Annual report

1 January - 31 December 2016

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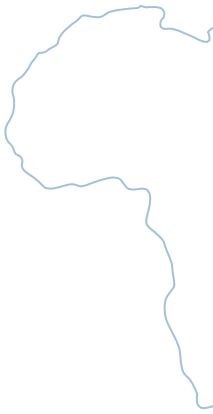

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Abbreviations

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
DVC	Deputy Vice-Chancellor
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 Committee
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
ICTP	International Centre for Theoretical Physics

Director's report

2016 WAS THE LAST YEAR IN THE SECOND FUNDING CYCLE OF NITHEP. As such, it was a year for developing plans for NITheP's short and medium term future and to prepare for the second five year review, which was scheduled to take place early in 2017.

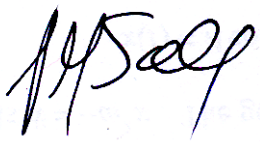
I am happy to report that this process went smoothly, that the five year review report was very positive and strongly endorsed continued funding for NITheP. Subsequently, the DST has made funding available for the three year period 1 April 2017- 31 March 2020, albeit at considerably lower levels then in the past. A process to determine the way ahead after March 2020 has also been initiated by the DST and NRF.

Apart from the important planning and review activities, 2016 was again a very active year with a range of training and research workshops, schools, internships and many other science engagement activities. These are fully reported on below.

As in the past, one of the highlights of 2016, was NITheP's continued good performance as measured by the Nature's Index of Top Institutions. After topping the list of top institutions in Africa in the Physical Sciences in 2015, NITheP slipped back to fourth position in 2016, which is still a remarkable result if the competition and resources available to NITheP are factored in. Even in all subject categories, NITheP did extremely well by taking sixth position in 2016.

The large range of training and research activities and the positive showing on international rating indexes, demonstrate that NITheP has established itself as a mature research institute in the past eight years.

We are looking ahead at a new phase in NITheP's life in which there will be an even stronger emphasis on the development of high level human capacity and international competitiveness.



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 CoE, makes provision for the establishment of a Steering Committee, Scientific Advisory Committee and Management Committee (MANCO). The composition of these three core governance committees was as follows on 31 December 2016:

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 (University of Venda)
- Prof Azwinndini Muronga (NMU Executive Dean: Faculty of Science and SAIP President)
- Prof Francesco Petruccione (NITheP Deputy director, UKZN; South African Research Chair in Quantum Information Processing and Communication)
- Prof João Rodrigues (NITheP Deputy director, WITS; Head: School of Physics)
- Mr Nathan Sassman (Director: Research Chairs and Centres of Excellence)
- Prof Frederik Scholtz (NITheP Director)
- Prof Amanda Weltman (UCT and South African Research Chair in Physical Cosmology)

Scientific Advisory committee (SAC):

- 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 (MANCO):

- Prof Alan Cornell (Associate representative, School of Physics, WITS)
- Prof Francesco Petruccione (NITheP Deputy director, UKZN)
- Prof João Rodrigues (NITheP Deputy director, School of Physics, WITS)
- Prof Frederik Scholtz (NITheP Director, Stellenbosch)

Staff

THE STAFF PROFILE of NITheP as on 31 December 2016 is shown in Table 1.

Table 1: Staff profile on 31 December 2016

Position	Node	Number of positions (appointment)
Director	SU	1 (five-year contract)
Deputy Director	WITS/UKZN	2 (five-year contracts, 25%)
Chief Researcher	SU	2 (five-year contracts)
Researcher	SU	1 (five-year contracts)
Senior administrative officer	SU	2 (five-year contracts)
Secretary	UKZN	1 (five-year contract)
Total		**9**

Postdoctoral fellows

THE POSTDOCTORAL FELLOWS per node as on 31 December 2016 are shown in Table 2. All positions comprise two-year contracts.

Table 2: Postdoctoral fellows on 31 December 2016

Node	NITheP funded	Externally funded
SU	3	3
UKZN	3	4
WITS	2	5
Total	**8**	**12**

Activities in 2016

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 2016 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. The community has been interacting with one another through the communication channels provided by NITheP. Job and study opportunities in SA and abroad have been channelled through NITheP to the SA theoretical physics community. SA theoretical physics workshops have been advertised abroad in order to attract paying international delegates to NITheP workshops, in addition to NITheP supported South African students. NITheP renders a service by being a distribution channel for information dissemination within the South African theoretical physics community and also two way communication between SA and the international theoretical physics community.

NITheP Website www.nithep.ac.za

The current website platform has become outdated and work will commence during 2017 to create a fresh modern website that is well integrated with social media platforms that is also appealing to this generation of students.

NITheP database and e-mail distribution list

509 subscribers receive news in various categories including news on regional seminar announcements, workshop announcements, bursary/internship calls, job and study opportunities as well as general news of interest to the South African and African theoretical physics communities.

NITheP Facebook page @NITheP

819 Facebook Followers with an average 580 post reach is achieved per week. Visitors to the page post comments and form discussion groups around various topics of interest. Events and visitors photo's of workshops are shared via this platform.

NITheP Twitter account @NIThePSA

189 followers view announcments and dissemination of news within the community. Followers include @womeninstemi, @africanphysics, @NRF_SAASTA, @BlackPhysicists, @SAJS_Official and @NaturePhysics.

LinkedIn

NITheP connects with 840 people throughout the South African and International theoretical physics community, including NITheP bursary alumni. To highlight one such a connection is the highly esteemed Prof Matthias Troyer. Prof Troyer reports directly to Bill Gates and is the Principal Researcher at Microsoft for Quantum Computing.

Prof Matthias Troyer gave a public talk in Stellenbosch on the "Quantum future of Computing". Approximately 200 attendees had the opportunity to engage with Prof Troyer

Networking

Associate programme

In order to achieve the strategic goals of NITheP, it is crucial to maintain a national network throughout South Africa. In 2016, the successful NITheP Associate programme continued growing.

