



Annual Report
1 January-31 December
2008

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1. Introduction

After several years of negotiation between the Department of Science and Technology, National Research Foundation and the working committee of the Organization for Theoretical Physics, under leadership of Prof H B Geyer, the National Institute for Theoretical Physics (NITheP) was formally established in 2008. The model that was decided on 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 official opening took place on 13 May 2008 and the opening address was delivered by the minister of Science and Technology, Mr Mosibudi Mangena. This was a high profile event featuring eminent scientist such as Profs Stephen Hawking, David Gross, Michael Berry, Jacek Dobaczewski, Neil Turok and George Smoot.

Although NITheP was officially opened relatively early in 2008, it took several months to complete the appointment process which began with the advertisement of the position of director, five research positions and nine post doctoral positions early in 2008. Subsequently the institute only became operational in August 2008 when Prof F G Scholtz took up the position as first director and Profs J Rodrigues and F Petruccione as deputy directors at WITS and UKZN, respectively. Since then the outstanding positions have been filled and the institute should be fully staffed by early 2009 (see section 4).

2. Management and governance

During 2008 NITheP was managed by an interim management committee. This committee consisted of Prof Krish Baruth-Ram who acted as chairman in his capacity as acting vice president national facilities of the NRF. NITheP was represented by Prof H B Geyer (interim director) and later replaced by Prof F G Scholtz, Profs J Rodrigues and F Petruccione. The department of Science and Technology was represented by Dr D Adams and Mr B Archary.

One of the tasks of the interim management committee was the drafting of the governance documents and memoranda of agreement (MoA) between the hosting institution, SU, the NRF and the two other partaking institutions, namely, WITS and UKZN. The drafting of the governance document was completed in October 2008 and the document was approved by the NRF management in December 2008. This document, together with a draft of the MoA between SU and the NRF, was submitted for approval to Stellenbosch University. The revised documents were sent to the NRF in January 2009 and approval is awaited. Once these documents have been approved the MoA's between the host institution and two other partaking institutions as well as the service level agreement (SLA) will be put in place.

The governance document makes provision for the establishment of a board of directors and a scientific advisory committee. These bodies have not yet been established by the end of 2008 and this will be a matter of high priority in 2009.

3. Corporative identity

The establishment of a corporative identity for NITheP was a matter of urgency. Subsequently a logo, displayed on the front page of this report, was designed in accordance with the guidelines for national facilities. This logo was approved by the interim management committee. Letterheads and business cards carrying this logo were also designed for the three nodes and submitted for approval to the interim management committee. These will be put to use at the beginning of 2009. A webpage was designed and registered under the academic domain. The web address is <http://www.nithec.ac.za>.

4. Staff

The position of director, five research positions and nine post doctoral positions were advertised at the beginning of 2008. A search committee consisting of the appointment committee of the Faculty of Science of SU as well as representatives from all the partaking institutes and the broader community was appointed to screen the candidates. The committee consisted of Profs D Rawlings (Dean SU Science Faculty and chairperson), R de Mello Koch (WITS), H B Geyer (NITheP interim director), B W Green (SU), S Maharaj (UKZN), P E Ngoepe (University of Limpopo), J P Rodrigues (NITheP deputy director WITS) and Drs A Fransman, C Steenkamp and S Jackson all standing members or representatives of standing members of the appointment committee of the SU Science Faculty.

The screening process was completed with interviews held on 25 April 2008 with all the candidates that were short listed for the research positions and the position of director. Since several of these positions were offered to foreign researchers it took some time before these persons could take up their positions. Two candidates will only take up their positions on 1 February 2009, while one candidate declined the offer leaving a research position at UKZN vacant. This position will be re advertised at the beginning of 2009.

In August 2008 the position of senior administrative officer at the Stellenbosch node was advertised. The appointment process followed the processes as described by the Department of Human Resources of Stellenbosch University. An appointment was made and the position was filled on 1 December 2008.

The current staff profile is summarized in table 1.

