoral fellows. Their output remained virtually constant, while the output of the network increased considerably from 2014.

Table 17: Publication output per geographical region for 2015

Geographical region	Publications
Gauteng	28
KwaZulu-Natal	34
Western Cape	22
Total	**84**

Figure 5: Publication trend for the period 2009 to 2015

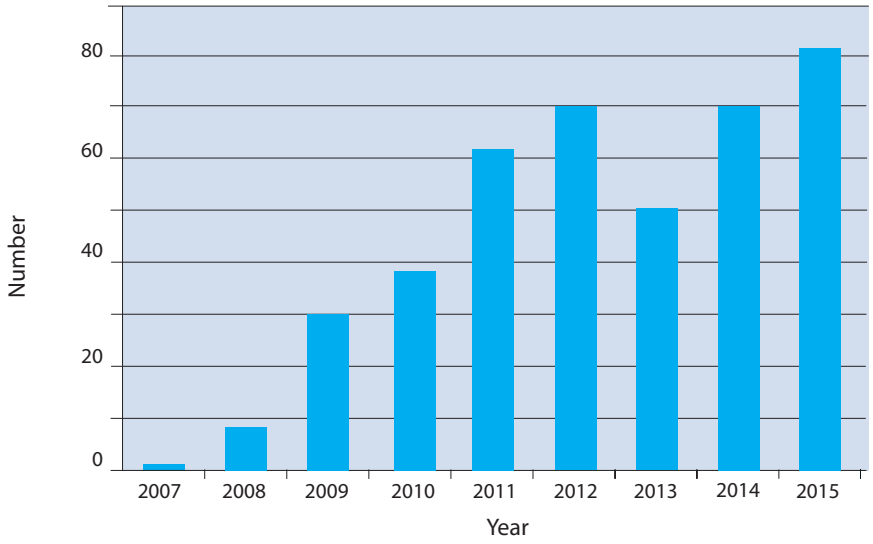


Figure 6: Citation record for the period 2007 to 2015

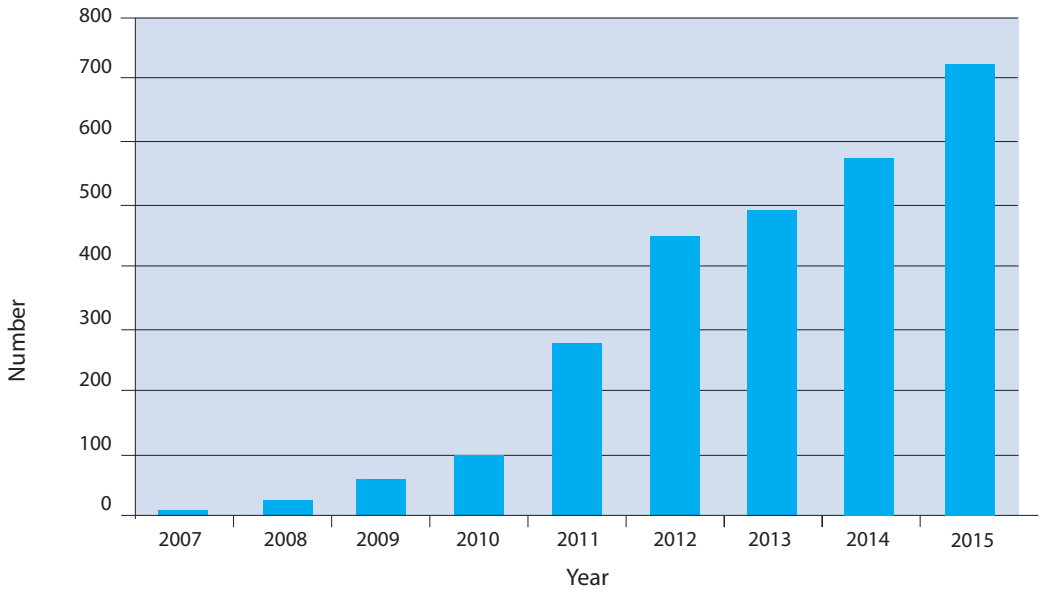


Figure 7: Contribution of core staff and postdoctoral fellows to total number of publications for the period 2009 to 2015