NITheP has 84 Associates across all Universities in South Africa:

- 75 Regular/Senior Associates
- 5 Strategic Associates
- 4 Institutional Associates

Associates have access to the NITheP Visitor, Mobility and Workshop programmes through an annual Request for Proposal (RFP) system.

Table 3: Associates on 31 December 2016

REGULAR/SENIOR ASSOCIATES (75)	
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
Dr Álvaro de la Cruz Dombriz	UCT
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
Prof Stefan Ferreira	NWU
Prof Kevin Goldstein	WITS
Dr Filippo Giraldi	UKZN
Prof Dieter Heiss	SU
Prof Manfred Hellberg	UKZN
Dr Gregory Hillhouse	UZULU
Dr Shinji Hirano	WITS
Dr William A Horowitz	UCT
Prof Vishnu Jejjala	WITS
Prof Daniel Joubert	WITS
Prof Steven Karataglidis	UJ
Dr Hannes Kriel	SU
Prof Thomas Konrad	UKZN
Dr Julien Larena	RU
Prof Mantile Lekala	UNISA
Dr Yin-Zhe Ma	UKZN
Prof Roy Maartens	UWC
Prof Richard Mace	UKZN
Prof Sunil Maharaj	UKZN
Prof Daniel Makinde	CPUT
Dr Eric Maluta	UNIVEN
Dr Joseph Medved	RU
Dr Shazrene Mohamed	SAAO
Prof Kavilan Moodley	UKZN

Dr Thuto Mosuang	University of Limpopo
Prof Kristian Müller-Nedebock	SU
Prof Azwinndini Muronga	NMU
Prof Jeff Murugan	UCT
Dr Giuseppe Pellicane	UKZN
Prof André Peshier	UCT
Dr Denis Pollney	RU
Prof Martin Porrmann	UKZN
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 Ilya Sinayskiy	UKZN
Dr Izak Snyman	
Dr Du Toit Strauss	NWU
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)	
AIMS	
DST/NRF CoE in Strong Materials	
HartRAO	
iThemba LABS	
University of Venda	

Table 4: Representativeness of associate network

Type of institution	% of institutions covered by network
Traditional (UCT,UFH,UFS, UKZN,UL,NWU,UP,RU,US,UWC,WITS)	82%
Comprehensive (UJ,NMMU, Unisa, Univen, WSU, UniZulu)	50%
Histrically disadvantaged (UFH, UL, Univen, WSU, UWC, UniZulu)	50%
Univ of Technology	0%

NITheP Associate and Steering Committee member Prof Azwinndini Muronga served as the President of the South African Institute of Physics for the period July 2015-July 2017.

Associate workshop

The annual NITheP associate workshop was held on the 15-16th of September 2016 in Stellenbosch.

The workshop started with the customary meeting on general associate matters, followed by the annual Associate meeting. The second day consisted of a scientific programme, with three talks of one hour each.

Prof Alan Cornell (WITS) serves as the Associate representative on the NITheP management committee.

International linkage

NITheP currently has agreements with the following international institutes:

- International Centre for Theoretical Physics (ICTP) in Trieste, Italy
- International School for Advanced Studies (SISSA) in Trieste, Italy

A possible agreement with the Yukawa Institute for Theoretical Physics (YITP) in Kyoto is currently in a drafting phase.

Request for Proposal (RFP) system

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

Table 5 summarises the support given to staff and Associates under the RFP program during 2016. Greater detail on each activity is listed further below under the appropriate headings.

Table 5: Summary of proposals supported under the RFP program in 2016

Type of activity	Number of proposals
Long-term visitors	11 (18 visitor months)
Mobility	3
Schools	1
Capacity development workshops	3
Research workshops	8

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 were strongly motivated and justified, transport costs. Three such proposals were supported under the Mobility programme during 2016.

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 long-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 a few weeks (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.

Activities by visitors that receive support under this program include interaction with researchers and post-graduate students, special courses and public or general lectures. Often long term visits result in publications, but the building of a collaborative network is currently a higher priority.

The NITheP short-term visitor programme supported 48 visitors during 2016, and the details are indicated in Table 6

Table 6: Short-term visitors who visited NITheP in 2016

NITheP node	Short-term visitors
SU	12
UKZN	19
WITS	17
Total	**48**

In the period 1 January 2009 - 31 December 2016 NITheP hosted a total of 369 short-term visitors, averaging to 46 per year. This vibrant visitor program is partially responsible for NITheP's good showing on international rating indexes.

Table 7 summarises the long-term visitors who were supported under the RFP system, totalling to 18 visitor months.

Table 7: Long-term visitors supported under the RFP system in 2016

Visitor	Home Institute (affiliation)	Host (affiliation)	Term (month)	Publication
Dr Ken Ganga	APC	Dr Cynthia Chiang (UKZN)	2	1
Prof Joseph Indekeu	Leuven University	Prof Hugo Touchette (NITheP)	1	0
Prof Martin Bucher	APC	Prof Kavilan Moodley (UKZN)	3	1
Prof Sandra Klevansky	Heidelberg University	Prof Richard Lemmer (WITS)	1.5	0
Dr Jose Beltran Jiminez	Universite d' Aix-Marseille	Dr Alvaro de la Cruz-Dombriz	1	0
Prof David Mota	University of Oslo	Prof Peter Dunsby (UCT)	3	0
Prof Tommaso Macri	Universidade Federal do Rio Grande do Norte	Dr Fabio Cinti	1	0
Dr Shamik Gupta	Max-Planck Institute for the Physics of Complex Systems	Prof Michael Kastner (NITheP)	1	0
Dr Piermanco Fonda	SISSA	Prof Vishnu Jejjala (WITS)	2	0
Prof Shigeaki Nagamachi	University of Tokushima	Prof Erwin Bruning (UKZN)	1	0
Prof Gunter Wunner	1st Institute for Theoretical Physics	Prof Dieter Heiss (SU)	1.5	1
Total			**18**	**3**

Bursaries

The application statistics for 2017 on the date of closure for bursary applications (30 November 2016) are shown in tables 8 and 9. For comparison the corresponding statistics for 2016 are also shown.