Table 1: Staff profile 2008

Name	Position	Term	Race	Gender	Citizenship	Node	Employment date
Prof F G Scholtz	Director	5 yrs	W	M	SA	SU	1 August 2008
Prof M Kastner	Chief researcher	5 yrs	W	M	German	SU	1 February 2009
Dr A Avdeenkov	Senior reseacher	5 yrs	W	M	Russian	SU	1 February 2009
Dr I Snyman	Researcher	5 yrs	W	M	SA	SU	1 October 2008
Ms M Louw	Senior Adimistrative officer	5 yrs	W	F	SA	SU	1 December 2008
Dr L Gouba	Post doctoral fellow	2 yrs	B	F	Burkinabe	SU	1 July 2008
Dr J BenGeloun	Post doctoral fellow	2 yrs	B	M	Senegal	SU	1 October 2008
Dr S Gangopadhyay	Post doctoral fellow	2 yrs	Indian	M	India	SU	1 November 2008
Prof J Rodrigues	Deputy director	5 yrs	W	M	SA	WITS	1 April 2008
Dr A Cornell	Senior researcher	5 yrs	W	M	Australian	WITS	1 October 2008
Dr J Raeymaekers	Post doctoral fellow	2 yrs	W	M	German	WITS	17 July 2008
Prof F Petruccione	Deputy director	5 yrs	W	M	Italian	UKZN	1 August 2008
Ms N Mncube	Secretary	Temp	B	F	SA	UKZN	1 December 2008

5. Programs

To meet the goals set out in the proposal and business plan for NITheP, as well as the requirements of the key performance areas, a number of programs were launched in 2008. These programs are discussed briefly under separate headings and their impact in terms of the key performance areas will be discussed in section 7.

a. Associate program

It is crucial that NITheP establishes a network of researchers nationally to promote research and training in Theoretical Physics outside of the hub and node structure. To establish this network an associate program was launched in 2008. This program aims at appointing both individual and institutional associates as far as possible at all South African tertiary institutions. Associates will be supported in terms of the NITheP visitor and workshop programs. An advertisement inviting applications for associate membership was sent to all tertiary institutions. Twelve applications for individual and three for institutional associate membership were received by 31 December 2008. These applications will be screened in February 2009 and the appointments finalized. The current applications still do not reflect the interest of all South African tertiary institutions and a concerted effort will be made in 2009 to attract applications from underrepresented tertiary institutions. It is also envisaged that associates will be represented on the NITheP management committee by a nominated member.