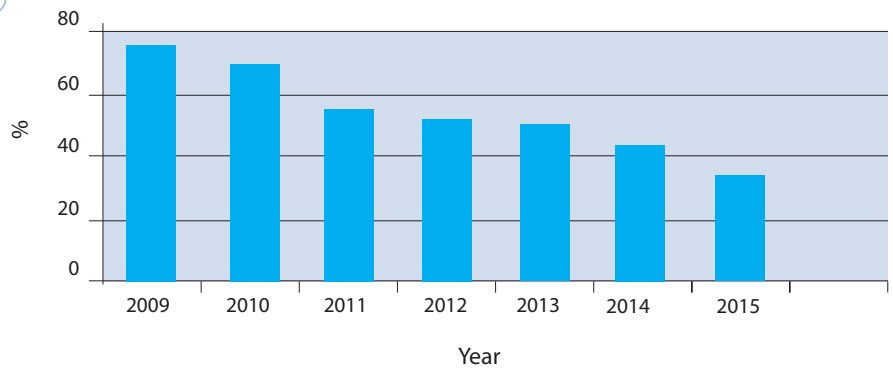
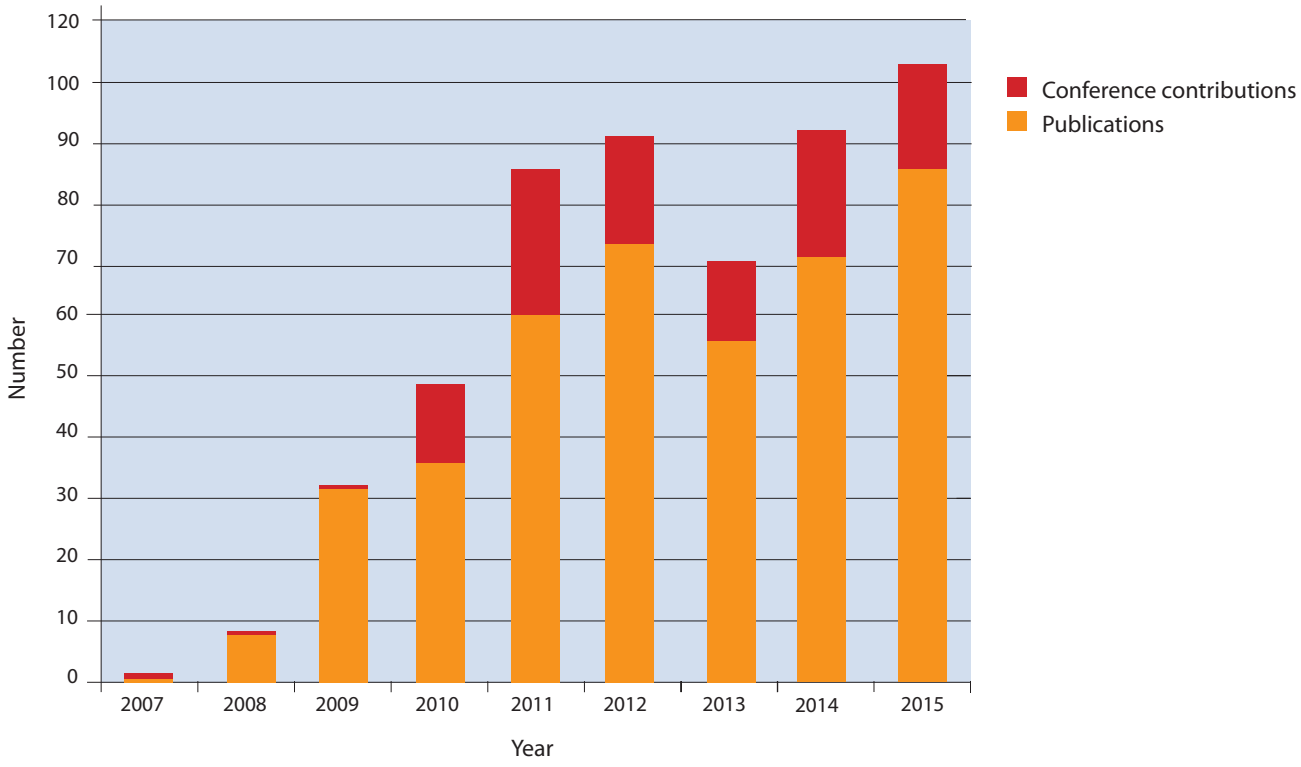