Table8: Application statistics for SA citizens for 2016 and 2017

Degree	2016	2017
Honours	25	17
MSc	22	16
PhD	11	12
Total	**58**	**45**

Table 9: Application statistics by gender and race for 2016 and 2017

Degree	White(%)		Black(%)		Female(%)	
	2016	2017	2016	2017	2016	2017
Honours	20	41	80	59	24	35
MSc	55	38	45	62	5	13
PhD	82	58	18	42	36	0

A total of 40 bursaries were awarded in 2016. The total actual amount paid out was R3,250,000. The bursaries awarded are summarised in Table 10.

Table 10: Bursaries awarded in 2016

Level	Number	Amount allocated per bursary (R)	Actual cost* (R)	Budgeted cost (R)
Hons	7	50 000,00	350 000,00	350 000,00
MSc	20	80 000,00	1 600 000,00	1 470 000,00
PhD	13	100 000,00	1 300 000,00	1 300 000,00
Total	**40**		**3 250 000,00**	**3 120 000,00**

NITheP bursary holders per institution and degree are shown in Table 11 and the relative support to these institutions in figure 1.

Table 11: Bursary holders per institution in 2016

Institution	Honours	MSc	PhD	Total
SU	2	1	3	6
UCT	1	6	4	11
RU	0	2	0	2
UKZN	0	0	1	1
Univen	4	1	0	5
UP	0	3	2	5
WITS	0	7	2	9
NWU	0	0	1	1

Figure 1: Relative support of institutions in bursary holder network

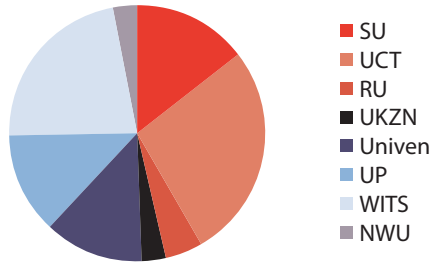


Table 12:2016 Bursary Demographics

Degree	White		Black		Coloured		Indian		Percentages	
	Male	Female	Male	Female	Male	Female	Male	Female	% Black	% Female
Hons	1	1	4	1	0	0	0	0	71	29
MSc	11	1	6	0	1	0	1	0	40	5
PhD	3	2	7	0	0	0	1	0	62	15
Totals	**15**	**4**	**17**	**1**	**1**	**0**	**2**	**0**	**53**	**13**

Table 12 shows the details 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.

- **53%** of NITheP bursary holders are non-white
- **13%** of NITheP bursary holders are female

Table 12 also indicates that the sustained efforts of NITheP for the past 9 years engaging particularly with students from HDI Universities, has led to an increased success rate in the uptake of NITheP bursaries.

It is important to note that the gender profile remains skewed, as is the international phenomena with low levels of female participation in the mathematical sciences. This is particularly pressing in the black and coloured communities and NITheP aims to continue addressing this matter during 2017. One such measure to assist in driving the transformation agenda, is that NITheP requires all workshop organising committees and lecturer profiles to include black and female members. Obviously, the same is required for the students supported by NITheP funding.

Figures 2 and 3 summarize the trend in demographics of bursary holders at the M.Sc. and Ph.D. levels for the period 1 January 2009-31 December 2016. Figure 4 reflects the composition of the bursary pool by degree over the period 1 January 2008-31 December 2016.

Figure 2: Demographics of NITheP bursary holders at MSc level (%)

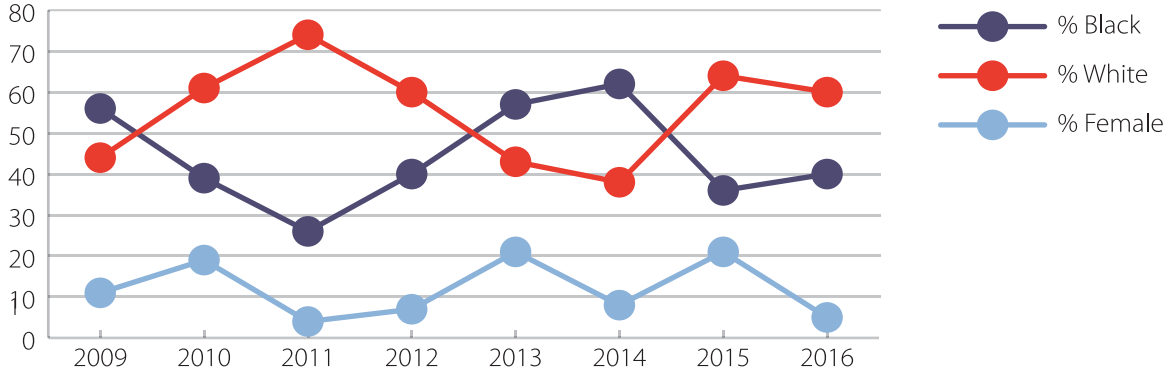


Figure 3: Demographics of NITheP bursary holders at PhD level (%)

