Annual report

1 January - 31 December 2009

Contents

Director's Report

2009 WAS A CRUCIAL YEAR in the establishment of the National Institute for Theoretical Physics (NITheP).

Although the institute was officially launched on 13 May 2008, it only became fully functional at the end of 2008/ beginning of 2009 with the appointment of the director, researchers, administrative staff and post doctoral fellows.

During 2009 all the governance and legal structures of NITheP had to be put in place, including the management committee, scientific advisory committee and the board. It also meant implementing the main agreement between the host institution (Stellenbosch University) and the NRF as well as the consortium agreement between the three participating institutions, Stellenbosch University, The University of Witwatersrand and the University of KwaZulu-Natal. I am happy to report that this process is virtually completed and reported on below.

In parallel to the structuring process above, it was also vital that NITheP establishes itself as quickly as possible as an active, high quality research institution and a user facility that facilitates and stimulates research and training in Theoretical Physics throughout the country.

On the research front, 2009 was extremely productive, keeping in mind the short time span researchers had to establish themselves and find cohesion. A highlight of the year was the appearance of two NITheP articles in the same issue of Physical Review Letters.

A concerted effort was made during 2009 to lift the visibility of NITheP in the community and to establish a national network. This was done by establishing a strong corporative identity, the distribution of promotional material and presentations at more than 50% of the country's tertiary institutions. A very successful associate programme has led to the appointment of a network of more than 30 individual and institutional associates. A number of programmes to support associates and students were also launched in 2009. These include an impressive bursary programme (74 students), high profile visits, workshops, internships and several outreach activities.

Overall 2009 was a year of rapid growth for NITheP. The next phase is to consolidate this growth and use the foundation laid in 2009 for the systematic and structured growth of NITheP also beyond South Africa's borders.

Frederik Scholtz

Introduction

THE STRATEGY SET OUT in the document: "NITheP, a National Platform for the Development of Theoretical Physics, Strategy and Business Plan 2007/08-2010/11" was adopted by DST and NRF and implemented in 2008.

The chosen model is that of a geographically distributed institute with headquarters at the Stellenbosch Institute for Advanced Studies (STIAS), and regional nodes at the University of Witwatersrand (WITS) and the University of KwaZulu-Natal (UKZN). Stellenbosch University (SU) will act as the host institution.

The original proposal envisaged a governance and legal framework similar to those of National Facilities within the NRF. The plan therefore was narrowly aligned to the core missions and strategies of the NRF as related to National Facilities. For several practical and strategic reasons the decision was made to adopt a governance system based on the national centres of excellence (CoE) with SU acting as the host organisation. It should, however, be noted that 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 to a particular institute and to develop an independent identity.

NITheP should therefore be seen as an emerging national resource (platform) with significant national and global impact requiring long term and extended support. This extended support is best provided currently through the CoE system and is subject to the notarisation of binding contracts between the granter, the NRF, and the grantee, the host institution of the NITheP hub, SU.

The interaction between the hub and nodes situated at WITS and UKZN, is governed by a consortium agreement between the host institution of the hub (SU) and the host institutions of the nodes (WITS and UKZN).

The NITheP Mandate and Strategy

Vision

THE NATIONAL INSTITUTE of Theoretical Physics leads and coordinates research programmes and fosters education in Theoretical Physics which allows South Africa to play its rightful international role in a truly fundamental scientific field.

Mission

To provide a stimulating national and African user facility for Theoretical Physics linking South Africa and the continent to an international family of Institutes of Theoretical Physics and similar institutions where its programmes are recognised for their excellence in research and innovative role in the education of Theoretical Physics, especially in underrepresented communities.

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 in line with the NEPAD vision;
- To provide a source of expertise that 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 CoE, makes provision for the establishment of a Management Committee, a Board of Directors and a Scientific Advisory Committee. The appointment of these three core governance committee structures were completed in 2009 and are as follow:

Board Members:

- Prof A van Zyl (Vice Rector Research, Stellenbosch University)
- Dr A Kaniki (National Research Foundation)
- Prof J Rodrigues (Deputy Director, University of Witwatersrand)
- Prof F Petruccione (Deputy Director, University of KwaZulu-Natal)
- Prof N Chetty (University of Pretoria)
- Prof P Ngoepe (University of Limpopo)
- Prof R de Mello Koch (University of Witwatersrand)
- Prof H B Geyer (Stellenbosch Institute of Advanced Study)
- Prof T Hillie (Council for Scientific and Industrial Research)
- Prof F G Scholtz (Director)
- DST Representative

Scientific Advisory Committee:

- Prof P Knight (Imperial College)
- Prof S J Gates (University of Maryland)
- Prof J Govaerts (Catholic University Louvain)

Management Committee:

- Prof F G Scholtz (Director, Chair)
- Prof J Rodrigues (Deputy Director, WITS)
- Prof F Petruccione (Deputy Director, UKZN)
- Prof R de Mello Koch (Elected associate representative)
- Ms M Louw (Secretary)

Staff

The staff profile of NITheP as on 31 December 2009 is shown in Table 1. All positions are five year contract positions.