b. Bursary program

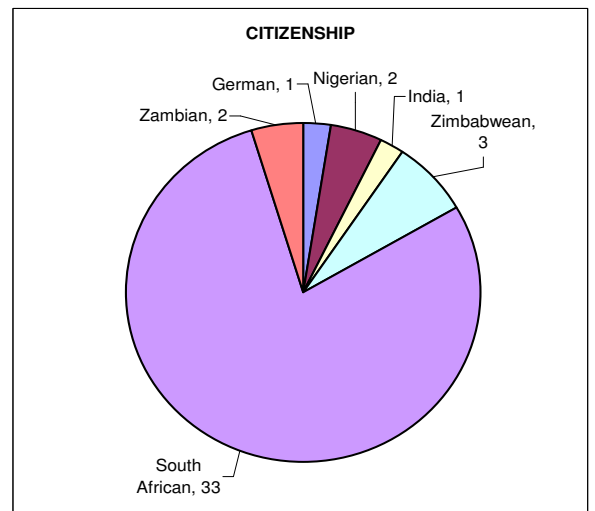
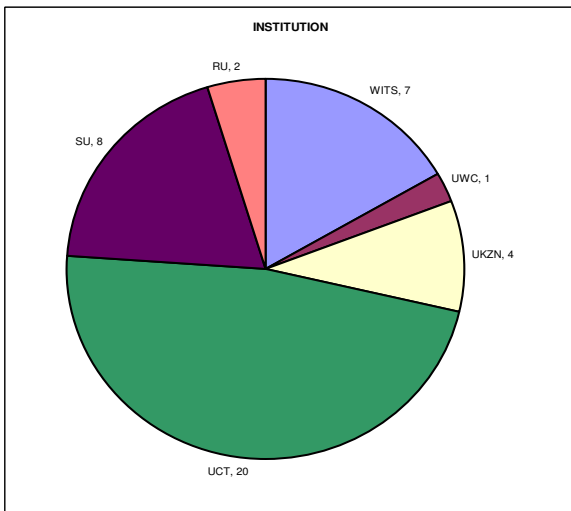
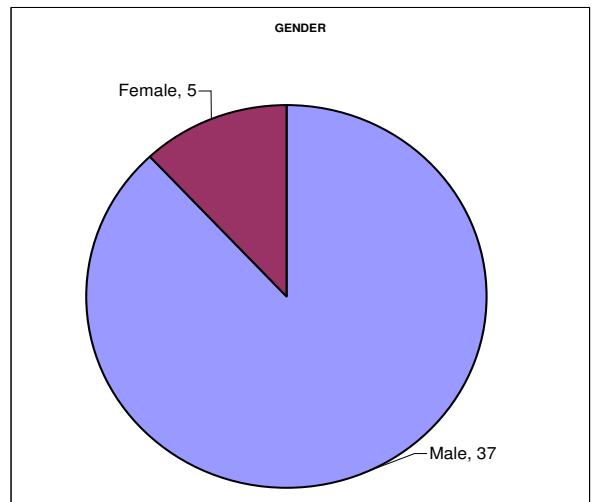
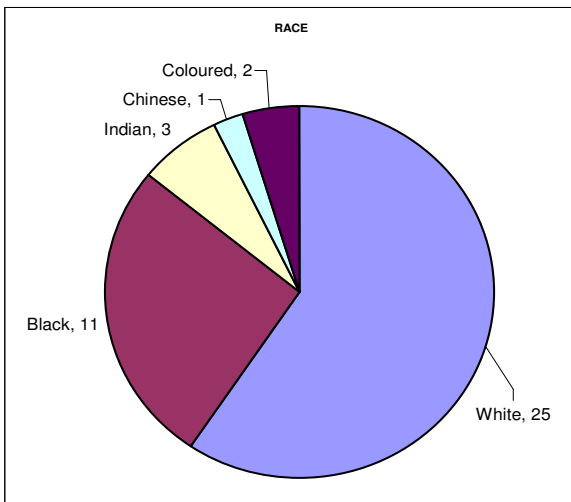
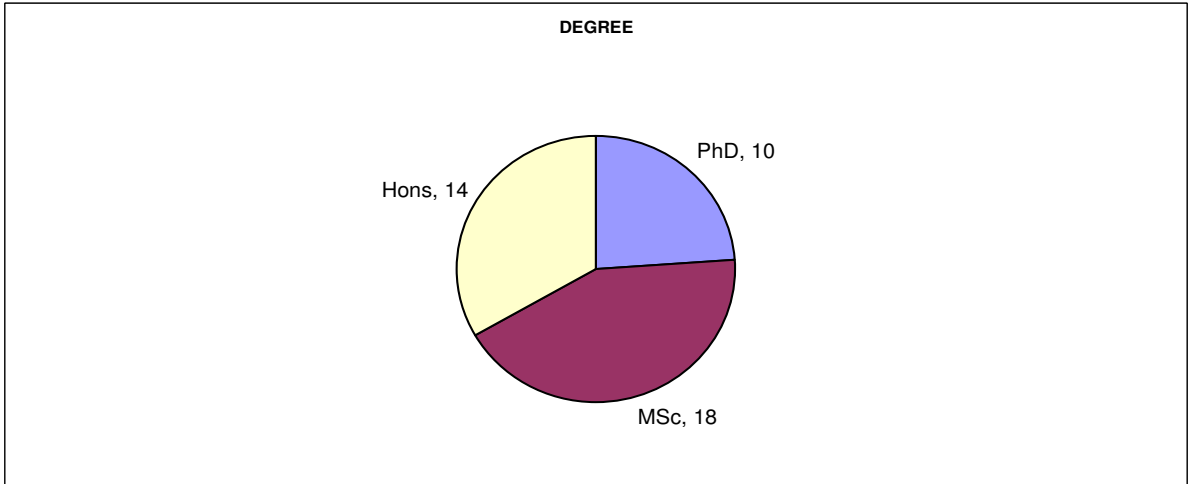
In 2008 NITheP started a bursary program that supports study in Theoretical Physics from the honours level upwards. Since not all tertiary institutions have an honours program in Theoretical Physics, bursaries on the honours level were also awarded for study in the broader field of physics. On the Masters and Ph. D. levels the criterion that study should be in Theoretical Physics was more stringently applied, but with the understanding that research proposals containing enough theoretical content will be considered favourably. Furthermore joined supervision with NITheP staff members was offered to institutions where Theoretical Physics is not a research focus. The values of bursaries and their duration are given in table 2.