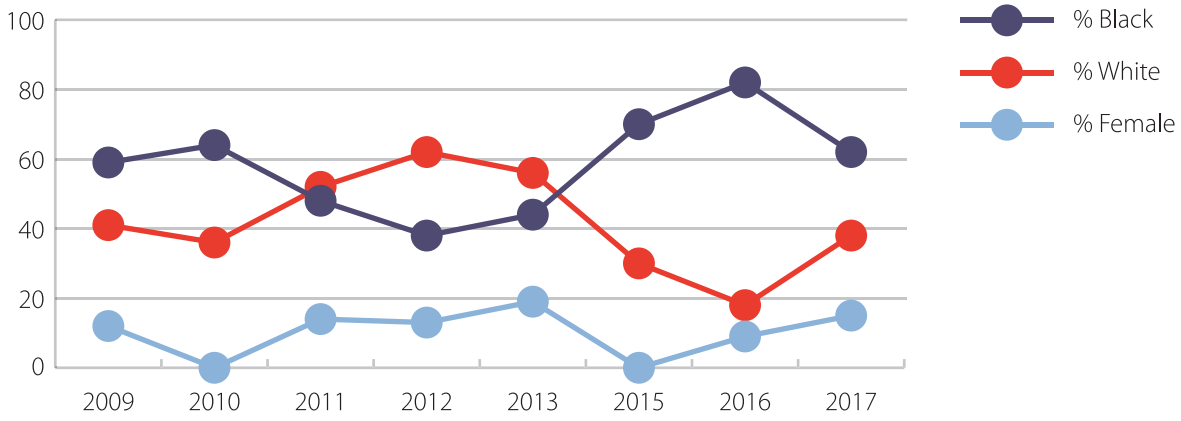
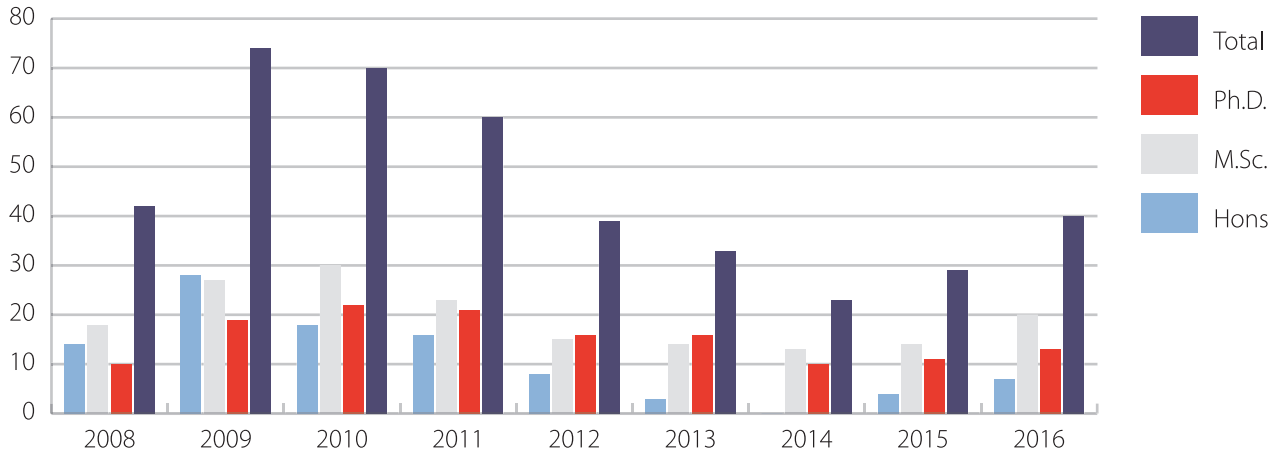
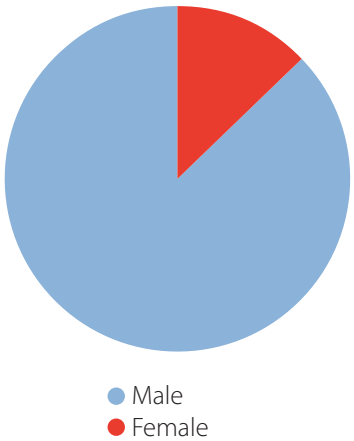


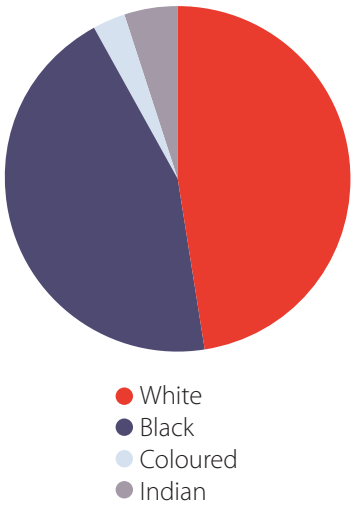
Figure 4: Change in composition of bursary pool in the period 2008-2016



2016 Bursary holder gender



2016 Bursary holder race



Bursary holder workshop

The fifth NITheP two-day annual bursary holder workshop was held at the NITheP offices in Stellenbosch during November 2016. 27 MSc and PhD students presented 20-minute talks on their current research projects and took questions from their fellow students. This opportunity gives students an excellent opportunity to learn from one another and to hone their skills in a non-threatening, encouraging environment. In general the feedback is that student appreciate the opportunity to have learnt more about presenting their work and gaining presentation skills as well as networking with fellow NITheP bursary holders.

Each year a member of the corporate or financial industry is invited to speak with the students about what opportunities are available to them once they have completed their studies.

The event is open to the entire community to attend. Normally a number of supervisors and associates attend the annual event. All NITheP researchers attend the event and act as judges along with the supervisors and associates that are in attendance.

Two prizes are awarded each year:

- R3000 prize for best MSc presentation
- R4000 prize for best PhD presentation

Internships

The internship programme continued in 2016. This turns out to be an excellent tool for the development of students and the creation of a pipeline from the honours to master level. In particular, it is very effective in drawing students from HDIs into a master program, not necessarily in theoretical physics, but also in the mathematical and experimental sciences.

This flagship programme has two components. The first enables students at honours or master's 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 master's level, to join NITheP staff or associates during June/July or November/December recess periods 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.

The benefits are that NITheP provides a training opportunity, often under the guidance of a leading researcher. At the same time, the pressure of project supervision on departments is alleviated. A crucial advantage of the program is that it creates mobility in the student body, which is essential for our small community.

Students apply to NITheP, following an annual call for Internship applications that is sent out. Typically NITheP supports the students who pass the screening process for this programme in terms of travel, accommodation and subsistence costs. There are 31 internship topics available for prospective internship students to choose from.

Table 13 summarises the details regarding the Internship programme for 2016. Particularly encouraging is the considerable number of interns who continue with higher degrees.