Table 1: Staff profile on 31 December 2009

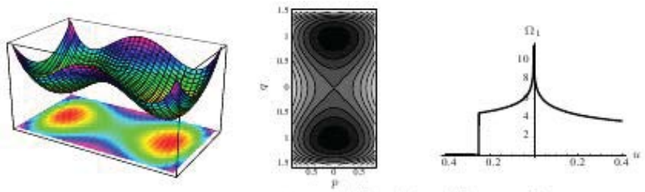
Position	Node	Number
Director	SU	1
Deputy Director	WITS/UKZN	2
Chief Researcher	SU	1
Senior Researcher	SU/WITS	2
Researcher	SU/UKZN	2
Senior Admin. Officer	SU/WITS	2 (one part time)
Secretary	UKZN	1
Total		**11**

Post doctoral fellows

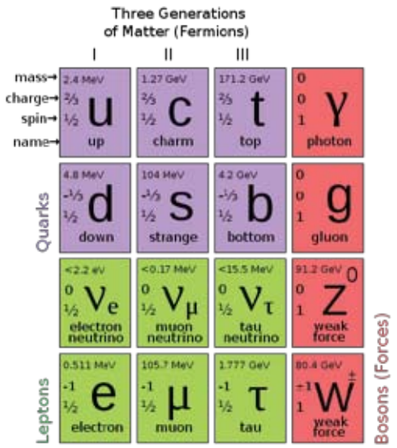
The post doctoral fellows per node in 2009 are shown in Table 2. All positions are two year contract positions.

Table 2: Post doctoral fellows

Node	Number
SU	3
WITS	1
UKZN	1
Total	**5**



Plot of the Hamiltonian function $H(p;q) = \frac{1}{2}p^2 + \frac{1}{4}q^4 - \frac{1}{2}q^2$, $p, q \in \mathbb{R}$ as a three-dimensional plot (left). The function has three stationary points (two minima and one saddle point) which correspond to topology changes of the contours in the middle plot. The corresponding density of states $\Omega_1(u)$ is nonanalytic at the energy $u = -1/4$ of the minima and at the energy $u = 0$ of the saddle point of H at which the contours also change their topology (right).



Service Rendering

Marketing

FOR AN INSTITUTE such as NITheP that has to function as a user facility it is important to maintain a high level of visibility within the community.

For this purpose promotional material was developed and distributed. In particular a small exhibition was held at the annual conference of the South African Institute of Physics in July 2009. In addition promotional presentations were given at the following tertiary institutions: Universities of Cape Town, Western Cape, Stellenbosch, Bloemfontein, Pretoria, Johannesburg, Witwatersrand, Unisa, North West, Venda and Limpopo. The remaining institutions will be visited in 2010.

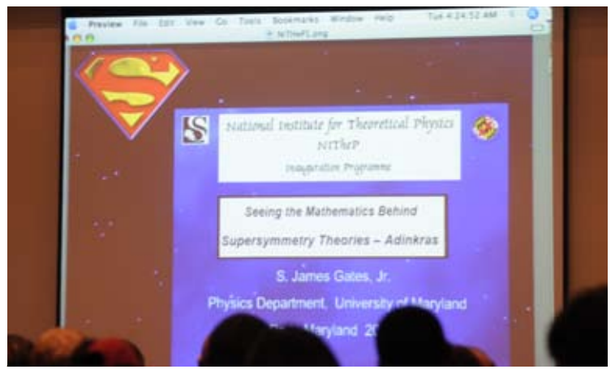
Networking

To achieve the strategic goals of NITheP it is crucial to develop a national network throughout South Africa. In 2009 the associate programme of NITheP was launched very successfully. Currently NITheP has a network of 31 individual associates and three institutional associates (see Table 3). Associates have access to the NITheP visitor, mobility and workshop programmes through a request for proposal (RFP) system that was also developed in 2009.