Figure 8: Total outputs for the period 2007 to 2015



List of publications

1. Abdalgabar, A. & Cornell, A.S. 2015, "Large trilinear A(t) soft supersymmetry breaking coupling from 5D MSSM", ***High Energy Particle Physics Workshop (HEPPW2015),*** vol. 645, pp. UNSP 012001.

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4. Akhalwaya, I., Moodley, M. & Petruccione, F. 2015, "Monte Carlo simulation of a noisy quantum channel with memory", ***Physical Review E***, vol. 92, no. 4, pp. 043304.

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Conference proceedings

1. A.C. Li, F. Petruccione and J. Koch, ***Perturbative study of interacting photons in open lattices.*** APS Meeting Abstracts 1, 39013 (2015).

2. B. Adams, I. Sinayskiy and F. Petruccione, ***An open quantum systems approach to Avian Magnetoreception***, in Proceedings of SAIP2014, the 59th Annual Conference of the South African Institute of Physics, edited by C. Engelbrecht and S. Karataglidis (UJ, 2015), pp. 564 -570. ISBN: 978-0-620-65391-6.

3. F. Petruccione and I. Sinayskiy, ***Microscopic derivation of open quantum Brownian motion***, APS Meeting Abstracts 1, 38009 (2015).

4. F.G. Scholtz, ***Noncommutativity and other applications of exact renormalization group dualities***, PHHQP13, 8 to 12 July 2015, Jerusalem.

5. I. Semina and F. Petruccione, ***The stochastic Schrödinger equation approach to open quantum systems***, in Proceedings of SAIP2014, the 59th Annual Conference of the South African Institute of Physics, edited by C. Engelbrecht and S. Karataglidis (UJ, 2015), pp 614-619.

6. M. Kastner, ***Spreading of correlations in long-range quantum lattice models***, Frontiers of Quantum and Mesoscopic Thermodynamics '15, Prague (Czech Republic), 27 July to 1 August 2015.

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9. M. Mafu, K. Garapo and F. Petruccione, ***Finite-size key security of Phoenix-Barnett-Chefles 2000 quantum-key-distribution protocol***, in Proceedings of SAIP2014, the 59th Annual Conference of the South African Institute of Physics, edited by C. Engelbrecht and S. Karataglidis (UJ, 2015), pp 590-595.

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13. ***Markov processes conditioned on large deviations***, 44th Dutch Stochastics Meeting Lunteren, The Netherlands, 9 November 2015.

14. N. Teper, L.N. Mbenza, I. Sinayskiy and F. Petruccione, ***Entanglement of two distant nitrogen-vacancy-center ensembles under the action of squeezed microwave field***, in Proceedings of SAIP2014, the 59th Annual Conference of the South African Institute of Physics, edited by C. Engelbrecht and S. Karataglidis (UJ, 2015), pp 637-642. ISBN: 978-0-620-65391-6.

15. ***Nonequilibrium Markov processes conditioned on large deviations,*** Workshop on Large Deviation Theory in Principle and Practice, Princeton Center for Theoretical Science, Princeton University, USA, 16 November 2015.

16. ***Nonequilibrium Markov processes conditioned on large deviations***, Workshop on Statistical Mechanics of Non-Hamiltonian Systems, Department of Physics, Università di Roma 'La Sapienza', Italy, 12 May 2015.

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19. V. Semin and F. Petruccione, ***Projection operator techniques in the theory of open quantum system***, EPJ Web of Conferences 103, 02007 (2015).

2015 Financial Statements

The statement of income and expenditure, cash flow and balance sheet for 2015 are reflected below.