Table 13: Internship statistics for 2016

Home Institute (Host institute)	Number of students	Number of students earning credits	Number continuing who continued with higher degree in TP
WITS (UKZN)	2	2	2
UCT (UP)	1	1	1
UNIZULU (UJ)	1	1	1
UWC (UJ)	2	0	1
WITS (UJ)	1	0	0
UCT (UJ)	2	1	1
UL (UJ)	1	1	1
UCT (UWC)	1	1	1
UCT (WITS)	1	1	1
Total	**12**	**8**	**9**

Table 14: Internship students per race and gender 2016

White		Black		Coloured		Indian		Total
Male	Female	Male	Female	Male	Female	Male	Female	
2	0	9	1	0	0	0	0	12

From a demographic point of view the internship profile is very satisfactory as all students are SA citizens, 81% black and 13% female. The participation of female students is, however, still low and should typically be raised to around 30%.

Travel grants

In addition to the bursary and internship programmes, NITheP also offers support to students, enabling 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.

Institution	National (R'000)	International
UCT	3	45 000
SU	2	26 727
Totals	**0**	**71 727**

Outreach, community service and the popularisation of science

Public talks

NITheP's outreach activities includes the popularisation of science. In this regard, NITheP hosts and supports a programme of public talks for the Theorectical Physics community and broader interest groups. These are normally aimed at the general public, students and high school learners.

NITheP arranged a very successful public talk by Prof Mattahias Troyer (ex ETH Zurich now Microsoft). The public talk took place on the 24th of October 2016 on the topic of the "Quantum Future of Computing". The talk was attended by 200 people and was held in the Stellenbosch University JS Gericke Library Auditorium.

Eskom Expo for Young Scientists, national finals in Johannesburg

For the sixth consecutive year in a row, NITheP sponsored two prizes of R2000 each at the Eskom Expo national finals. The two prizes were:

- Best Physics
- Best Mathematics projects.

NITheP Researchers offer their time to adjudicate the learners' projects.

Annual road trip of the SU Physics department Student Outreach group

In collaboration with the following sponsors NITheP has sponsored this outreach event for the past 6 years:

- Optical Society of America (OSA)
- The Dean's Office for the Faculty of Natural Sciences, Stellenbosch University
- Department of Physics, Stellenbosch University
- iThemba LABS

A group of post-graduate students from the Laser Research Institute, the Institute for Theoretical Physics and the greater part of the departments' student body team up together on an annual outreach road trip. The aim of the trip each year is to visit schools in underprivileged communities in areas that are not typically reached by outreach efforts of other organisations. During 2016 schools in remote areas in the West Coast were visited.

Typically during such a school visit, popular physics demonstrations are given and learners are informed about career options available to them in the STEM fields. The feedback received from teachers and leaners has been overwhelmingly positive year after year.

Annual SAIP Conference

NITheP has attended the annual South African Institute of Physics (SAIP) conference on a bi-annual basis for the past eight years. For the same period of time, NITheP has been present on the back cover of the SAIP Book of Abstracts that all delegates receive.

NITheP hosts and funds an exhibition stand at the SAIP conference on a bi-annual basis. The purpose of which is to provide a public relations and communication service to the theoretical physics community as well as facilitation of networking amongst theoretical physics community members and students.

Service to the Theoretical Physics community

Job shadowing: Four job shadowing opportunities were created for high school learners during 2016. These come about from requests by schools or learners themselves indiating that these individuals have expressed an interest in following a career in Theoretical Physics.

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 Theorectical Physics or broader physics community to propose a topic, speakers and organising committee for the school.

In 2016 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 R 940 100 was leveraged through these workshops/ conferences.

Schools

The 27th Chris Engelbrecht Summer School, titled "Hot and Dense Matter in Heavy Ion Collisions and Astrophysics", took place from 11 to 22 January 2016 at Tshipise, Vhembe District, Limpopo.

Capacity Development Workshops

- The fourth ASESMA workshop on "Electronic Structure Methods and Applications"
- Quantum Machine Learning

Short Research Programmes

- General Relatavistic Effects in Galaxy Surveys

Research Workshops

- Quantum Effects in Biological Systems
- Bayesian Analysis in Physics and Astronomy: Fundamentals and Applications
- Beyond the Concordance model II
- 7th Joburg Workshop on String Theory
- SA Gravity Society Workshop

Table 16: Participation in NITheP-organised events in 2016

Event	Student participants (including Postdocs)				Ordinary participants				Invited speakers	Total participants	NITheP Grant (R'000)	Funds leveraged from
	South African	Other African countries	International	Total	South African	Other African countries	International	Total				
SCHOOLS												
27th Chris Engelbrecht Summer School	33	2	2	37	2	0	0	2	6	45	300	180
ASESMA 2016	5	36	1	42	0	0	0	0	12	54	100	400
CAPCITY DEVELOPMENT WORKSHOPS												
58.2Quantum Machine Learning	6	1	5	12	0	0	22	22	6	40	125	58.2
SHORT RESEARCH PROGRAMS												
General relativistic effects in galaxy surveys	3	3	20	26	5	0	0	5	9	40	125	25
RESEARCH WORKSHOPS												
Quantum Effects in Biological Systems	15	6	29	50	0	0	10	10	5	65	125	75
Bayesian Analysis in Physics and Astronomy: Fundamentals and Applications	33	0	1	34	15	0	4	19	3	56	125	0
Beyond the Concordance model II	10	6	19	35	9	0	11	20	19	74	100	79
7th Joburg Workshop on String Theory	31	7	0	38	0	0	0	0	15	53	125	82.9
SA Gravity Society Workshop	31	0	0	31	16	0	3	19	2	52	60	40
Total	**167**	**61**	**77**	**305**	**47**	**0**	**50**	**97**	**77**	**479**	**1185**	**940.1**

Teaching and postgraduate supervision

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

Table 17 shows the 2016 involvement of NITheP staff in teaching, while Table 18 displays the number of Honours (projects), MSc and PhD students under NITheP staff supervision.