Table 3: Associates on 31 December 2009

INDIVIDUAL ASSOCIATES	
Dr Alessandro Sergi	University of KwaZulu-Natal
Prof Bruce A Bassett	University of Cape Town
Dr Bruce Bartlett	Stellenbosch University
Prof Cesareo A Dominguez	University of Cape Town
Prof Jacek Banasiak	University of KwaZulu-Natal
Prof Jean Cleymans	University of Cape Town
Dr Mantile Lekala	University of South Africa
Prof Oluwole Daniel Makinde	Cape Peninsula University of Technology
Dr Rocco Duvenhage	University of Pretoria
Prof Steven Karataglidis	Rhodes University

INDIVIDUAL ASSOCIATES	
Dr Kevin Goldstein	University of Witwatersrand
Prof Arthur Every	University of Witwatersrand
Prof W Dieter Heiss	Stellenbosch University
Dr Dimitri Polyakov	University of Witwatersrand
Prof Kristian Müller-Nedebock	Stellenbosch University
Prof Martin Porrmann	University of KwaZulu-Natal
Prof Igor Barashenkov	University of Cape Town
Prof Sunil Maharaj	University of KwaZulu-Natal
Prof Robert de Mello Koch	University of Witwatersrand
Prof Kavilan Moodley	University of KwaZulu-Natal
Prof Thomas Konrad	University of KwaZulu-Natal
Prof Hans Eggers	Stellenbosch University
Prof Nithaya Chetty	University of Pretoria
Prof Daniel Joubert	University of Witwatersrand
Prof Raoul Viollier	University of Cape Town
Prof Moritz Braun (1 Jan 2010)	University of South Africa
Dr Azwinndini Muronga	University of Cape Town
Dr Gary Tupper (1 Jan 2010)	University of Cape Town
Dr Jeff Murugan	University of Cape Town
Prof Marius Potgieter	University of North West
Prof Andre Peshier (1 Jan 2010)	University of Cape Town
INSTITUTIONAL ASSOCIATES	
Cosmology Group	University of Cape Town
Centre for Theoretical Physics	University of Cape Town
Alice Group	University of Cape Town



Request for Proposal (RFP) System

A competitive RFP call was initiated in 2009 to implement the mobility, visitor, workshops and research programmes. Under this initiative associates were invited in August 2009 to submit proposals for 2010 under these programmes. These proposals were screened by the management committee. Nine workshops and two longer term visitors were selected for support in 2010.

Mobility

In 2009 support was provided for the first time to associates to travel between higher education institutions, and in particular to the three nodes situated at the Universities of Stellenbosch, Witwatersrand and KwaZulu-Natal. Support was given for a period of up to two months per year and included accommodation, subsistence and transport costs (in cases that were strongly motivated and justified).

Visitors

A vibrant visitor programme is vital for the success of NITheP. Under NITheP's visitor programme staff and associates can apply for support of longer term visiting collaborators, typically for a period of one to six months.

This support covers accommodation and subsistence, but only in exceptional cases travel cost. In addition the possibility exists for foreign researchers to apply for support under this programme.

In 2009 the visitor programme was very active with a considerable number of often very high profile visitors that passed through NITheP nodes and/or associate institutions (see table 4).