Level	Value	Term
Honours	R35 000	1 yr full time
M.Sc.	R40 000	2 yrs full time, 3 yrs part time
Ph.D.	R60 000	3 yrs full time, 4 yrs part time

In cases where students already received DST or NRF related bursaries which were in value less than those of NITheP, a top up to the NITheP value was granted.

Essentially all applications received in 2008 were supported. A break down of the profile of the 2008 NITheP bursary holders is given in figure 1.

Figure 1: BURSARY PROFILE 2008



c. Visitor program

It is not only important to establish a national network of researchers, but indeed an international one. To achieve this an active visitor program is required. This program was launched in 2008 and a number of visitors were already supported under this program. A detailed breakdown is given in table 3.

Name	Affiliation	Period	Node
Prof B Chakraborty	S N Bose National Center for basic research, Kolkatta, India.	30 Oct-15 Nov	SU
Prof M Znojil	Ustav jaderne fyziky, Prague, Czech Republic.	14 Nov-3 Dec	SU
Dr J Brink	Caltech, USA	28 Sept-3 Oct	SU, UKZN
Prof J McKenzie		6 Mar-8 Apr	UKZN
Prof U Jaekel	Univ of applied Sciences, Koblenz, Gemany	8-14 Sept	UKZN
Prof S Chervon	Ulyanovok University	18 Jun-29 Aug	UKZN
Prof J Gates	Univ of Maryland, USA	11-20 May	UKZN, SU
Prof S Hawkings	Univ of Cambridge, UK	11-15 May	SU
Prof D Gross	Kavli ITP, Santa Barbara, US	11-15 May	SU
Prof J Dobacewski	Univ of Warsaw, Poland	11-15 May	SU
Prof G Smoot	Lawrence Berkley Laboratory, US	11-16 May	SU
Prof N Turok	Univ of Cambridge, UK	11-16 May	SU
Prof M Berry	Univ of Bristol, UK	11-15 May	SU
Dr D Burgarth	Univ of Oxford	17 Jan	UKZN
Mr M Molati	Univ of Witwatersrand	29 Feb	UKZN
Prof R Jimenez	ICE, Barcelona	14 Mar	UKZN
Prof S Knight	Imperial College, London	28 Mar	UKZN
Prof D Chruscinski	Nicolaus Copernicus University	17 Apr	UKZN
Dr P Cilliers	Hermanus Magnetic Observatory	09 May	UKZN
Prof J V Narlikar	Interuniversity Centre for Astronomy & Astrophysics	06 June	UKZN
Dr N Gohee	University of Cape Town	11 July	UKZN
Dr C Dion	Univ of Umea, Sweden	18 July	UKZN
Prof K Muller-Nedebock	Univ of Stellenbosch	08 Aug	UKZN
Prof S Mukherjee	Inter University Center for Astronomy and Astrophysics, Pune, India	28 Aug-17 Oct	UKZN
Dr G Pellicane	Univ of Messina, Italy	24 Oct	UKZN
Dr Y Hardy	Univ of Johannesburg	31 Oct	UKZN
Prof N K Dadhich	Inter University Center for Astronomy and Astrophysics, Pune, India	26 Nov	UKZN
Prof L Diosi	Hungarian Academy of Sciences, Budapest	2- 12 Dec	UKZN

d. Short research programs

A key element in stimulating research within and outside the NITheP hub and node structure is short research programs run on a basis similar to the Kavli institute in Santa Barbara and the International Center for Theoretical Physics in Trieste. Such programs are proposed by NITheP staff members and associates and will be supported on the basis of relevance to the South African Theoretical Physics community, quality of proposal and training opportunities for NITheP staff, faculty members of South African tertiary institutions and students. In 2008 no proposals could be supported due to the short operational time span of NITheP, but at least two short research programs are already in an advanced stage of planning for 2009.

e. Workshop program

An important training opportunity for South African researchers and students are workshops. Workshops have been part of the South African Theoretical Physics scene for many years, but such a program has now been formalized within the NITheP structure and NITheP staff, associates and members of the broader Theoretical Physics community can submit proposals for workshop. The criteria for support are similar to those of short research programs. Workshops held or supported in 2008 are summarized in table 4.