Balance Sheet at 31 December 2015

	2015 R	2014 R
ASSETS		
NON-CURRENT ASSETS	52 794,90	67 074,50
Computers and office equipment	52 794,90	67 074,50
Intangible assets	-	-
CURRENT ASSETS	1 891 751,11	2 718 137,97
Other receivables	-	642 766,30
Petty cash	1 000,00	1 000.00
Stellenbosch University	1 890 751,11	2 074 371,67
TOTAL ASSETS	**1 944 546,01**	**2 785 212,47**
EQUITY AND LIABILITIES		
CAPITAL AND RESERVES	1 373 303,16	2 688 273,16
Accumulated funds	1 373 303,16	2 688 273,16
CURRENT LIABILITIES	571 242,84	96 939,30
Trade and other payables	96 939.30	130 939.14
TOTAL FUNDS AND LIABILITIES	**1 944 546,00**	**2 785 212,46**

Consolidated Income Statement

for the year ended 31 December 2015

	2015	2014
	R	R
INCOME	11 169 873,99	10 612 540,63
National Research Foundation grant	11 142 974,00	10 612 356,00
Exchange rate gain	-	184,63
Other income	26 899,99	-
EXPENDITURE	12 484 843,99	10 497 692,56
Advertisements	-	17 086,37 44
Audit fees - under provision previous year	2 122,68	-
- current year	43 965,00	45 073,32
Affiliation and registration	8 442,00	4 315,10
Bursaries - post graduate	4 067 581,99	2 578 229,59
Computer materials and software	120 977,70	58 850,78
Conference fees	1 179 011,35	403 010,00
Consultation	-	-
Consumables	186,80	2 678,30
Contribution to workshops	274 451,88	502 109,15
Contribution to visiting researchers	-	30 000,00
Copying and stationery	44 122,94	41 900,80
Depreciation	33 658,46	23 344,26
Entertainment	67 715,04	79 438,23
Exchange rate loss	4 194,12	15,00
Furniture and equipment not capitalised	-	3 511,20
Marketing and promotions	27 788,71	48 655,50
Office administration	100 486,50	28 879,49
Postage, telephone and fax	48 598,56	44 262,07
Prizes and medals	7 000,00	11 000,00
Research costs	-	51 241,74
Repairs and maintenance	-	5 291,85
Salaries	5 130 928,83	5 350 816,22
Sundry expenses	15 491,94	8 431,02
Travel and accomodation	1 308 119,49	1 159 552,57
SURPLUS/(SHORTAGE) FOR THE YEAR BEFORE TRANSFERS	(1 314 970,00)	114 848,08
TRANSFERS BETWEEN NODES	-	-
Transfer to University of Kwazulu-Natal	(929 850,50)	(1 946 835,00)
Transfer to University of the Witwatersrand	(716 814,00)	(1 352 688,00)
Transfers from Stellenbosch University	1 646 664,50	3 299 523,00
SURPLUS/(SHORTAGE) FOR THE YEAR	**(1 314 970,00)**	**114 848,08**

Cash Flow Statement for the year ended 31 December 2015

	2015 R	2014 R
CASH FLOW FROM OPERATING ACTIVITIES		
(Loss) / surplus for the year	(1 314 970,00)	114 848,08
Adjustment for:		
Depreciation	33 658,46	23 344,26
Operating loss before working capital adjustments	(1 281 311,54)	138 192,33
Working capital adjustments	1 117 069,84	(179 167.56)
(Increase)/Decrease in trade and other receivables	**642 766,30**	**(145 167.72)**
Decrease in trade and other payables	**474 303,54**	**(33 999.84)**
Cash utilised in operations	(164 241,70)	(40 975.23)
NET CASH FLOW FROM OPERATING ACTIVITIES	**(164 241,70)**	**(40 975.23)**
CASH FLOW FROM INVESTMENT ACTIVITIES		
Computers and office equipment purchased	(19 378,86)	(34 990.71)
Decrease in amount owed by Stellenbosch University	183 620,56	75 965.94
NET CASH FLOW FROM INVESTMENT ACTIVITIES	**164 241,70**	**40 975.23**
NET INCREASE IN CASH AND CASH EQUIVALENTS	-	-
CASH AND CASH EQUIVALENTS AT THE BEGINNING OF THE YEAR	1 000.00	1 000.00
CASH AND CASH EQUIVALENTS AT THE END OF THE YEAR	**1 000.00**	**1 000.00**

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