Table 4: NITheP visitors in 2009

Visitor	Affiliation	Node
Prof J Feinberg	University of Haifa, Isreal	SU
Prof B de Wit	University of Utrecht, Netherlands	SU
Dr J H. Bardarson	Cornell University, USA	SU
Dr S Surya	Raman Research Institute, Bangalore, India	SU
Prof B Giraud	Institut Physique Théorique, Saclay, France	SU
Prof G Goldstein	Tufts University, USA	SU
Prof V Rivasseau	TPL Orsay, France	SU
Prof M Bianchi	NFNL Rome, Italy	SU/WITS
Prof R Alicki	University of Gdansk, Poland	UKZN
Prof R Maartens	University of Portsmouth, UK	UKZN
Dr F Caruso	Imperial College, UK	UKZN
Prof C Singh	Central India Research Institute, India	UKZN
Prof J McKenzie	University of Alabama, USA	UKZN
Prof J Dey	Kolkata University, India	UKZN
Prof N Dadhich	InterUniversity Centre for Astronomy and Astrophysics, India	UKZN
Prof A Barchielli	University of Milan, Italy	UKZN
Dr C Dappiaggi	Hamburg University, Germany	UKZN
Prof A Ekert	University of Oxford, UK	UKZN
Prof M Oluseyi	Florida Institute of Technology, USA	UKZN
Dr T Busch	University College Cork, Ireland	UKZN
Dr F Mintert	University of Freiburg, Germany	UKZN
Dr Hermann Uys	National Institute of Standards, USA	UKZN
Dr S Barway	South African Astronomical Observatory, South Africa	UKZN
Prof B Sanders	University of Calgary, USA	UKZN
Prof S Nagamachi	University of Tokushima, Japan	UKZN
Prof A Molina	University of Barcelona, Spain	UKZN
Prof Frank Verheest	University of Gent, Belgium	UKZN
Dr A Braggio	University of Genova, Italy	UKZN
Prof K Chakraborty	Ragon Institute of MGH, MIT & Harvard, USA	UKZN
Dr Martin Landriau	Technical University of Denmark, Denmark	UKZN
Prof S R Valluri	University of Western Ontario, Canada	UKZN
Prof Nimish Sane	University of Maryland, USA	UKZN
Dr SK Ramgoolam	University of London, UK	WITS
Prof A Jevicki	Brown University, USA	WITS
Prof A Dabholkar	CNRS/University of Paris, France	WITS
Prof S Sheik-Jabbari	IPM, Tehran & ICTP, Iran	WITS
Prof M Schnabl	Institute of Physics of the ASCR, Czech Republic	WITS

Bursaries

A total of 74 bursaries was awarded in 2009. The total actual amount paid out was R3 118 750. This was indeed a major achievement for NITheP to launch and implement a successful bursary programme within a year of its inception. The bursaries awarded are summarised in Table 5.

Table 5: Bursaries awarded in 2009

Level	Number	Amount allocated per bursary	Budgeted cost
Hons.	28	R 35 000	R 980 000
M.Sc.	27	R 45 000	R 1 215 000
Ph.D.	19	R 60 000	R 1 140 000
Total	**74**		**R 3 335 000**

The bursary holders per institution and degree are shown in Table 6. In 2009 there were still several, especially previously disadvantaged institutions, that did not benefit from this programme. The data for 2010 indicates a change in this trend, probably due the marketing of NITheP programmes at these institutions.

Table 6: Bursary holders per institution

Institution	Hons.	M.Sc.	Ph.D.	Total
Stellenbosch	4	5	4	13
Cape Town	9	12	6	27
Witwatersrand	2	5	3	10
KwaZulu-Natal	8	2	3	13
Western Cape			2	2
Johannesburg		1		1
North-West	1			1
Pretoria	2	1	1	4
Free State	1			1
Rhodes	1	1		2
Total	**28**	**27**	**19**	**74**

Despite the lack of participation by previously disadvantaged institutions, a substantial percentage of the NITheP bursary holders were from previously disadvantaged groupings as shown in Table 7. There is, however, still severe gender inequality.

Table 7: Bursary holders by race and gender

Degree	White		Black		Coloured		Indian	
	Male	Female	Male	Female	Male	Female	Male	Female
Hons.	18	3	5	1			2	1
M.Sc.	10	2	11	1	1		2	
Ph.D.	7		7	1	1			1
Total	**35**	**5**	**23**	**3**	**2**	**0**	**4**	**2**

Internships

In 2009 an internship programme for students was launched. This programme has two components.

The first component makes it possible for students at Honours or M.Sc. level to join NITheP workshops and complete a small research project, typically on the scale of an honours project, under the supervision of one of the invited workshop participants. The supervisor and an independent local examiner, normally at the home institution of the student, also evaluate this project. The student can use the mark generated in this way for credits at his home institution, if the home institution approves.

The second component makes provision for students, mainly at the honours level, to join NITheP staff or associates during recess periods to complete a research project. Once again these projects are evaluated by the supervisor and an independent examiner, again normally at the student's home institution, and can be used for credits if the home institution approves.

In this way NITheP provides a training opportunity for students, often under the guidance of a leading researcher, while also alleviating the pressure of project supervision on departments. Typically NITheP supports students who pass the screening process for this programme in terms of travel cost, accommodation and subsistence. Table 8 summarises the statistics of this programme for 2009.

Table 8: Internship statistics for 2009

Institution	Students	Students earning credits
Pretoria	1	0
Johannesburg	1	0
Cape Town	2	0
Stellenbosch	4	0
Venda	3	3
Total	**11**	**3**

Travel grants

Apart from the bursary and internship programmes, NITheP also offers support to students for travelling to international and national conferences and schools. Support is only given if the student gives a presentation or poster or, in the case of schools, if attendance is well motivated by the supervisor. Support is limited to R15 000 for international conferences and R5 000 for national conferences. Table 9 gives the statistics for travel grants allocated in 2009.