Table 17: Hours of teaching by NITheP staff in 2016

Node	Undergraduate (hours)	Honours (hours)	Advanced (MSc/PhD) (hours)	Total (hours)
SU	0	60	0	60
UKZN	24	96	0	120
WITS	0	0	0	0
Total	0	156	0	180

Table 18: Postgraduate supervision in 2016 (figures in brackets denote the number of NITheP bursary holders contained in the preceding figure)

Node	Honours (Projects)	MSc	PhD	Total
SU	1(1)	1	2 (1)	4 (2)
UKZN	3	7	13	23
WITS	0	2 (1)	2	4 (1)
Total	4(1)	10 (1)	17 (1)	31 (2)

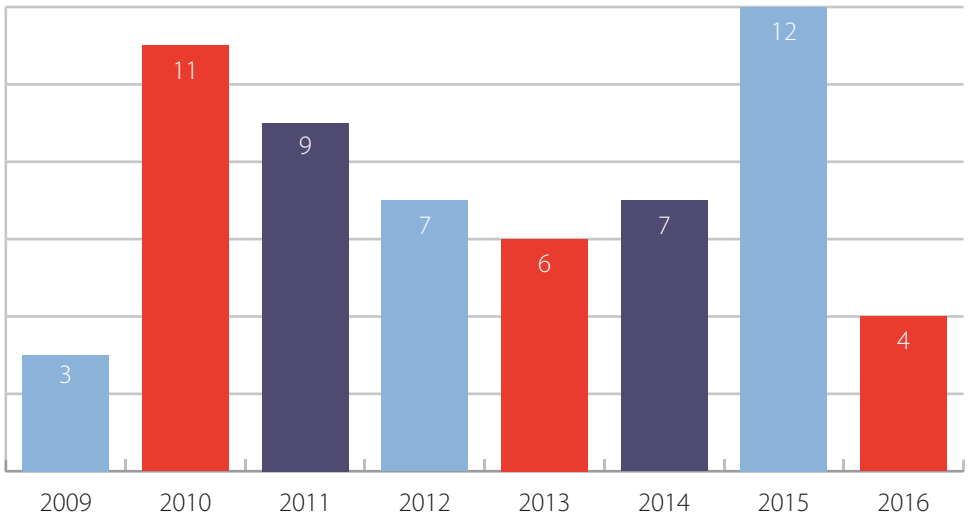
The number of MSc and PhD students under NITheP staff supervision who graduated in 2016 is displayed in Table 19.

Table 19: MSc and PhD students under NITheP supervision who graduated in 2016 (figures in brackets denote NITheP bursary holders)

Node	Students	
	MSc	PhD
SU	0	0
UKZN	2 (0)	1 (0)
WITS	1	0
Total	3 (0)	1 (0)

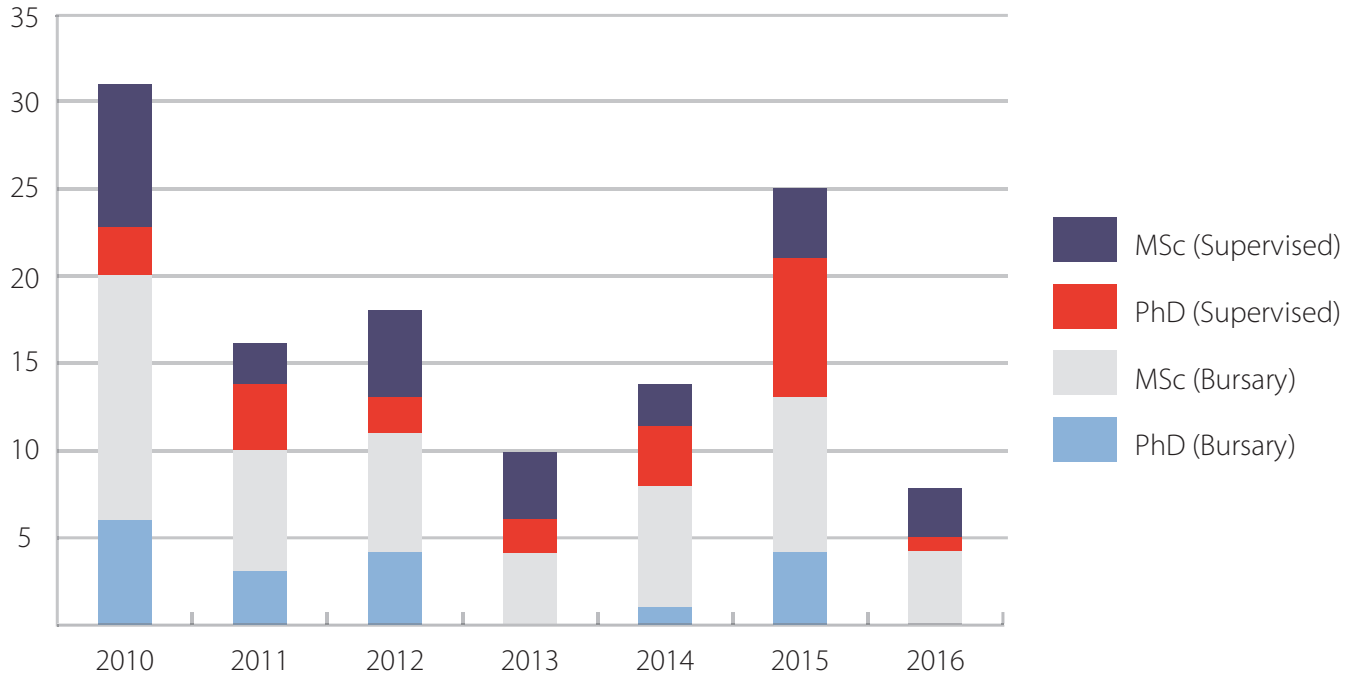
The graduation trend for students under NITheP supervision for the period 1 January 2009-31 December 2016 is summarized in figure 5.

Figure 5: MSc and PhD students under NITheP supervision who graduated in the period 2009 to 2016



The total output of MSc and PhD students who were under NITheP supervision and/or participated in the bursary programme for the period 1 January 2010-31 December 2016 is shown in Figure 6. The decline in the number of graduations over the past 5 years must be correlated with the decline in the number of bursary holders as displayed in figure 4.