Topic	Period	Organiser/affiliation	Venue
Soft Condensed Matter and Physics of Biological Systems-- Perspectives and topics for S.A.	4-6 Feb	Dr K K Müller-Nedebock, SU	Wallenberg Center, STIAS
NITheP inaugural workshop	13 May	Prof H B Geyer, NITheP	Wallenberg Center, STIAS
New Horizons in Cosmology: Theoretical and Observational	14-16 May	Prof H B Geyer, NITheP Prof B Basset, UCT	Wallenberg Center, STIAS
African School on Electronic Structure Methods and Applications'	14-25 July	Prof D Joubert, WITS	AIMS
Applications of Gauge/Gravity duality	4-8 Dec	Dr J Muragan, UCT	Wallenberg Center, STIAS

f. Chris Engelbrecht summer school series

This is an old program of the Organization for Theoretical Physicists that was initiated by the late Prof Chris Engelbrecht in 1981. Since then it was funded from a NRF grant with grant holders Profs H B Geyer, F J W Hahne and F G Scholtz. From 2008 it falls under the auspices of NITheP, which also provides the funding. The first school organized and funded by NITheP was held from 23 Jan-1 Feb 2008. The title was 'Soft Condensed Matter and Biological Systems'. The school was organized by Dr K K Müller-Nedebock from Stellenbosch University and held at the Wallenberg Research Center, STIAS. The school was followed by a workshop already reported on in section 5e. Full details on this school are available on the NITheP website.

During 2008 members of the Theoretical Physics community were invited to submit proposals for the 2009 summer school. The topic decided upon was 'Nuclei and Nucleonic Systems' and the school will take place from 19-28 January 2009 at the Wallenberg Research Center, STIAS.

g. Teaching and post graduate supervision

The mandate given to NITheP clearly states an involvement of NITheP staff members in teaching and post graduate supervision. In 2008 this was, due to the limited operational time, limited to staff members already involved in academic institutions. However, this issue has already been discussed with the Physics Departments at the different nodes and agreement on limited use of NITheP staff for teaching on the post graduate level has been reached. At SU the contact time of NITheP staff members will be limited to 42 hours per year. Similarly NITheP staff members can act as supervisors for honours, M.Sc. and Ph.D. projects. It is also envisaged to link honours projects to short research programs. Arrangements for the first research program of this nature are already well under way and will take place in September 2009.

Apart from involvement with Physics Departments, it is also envisaged that NITheP staff members, associates and visitors will be involved in specialist courses for students and young faculty members. A possible model for this is the course structure used by the African Institute for Mathematical Sciences (AIMS). The possibility that AIMS may be used to host these courses has already been discussed with them. These discussions will be followed up in 2009 with the aim of implementing the first courses in 2010.

Table 5 summarizes the involvement of NITheP staff in post graduate supervision during 2008.

Table 5: Postgraduate students supervised in 2008			
Student	Degree	Supervisor/co supervisor	Node
Ms F Mountfort	M.Sc.	Prof F G Scholtz	SU
Mr J N Kriel	Ph.D.	Prof F G Scholtz	SU
Mr L Boonzaaier	Ph.D.	Prof F G Scholtz	SU
Mr J P Diener	Ph.D.	Prof F G Scholtz	SU
Mr J N Thom	Ph.D.	Prof F G Scholtz	SU
Ms A Zaidi	Ph.D.	Prof J Rodrigues	WITS
Mr M Masuku	Ph.D.	Prof J Rodrigues	WITS
Mr I Akhalwaya	PhD	Prof F. Petruccione	UKZN
Mr C Darrehim	PhD	Prof F. Petruccione	UKZN
Mr C Freeman	PhD	Prof F Petruccione	UKZN
Mr A Mirza	PhD	Prof F Petruccione	UKZN
Mr P Musumbu	PhD	Prof F Petruccione	UKZN
Mr T. N. Nzundu	PhD	Prof F. Petruccione	UKZN
Mr. Y. Hamdouni	PhD	Prof F. Petruccione	UKZN
Mr L Mbenza	MSc	Prof F. Petruccione	UKZN
Mr L Kabeya	MSc	Prof F. Petruccione	UKZN
Mr D Nganga	MSc	Prof F. Petruccione	UKZN
Mr N Wamunyima	MSc	Prof F. Petruccione	UKZN
Mr N Pumulo	MSc	Prof F. Petruccione	UKZN

Ms M. Semonyo	MSc	Prof F. Petruccione	UKZN
Mr G. C. Daniels	MSc	Prof F. Petruccione	UKZN
Ms A Marais	MSc	Prof F Petruccione	UKZN

h. Internship

A key element in capacity building is internship. Such a program has been initiated in 2008, but again due to time constraints it had limited success. A concerted effort to implement this program will be made in 2009.