Table 9: Travel grants allocated in 2009

Institution	International	National
Cape Town	2	2
Stellenbosch	1	
Total	**3**	**2**

Outreach, community service and the popularisation of science

Part of NITheP's outreach is the popularisation of Science. NITheP presented or sponsored three such high level events in 2009:

- *Beauty and the Beast — a Dating Game with a Difference*, Prof Walter Kutchera, 1 April 2009.
- *Aeons before the Big Bang*, Prof Roger Penrose, 11 August 2009.
- *The Cosmic Landscape — the Myth of Intelligent Design*, Prof Leonard Susskind, 27 August 2009.

In 2009 NITheP and the Stellenbosch University Physics Department also co-sponsored an initiative to promote science awareness to the broader public through the fabrication of three dimensional glasses that were sold with Stellenbosch University's community service magazine *Akkerjol*. These glasses show a NITheP and Stellenbosch University Physics Department advertisement in three dimensions. The contract for the fabrication of the glasses was given to a charity organisation employing physically handicapped persons.

Research and Training

Research focus

NITheP has clear research focuses that are derived from existing research capacity at the hub and nodes and strategic priorities. With the appointment of associates, the research focus will be extended to include existing research capacity outside the hub and node. 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)

Workshops, schools and short research programmes

NITheP's workshop and short research programmes make provision for the support of workshops and research programmes organised at NITheP nodes or the home institution of an associate. Typically workshops span three to five days and research programmes a period of one to three months. Often these activities may also be combined.

NITheP's flagship training programme, the Chris Engelbrecht Summer School series, runs annually. This is a proposal driven programme in which any member of the Theoretical Physics, or broader Physics community, may propose a topic, speakers and organising committee for the school.

In 2009 the following schools, workshops and short research programmes were held:

- The 20th Chris Engelbrecht Summer School: *Nuclei and Nucleonic systems*. This school took place from 19 to 28 January 2009 at the Wallenberg Research Centre in Stellenbosch. The invited speakers were Profs B Barret (Arizona), J Dobaczewski (Warsaw, Jyväskylä), M Hjorth-Jensen (Oslo), W Nazarewicz (Tennessee, Warsaw), K Langanke (GSI), T Nakatsukasa (Riken Nishina Center) and A Schwenk (Triumf). The school was attended by 55 participants of which 30 were students.

- International Workshop on *Macroscopic Quantum Systems* by Prof R Alicki from University of Gdansk, Poland. This workshop was organised by Prof F Petruccione. It was held at the School of Physics, Seminar Room at UKZN from 26-30 January 2009.
- International Workshop on *Quantum trajectories, spectra, squeezing* by Prof A Barchielli from University of Milan, Italy. This workshop was organised by Prof F Petruccione. It was held at the School of Physics, Seminar Room at UKZN from 2 to 6 March 2009.
- International Workshop on *Path Integrals, Coherent States and Non Commutative Geometry*. This workshop was held at the Wallenberg Research Centre in Stellenbosch from 4 to 22 May 2009. It was attended by 10 senior researchers of which one was from South Africa and two from African countries, two African post doctoral fellows associated to NITheP and three students from Stellenbosch University. This workshop led to two publications in international journals during 2009.
- International Workshop on *Physico-Chemical Concepts in adaptive Immunity* by Prof Arup K Chakraborty from Ragon Institute of MGH, MIT & Harvard. This workshop was organised by Prof F Petruccione. It was held at the School of Physics, Seminar Room at UKZN from 14 to 16 July 2009.It was attended by various staff members across all four campuses including the nearest Institution e.g. Mangosuthu University of Technology.
- International workshop on *Non-linear Effects in Quantum Electrodynamics*. This workshop, which was organised by Prof C Domingues from UCT, was held at the Wallenberg Research Centre from 14 to 25 September 2009. The workshop was attended by seven senior researchers of which two were from South Africa and one student from Stellenbosch University.
- International Workshop on *New Renormalisation Techniques in Condensed Matter Systems*. This workshop took place at the Wallenberg Research Centre in Stellenbosch from 31 August to 11 September 2009. The workshop was attended by 19 senior researchers. Of these, 16 were international participants while three were South African.