Figure 6: MSc and PhD students under NITheP supervision and/or in NITheP's bursary programme who graduated in the period 2010 to 2016



Performance on international ranking lists

Nature Index of Leading Institutes in the Physical Sciences in Africa for 2016:

1. UKZN
2. WITS
3. UCT
4. NITheP
5. SAAO

Publications and conference proceedings

The publication outputs are shown in Table 20, while Figure 7 summarises the trend for the period 2007 to 2016.

Figure 8 shows the citation record for the corresponding period and Figure 9 shows the contribution of the core staff and postdoctoral fellows to the total research outputs for the period 2009 to 2016. 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 as from 2015 does not indicate a lower productivity of NITheP staff or postdoctoral fellows. Their output remained virtually constant, while the output of the network increased considerably as from 2014 due to a larger number of associates contributing to the publication statistics. It must also be kept in mind there was a decline in the number of researcher on contract at NITheP in 2016.

Table 20: Publication output per geographical region for 2016

Geographical region	Publications
Gauteng	22
KwaZulu-Natal	20
Western Cape	27
Total	**69**

Figure 7: Publication trend for the period 2009 to 2016

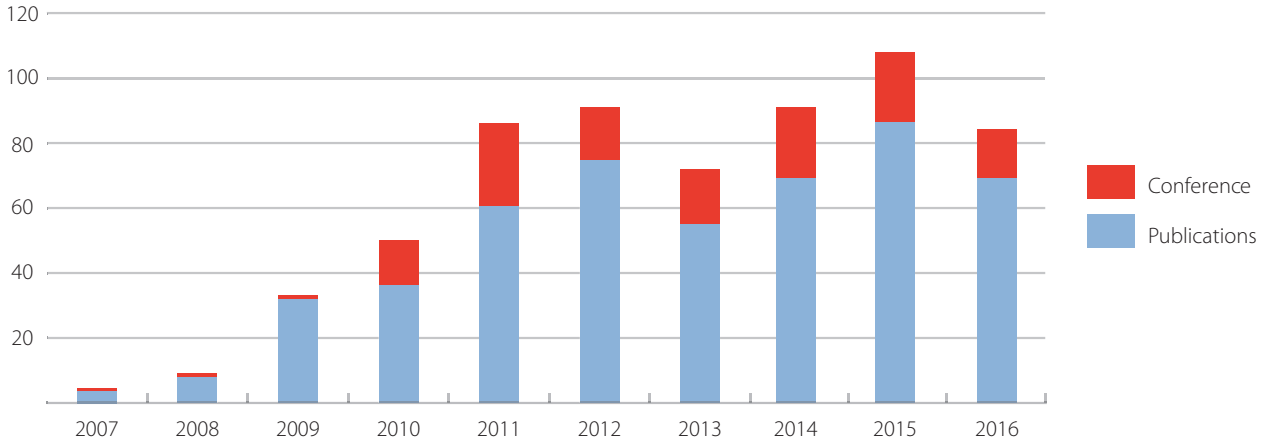


Figure 8: Citation record for the period 2007-2016

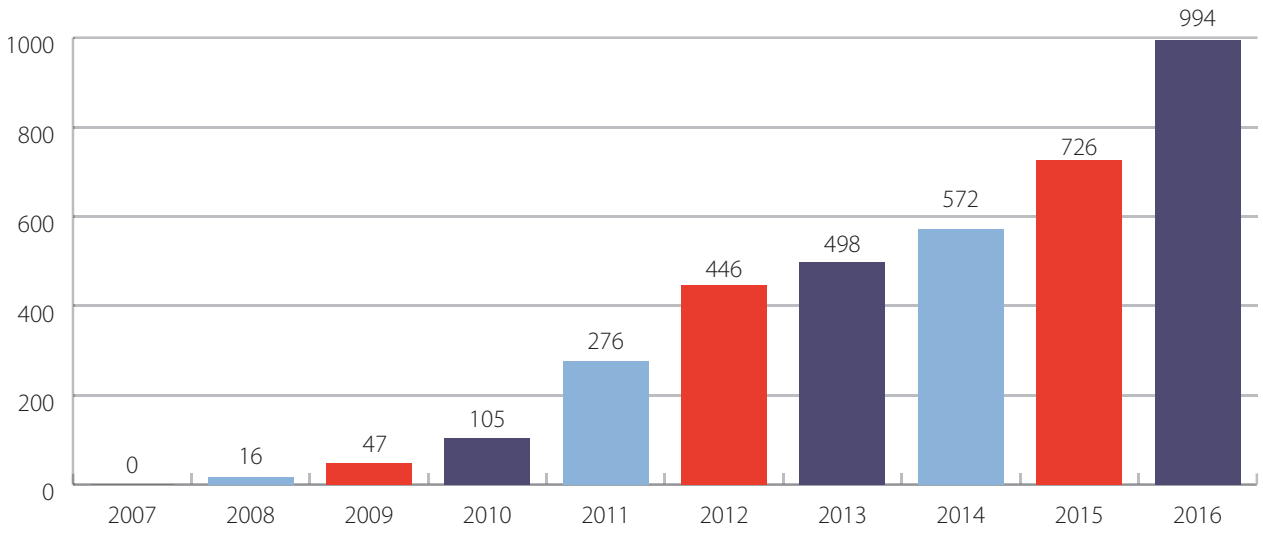
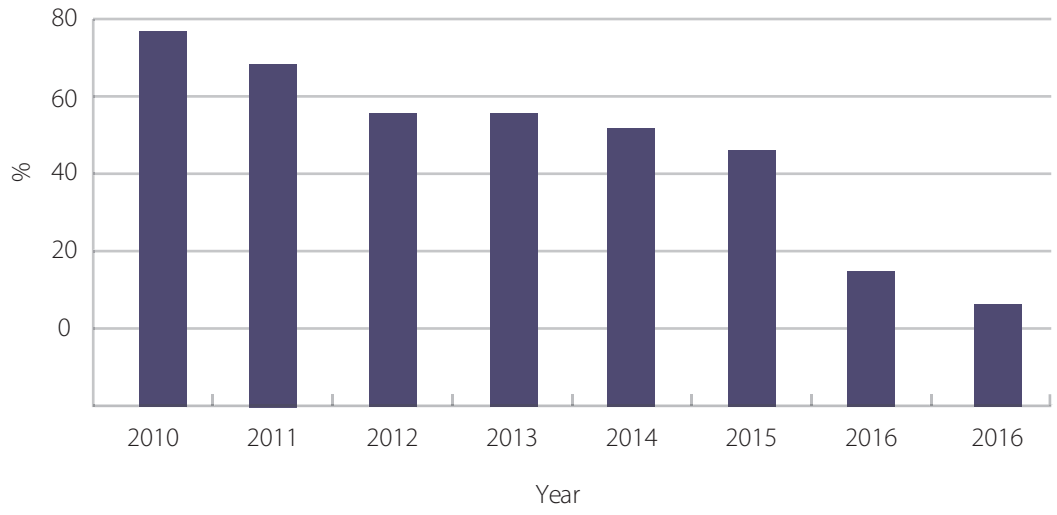