As already mentioned in section 5g a link between honours projects and short research programs is envisaged, which should create an ideal opportunity for in house training. A constraint on this program, particularly at the honours level, is the limited time that students can spend away from their home institutions during the semester. This is particularly problematic for students outside the existing nodes and a way of accommodating these students still needs to be found.

i. Outreach

Preliminary work has been done in 2008 to launch an outreach program targeted mainly at grade 10-12 learners. The idea is to buy into existing outreach programs such as the one run by iThemba LABS and preliminary discussions were conducted. The aim is to roll out this program in 2009, with the main event a NITheP open day to be held in September 2009.

6. Research

NITheP's main function is that of a research institute and there must be a strong drive towards excellence in research. The first steps to do this were taken in 2008 when several existing research programs at the hub and nodes came under the NITheP umbrella, while several new ones were also initiated as staff arrived.

a. Research focuses

NITheP has clear research focuses that derive from existing research capacity at the hub and nodes. With the appointment of associates, these research focuses will be extended to include existing research capacity outside the hub and node. The 2008 research focuses, listed by node, are given in table 5.

Node	Focus
SU	Statistical and Condensed Matter Physics
UKZN	Quantum Information and Computation
WITS	String Theory and Matrix Models

b. Research outputs

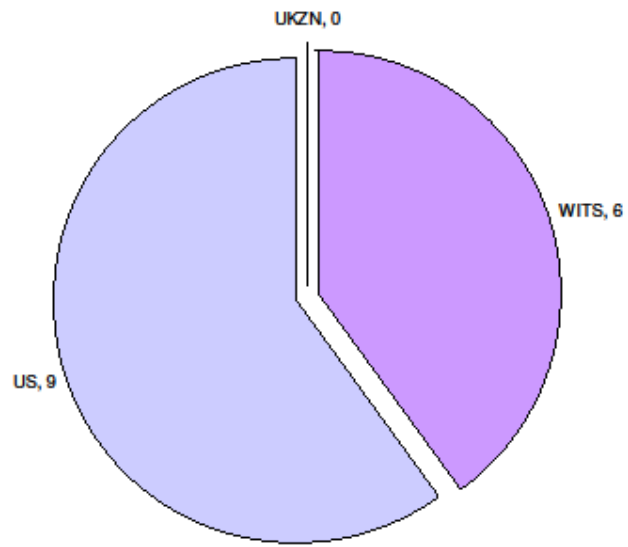
1. Publications in refereed journals

1. Scholtz FG and Govaerts J, *Thermodynamics of a non-commutative fermion gas*, Jnl. Phys. A 41 (2008) 505003.
2. Geyer HB, Heiss WD and Scholtz FG, *The physical interpretation of non-Hermitian Hamiltonians and other observables*, Can. Jnl. Phys. 86 (2008) 1195.
3. Cook MNH and Rodrigues JP, *Strongly coupled large N spectrum of two matrices coupled via a Yang-Mills interaction*, Phys. Rev. D 78 (2008) 065024.
4. Koch RD, *Geometries from Young diagrams*, JHEP 11 (2008) 061.
5. Bhattacharyya R, Koch RD, Stephanou M, *Exact multi-restricted Schur polynomial correlators*, JHEP 6 (2008) 101.
6. Bekker D, Koch RD, Stephanou M, *Giant gravitons - with strings attached (III)*, JHEP 2(2008) 029.
7. Bhattacharyya R, Collins S, Koch RD, *Exact multi-matrix correlators*, JHEP 3 (2008) 044.
8. Heiss WD, *Chirality of wavefunctions for three coalescing levels*, Jnl. Math Phys. A 41 (2008) 244010.

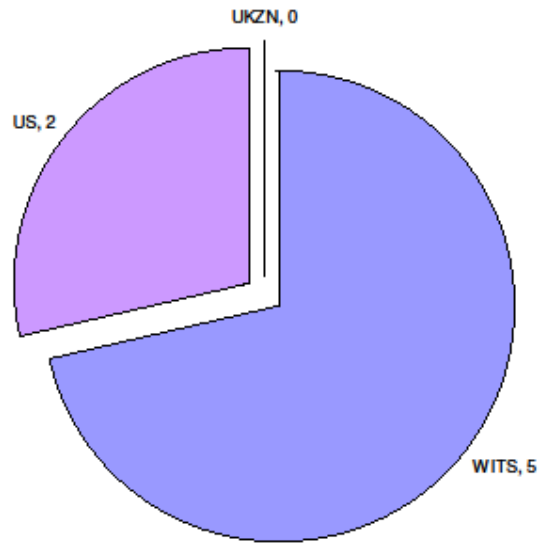
2. Submitted manuscripts/accepted for publication in 2009