  The international group consisted of nine invited speakers, who are faculty members at various European universities, as well as doctoral students and post-doctoral fellows accompanying the invited speakers. The three South African participants are affiliated with the

University of Stellenbosch (one) and NITheP (two). Apart from the 'full time' participants, several members of staff at the University of Stellenbosch and NITheP also attended some of the lectures.

Eight students also took part in the student programme, which entailed completing short research projects under the supervision of the senior researchers. They were all in either their final (fourth) year of undergraduate study, or in their first year of graduate study (Masters degree). Of these four students were from Stellenbosch University, two from the University of Cape Town and one each from the University of Johannesburg and the University of Pretoria.

- International Workshop on *Long-range Interactions in Classical and Quantum Physics*. This workshop was held at the Wallenberg Research Centre in Stellenbosch from 17 to 27 November 2009. It was attended by 15 senior researchers of whom four are affiliated to NITheP and Stellenbosch University. In addition two NITheP post doctoral fellows and two students from Stellenbosch University took part in the workshop.
- International workshop: *Joburg Workshop on String Theory, Gravity and Cosmology*. This workshop was held at the Gauteng node, University of the Witwatersrand, from 30 November to 4 December 2009. It was attended by 14 senior researchers and 34 students. This workshop has led to a new collaboration between South African and Iranian scientists

Teaching and post graduate supervision

The mandate given to NITheP clearly states an involvement of NITheP staff members in teaching and post graduate supervision. Table 10 shows the 2009 involvement of NITheP staff in teaching, while Table 11 displays the number of Honours (projects), M.Sc. and Ph.D. students under the supervision of NITheP staff.

Table 10: Teaching hours by NITheP staff in 2009

Node	Undergraduate	Hons.	Advanced (M.Sc./Ph.D.)
SU		126	84
WITS	65	55	
UKZN		72	
Total	**65**	**253**	**84**

Table 11: Postgraduate supervision in 2009

Node	Hons. (projects)	M.Sc.	Ph.D.
SU	0	4	4
WITS	1	1	1
UKZN	6	11	7
Total	**7**	**16**	**12**

The number of M.Sc. and Ph.D. students under the supervision of NITheP staff who graduated in 2009 is displayed in Table 12. Clearly this number is still limited as the student intake of NITheP effectively only started in 2009 with the appointment of researchers, while the minimum typical time span for a Masters or Ph.D. degree is two and three years respectively.

The students who graduated were under the supervision of staff members, the director and deputy directors who were already involved in post graduate supervision in their respective Physics departments before moving to NITheP.

Table 12: M.Sc. and Ph.D. students who graduated in 2009

Node	Number
SU	3
WITS	1
UKZN	1
Total	**5**

Publications

1. *Diffusion approximation of stochastic master equations with jumps*, Pellegrini C, Petruccione F, JOURNAL OF MATHEMATICAL PHYSICS 50 (12): 122101 (2009).
2. *GROUND RING OF alpha-SYMMETRIES AND SEQUENCE OF RNS STRING THEORIES*, Polyakov D, INTERNATIONAL JOURNAL OF MODERN PHYSICS A 24 (31) 5897-5924 (2009).
3. Thermodynamic *consistency of energy and virial routes: An exact proof within the linearized Debye-Huckel theory*, Santos A, Fantoni R, Giacometti A, JOURNAL OF CHEMICAL PHYSICS 131 (18) 181105 (2009).
4. *Formulation, interpretation and application of non-commutative quantum mechanics*, Scholtz FG, Gouba L, Hafver A, Rohwer CM, JOURNAL OF PHYSICS A-MATHEMATICAL AND THEORETICAL, 42 (17): 175303 (2009).
5. *The N=1 supersymmetric Landau problem and its supersymmetric Landau level projections: the N=1 supersymmetric Moyal-Voros superplane*, Ben Geloun J, Govaerts J, Scholtz FG, JOURNAL OF PHYSICS A-MATHEMATICAL AND THEORETICAL 42 (49): 495203 (2009).
6. *A NOTE ON MATRIX MODEL WITH IR CUTOFF AND AdS/CFT*, Dey TK, Mukherji S, Mukhopadhyay S, Sarkar S, INTERNATIONAL JOURNAL OF MODERN PHYSICS A 24 (28-29) 5235-5260 (2009).
7. *Non-Markovian dynamics of an interacting qubit pair coupled to two independent bosonic baths*, Sinayskiy I, Ferraro E, Napoli A, Messina A, Petruccione F, JOURNAL OF PHYSICS A-MATHEMATICAL AND THEORETICAL 42 (48): 485301 (2009).
8. *Finite-temperature fidelity-metric approach to the Lipkin-Meshkov-Glick model*, Scherer DD, Muller CA, Kastner M, JOURNAL OF PHYSICS A-MATHEMATICAL AND THEORETICAL 42 (46): 465304 (2009).
9. *Bound state energies and phase shifts of a non-commutative well*, Thom JD, Scholtz FG, JOURNAL OF PHYSICS A-MATHEMATICAL AND THEORETICAL 42 (44): 445301 (2009).