Figure 9: Contribution of core staff and postdoctoral fellows relative to the total number of publications for the period 2009 to 2016



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1. F. Cinti, "Ground state stability of quantum dipolar filaments in BECs", Ultracold@Vilnius, Vilnius, Lithuania, Sep 2016

2. F. Cinti, "Strongly correlated many-body phases in single and multi-layer dipolar", Winter Workshop on Ultracold Quantum Matter, Padova, Italy, Jan 2016

3. FG Scholtz, "The thermodynamics of three-dimensional non-commutative Fermi gases", International Workshop on Quantum Physics: Foundations and Applications, IIS Bangalore, January 2016

4. H. Touchette, "Nonequilibrium processes and their fluctuations", SAIP 2016, University of Cape Town, South Africa, 5 July 2016

5. H. Touchette, Long-range systems with nonequivalent ensembles", Workshop on Long-range interacting many-body systems, ICTP, Trieste, Italy, 26 July 2016

6. M. Kastner, "Spreading of correlations in long-range quantum lattice models", Many-Body Physics in Synthetic Quantum Systems, Stellenbosch, South Africa, 07 April 2016

7. M. Kastner, "Equilibration and spreading of correlations in systems with long-range interactions", 4th Quantum Thermodynamics Conference, Erice, Italy, 09 May 2016

8. M. Kastner, "Spreading of correlations in long-range quantum lattice models", Quantum Non-Equilibrium Phenomena, Natal, Brazil, 15 June 2016 M.

9. Kastner, "Nonequilibrium physics of quantum spin systems with long-range interactions", StatPhys26, Lyon, France, 20 July 2016

DST / NRF NATIONAL INSTITUTE OF THEORETICAL PHYSICS (NITheP)
STATEMENT OF FINANCIAL POSITION AT 31 DECEMBER 2016: ALL NODES

	Notes	2016 R	2015 R
ASSETS			
NON-CURRENT ASSETS		48 950.81	52 794.90
Computers and office equipment	2	48 950.81	52 794.90
CURRENT ASSETS		1 732 723.04	1 891 751.11
Other receivables		588 747.12	-
Petty cash		1 000.00	1 000.00
Stellenbosch University	3	1 142 975.92	1 890 751.11
TOTAL ASSETS		**1 781 673.86**	**1 944 546.01**
EQUITY AND LIABILITIES			
CAPITAL AND RESERVES		1 667 965.01	1 373 303.16
Accumulated funds		1 667 965.01	1 373 303.16
CURRENT LIABILITIES		113 708.85	571 242.84
Trade and other payables	4	113 708.85	571 242.84
TOTAL FUNDS AND LIABILITIES		**1 781 673.86**	**1 944 546.00**

DST / NRF NATIONAL INSTITUTE OF THEORETICAL PHYSICS (NITheP)
DETAILED INCOME STATEMENT FOR THE YEAR ENDED 31 DECEMBER 2016: ALL NODES

	2016 R	2015 R
INCOME	11 852 623.00	11 169 873.99
National Research Foundation grant	11 700 123.00	11 142 974.00
Other income	152 500.00	26 899.99
EXPENDITURE	**11 557 961.15**	**12 484 843.99**
Advertisements	10 221.42	-
Audit fees - under provision previous year	6 155.10	2 122.68
- current year	53 124.00	43 965.00
Affiliation and registration	7 510.70	8 442.00
Books	3 000.00	-
Bursaries - post graduate	4 011 423.34	4 067 581.99
Computer materials and software	4 267.46	120 977.70
Conference fees	142 117.28	1 179 011.35
Consumables	6 857.14	186.80
Contribution to workshops	1 258 275.00	274 451.88
Copying and stationery	24 173.96	44 122.94
Course expenditure	6 500.00	-
Depreciation	33 156.69	33 658.46
Entertainment	55 234.80	67 715.04
Exchange rate loss	484.87	4 194.12
Marketing and promotions	45 337.20	27 788.71
Medical expenses	8 101.71	-
Office administration	49 155.43	100 486.50
Postage, telephone and fax	48 021.97	48 598.56
Prizes and medals	11 000.00	7 000.00
Research costs	45 000.00	-
Salaries	4 696 023.97	5 130 928.83
Services	5 383.00	-
Sundry expenses	555.42	15 491.94
Travel and accommodation	1 026 880.69	1 308 119.49
LOSS FOR THE YEAR BEFORE TRANSFERS	294 661.85	(1 314 970.00)
TRANSFERS BETWEEN NODES	-	-
Transfer to University of Kwazulu-Natal	(1 926 589.50)	(929 850.50)
Transfer to University of the Witwatersrand	(1 086 541.00)	(716 814.00)
Transfers from Stellenbosch University	3 013 130.50	1 646 664.50
LOSS FOR THE YEAR	**294 661.85**	**(1 314 970.00)**

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