9. Rodrigues JP and Zaidi A, *Non supersymmetric strong coupling background from the large N quantum mechanics of two matrices coupled via a Yang-Mills interaction*, arXiv: 0807.4376.
10. Snyman I, Nazarov YV, *Bi-stability in voltage-biased NISIN structures*, arXiv:0808.3658, published in Phys. Rev. B 79 (2009) 014510.
11. Scholtz FG, Gouba L, Hafver A, Rohwer CM, *Formulation, Interpretation and Application of non-Commutative Quantum Mechanics*, arXiv:0812.2803.
12. Ben Geloun J, Scholtz FG, *Supersymmetry breaking in noncommutative quantum mechanics*, arXiv:0812.3289.
13. Gangopadhyay S, Scholtz FG, *Free particle on noncommutative plane -- a coherent state path integral approach*, arXiv:0812.3474.
14. Ben Geloun J, Scholtz FG, *Coherent states in noncommutative quantum mechanics*, arXiv:0901.3315.
15. Ben Geloun J, Gangopadhyay S, Scholtz FG, *Harmonic oscillator in a background magnetic field in noncommutative quantum phase-space*, arXiv:0901.3412.
16. Gangopadhyay S, *Anomalies, Horizons and Hawking radiation*, arXiv:0809.4572, published in Euro Phys Lett 85 (2009) 10004.
17. Dey T K, Mukherji S, Mukhopadhyay S and Sarkar S, *A Note on matrix model with IR cutoff and AdS/CFT*, arXiv:0806.4562.
18. Collins S, *Restricted Schur Polynomials and Finite N Counting*, arXiv:0810.4217, Published in Phys.Rev.D79 (2009) 026002.
19. Koch R D, Ives N, Stephanou M, *Correlators in Nontrivial Backgrounds*, arXiv:0810.4041.

ALL PUBLICATIONS 2008



PUBLISHED 2008



3. Post graduate supervision: degrees completed in 2008

Student	Degree	Supervisor/co supervisor	Node
Ms F Mountfort	M.Sc.	Prof F G Scholtz	SU
Mr N van Ryn	M.Sc.	Prof F Petruccione	UKZN

7. Key performance areas

The NITheP must deliver against five key performance areas and meet targets as set out in the SLA. The SLA was not yet in place in 2008 so that it is not possible to measure the NITheP performance against these. However, we shall briefly indicate how the programs launched in 2008 are geared towards meeting the requirements of the key performance areas.

1. Research: NITheP's research focuses are all in the field of Theoretical Physics and research is NITheP's core function. As such the creation of new knowledge and the dispersion thereof through publication in appropriate journals are NITheP's primary functions. From section 6 it should be clear that NITheP has already made substantial progress in these areas.

2. Education and training: The bursary program of NITheP engages directly with this issue and a full report is given in section 5b. Staff members already engaged in 2008 in post graduate supervision and teaching as reported in section 5g. The Chris Engelbrecht summerschool series, workshop, internship and short research programs all engage directly this issue as outlined in section 5.

3. Information brokerage: Knowledge generated by NITheP is dispersed through appropriate channels such as electronic archives and research journals. NITheP also keep its own data base of publications, which is made accessible to the community on NITheP's website.

4. Networking: The associate, visitor and short term research programs are aimed at building a national and international collaborative network of researchers. In addition NITheP has already engaged with iThemba on possible collaborations and possible joint appointments. The establishment of a national network of collaborators and partners will be a priority in 2009, while the focus will shift to the international scene in 2010.

5. Service rendering: NITheP has already actively engaged in service rendering to the Physics Departments of Universities in terms of teaching, post graduate supervision, project supervision and curriculum development for theoretical courses. Furthermore NITheP has already engaged with iThemba in terms of possible theoretical support.

8. Financial Statements

As the MoA between SU and the NRF is not yet in place, a complete external audit of NITheP was not scheduled by SU. Instead, a statement of income and expenditure for the period 1 January-31 December 2008 is included.