10. *Asymptotic iteration method for spheroidal harmonics of higher-dimensional Kerr-(A)dS black holes*, Cho HT, Cornell AS, Doukas J, Naylor W, PHYSICAL REVIEW D 80 (6): 064022 (2009).

11. *Correlators of operators with a large R-charge*, Koch RD, Dey TK, Ives N, Stephanou M, JOURNAL OF HIGH ENERGY PHYSICS 8: 083 (2009).

12. *Non-Markovian quantum repeated interactions and measurements,* Pellegrini C, Petruccione F, JOURNAL OF PHYSICS A-MATHEMATICAL AND THEORETICAL 42 (42): 425304 (2009).

13. *Graviton emission from simply rotating Kerr-de Sitter black holes: Transverse traceless tensor graviton modes*, Doukas J, Cho HT, Cornell AS, Naylor W, PHYSICAL REVIEW D 80 (4): 045021 (2009).

14. Gapped state of a carbon monolayer in periodic magnetic and electric fields, Snyman I, PHYSICAL REVIEW B 80 (5): 054303 (2009).

15. *Pygmy dipole resonance in nuclei*, Avdeenkov AV, Kamerdzhiev SP, PHYSICS OF ATOMIC NUCLEI 72 (8): 1332-1339 (2009).

16. *Kinetic energy and microcanonical nonanalyticities in finite and infinite systems*, Casetti L, Kastner M, Nerattini R, JOURNAL OF STATISTICAL MECHANICS-THEORY AND EXPERIMENT: 07036 (2009).

17. *Ladder operators and coherent states for continuous spectra*, Ben Geloun J, Klauder JR, JOURNAL OF PHYSICS A-MATHEMATICAL AND THEORETICAL 42 (37): 375209 (2009).

18. *Harmonic oscillator in a background magnetic field in noncommutative quantum phase-space*, Ben Geloun J, Gangopadhyay S, Scholtz FG, EPL 86 (5): 51001 (2009).

19. *Poisson and Diffusion Approximation of Stochastic Master Equations with Control*, Pellegrini C, ANNALES HENRI POINCARE 10 (5): 995-1025 (2009).

20. *Numerical and analytical approach to the quantum dynamics of two coupled spins in bosonic baths*, Sergi A, Sinayskiy I, Petruccione F, PHYSICAL REVIEW A 80 (1): 012108 (2009).

21. *New classes of nonlinear vector coherent states of generalized spin-orbit Hamiltonians*, Ben Geloun J, Hounkonnou MN, JOURNAL OF PHYSICS A-MATHEMATICAL AND THEORETICAL 42 (29): 295202 (2009).

22. *Microcanonical Phase Diagrams of Short-Range Ferromagnets*, Kastner M, Pleimling M, PHYSICAL REVIEW LETTERS 102 (24): 240604 (2009).

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28. *Anomalies, horizons and Hawking radiation*, Gangopadhyay S, EPL 85 (1): 10004 (2009).

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Statistics of the publications are shown in Table 13.

Table 13: 2009 publication statistics

Node	Publications
SU	18
WITS	8
UKZN	9
Total	**35**

2009 Financial Statements

The statement of income and expenditure, cash flow and balance sheet for 2009 are shown below. It is important to note that NITheP's financial year, which runs from 1 January to 31 December, is out of phase with that of its funders, the National Research Foundation and Department of Science and Technology, which runs from 1 April to 31 March. The practical implication of this is that NITheP receives its grants only in June and November of the financial year. For this reason it is important that NITheP ensures a reserve equal to the bursary values (to be paid in the first semester) plus 50% of salaries and running costs is available at the end of the financial year on 31 December. This reserve is reflected in the statements below.

Balance Sheet at 31 December 2009

	2009 R	2008 R
ASSETS		
NON-CURRENT ASSETS	112,701.58	130,929.81
Computers and office equipment	83,062.55	112,296.43
Intangible assets	29,639.03	18,633.38
CURRENT ASSETS	9,352,565.98	579,306.76
Other receivables	314,605.79	578,306.76
Petty cash	1,000.00	1,000.00
Stellenbosch University	9,036,960.19	-
TOTAL ASSETS	**9,465,267.56**	**710,236.57**
EQUITY AND LIABILITIES		
CAPITAL AND RESERVES	9,385,962.43	(1,068,688.74)
Accumulated funds	9,385,962.43	(1,068,688.74)
CURRENT LIABILITIES	79,305.13	1,778,925.31
Trade and other creditors	79,305.13	89,140.40
Stellenbosch University	-	1,689,784.91
TOTAL FUNDS AND LIABILITIES	**9,465,267.56**	**710,236.57**

Income Statement for the year ended 31 December 2009

	2009 R	2008 R
INCOME	18,555,959.84	1,758,151.74
National Research Foundation grant	18,520,000.00	1,617,645.00
Interest income	-	13,504.43
Contribution from Stellenbosch University	34,498.90	127,002.31
Exchange rate gain	1,460.94	-
EXPENDITURE	8,101,308.67	4,757,301.16
Advertisements	15,396.36	6,510.87
Affiliation and registration	90,803.75	25,815.00
Amortisation of intangible assets	8,154.09	2,101.94
Bursaries - post graduate	3,346,950.00	2,064,492.15
Computer materials and software	2,940.86	1,503.29
Consultation	41,040.00	7,060.00
Consumables	17,495.46	1,463.33
Contribution to Summer School Theoretical Physics	3,820.00	15,280.00
Contribution to Department of Physics: 3D project	5,876.21	1,667.45
Copying and stationery	34,099.86	8,068.49
Course expenditure	-	236,255.80
Depreciation	44,023.88	10,812.99
Entertainment	170,218.01	158,282.30
Exchange rate loss	-	84.56
Furniture and equipment less than R2 000	1,545.17	2,881.69
Postage, telephone and fax	75,677.23	40,894.87
Rent paid for facilities	180,000.00	80,000.00
Repairs and maintenance	5,059.38	18,634.08
Salaries	2,619,413.45	880,891.75
Small capital works: not capitalised	-	35,642.60
Sundry expenses	34,437.49	154,124.85
Travel and accommodation	1,385,859.42	1,004,833.15
SURPLUS/(SHORTAGE) FOR THE YEAR BEFORE TRANSFERS	**10,454,651.17**	**(2,999,149.42)**
TRANSFERS BETWEEN NODES	-	-
Transfer to KwaZulu-Natal	(760,405.80)	(486,235.25)
Transfer to Gauteng	(617,125.00)	(398,504.60)
Transfers from Stellenbosch	1,377,530.80	884,739.85
SURPLUS/(SHORTAGE) FOR THE YEAR	**10,454,651.17**	**(2,999,149.42)**

Cash Flow Statement for the year ended 31 December 2009

ASSETS	2009 R	2008 R
CASH FLOW FROM OPERATING ACTIVITIES		
Surplus/(shortage) for the year	10,454,651.17	(2,999,149.42)
Adjustment for:		
Interest received	-	(13,504.43)
Depreciation and amortisation	52,177.97	12,914.93
Operating profit before working capital adjustments	10,506,829.14	(2,999,738.92)
Working capital adjustments	253,865.70	(723,749.90)
Decrease/(increase) in trade and other receivables	263,700.97	(274,042.83)
Decrease in trade and other payables	(9,835.27)	(449,707.07)
Cash utilised in operations	10,760,694.84	(3,723,488.82)
Interest received	-	13,504.43
NET CASH FLOW FROM OPERATING ACTIVITIES	10,760,694.84	3,710,984.39
CASH FLOW FROM INVESTMENT ACTIVITIES		
Computers and office equipment purchased	(14,790.00)	(123,109.42)
Intangible assets purchased	(19,159.74)	(20,735.32)
Increase in amount owed to/(by) Stellenbosch University	(10,726,745.10)	3,854,829.13
NET CASH FLOW FROM INVESTMENT ACTIVITIES	(10,760,694.84)	3,710,984.39
NET INCREASE IN CASH AND CASH EQUIVALENTS	-	1,000.00
CASH AND CASH EQUIVALENTS AT BEGINNING OF YEAR	1,000.00	-
CASH AND CASH EQUIVALENTS AT END OF YEAR	1,000.00	1,000.00