Review of the National Institute for Theoretical Physics
2017

FINAL REPORT

Review panel
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**Executive Summary**

In 2004, an international Panel reviewing physics in South Africa recommended the founding of a National Theoretical Physics Facility [1]. The specific aims were to contribute coherence, to enhance international competitiveness, and to link more effectively to national needs. The National Institute of Theoretical Physics was founded in 2008.

The Panel finds that NITheP is valuable in the short and the long term, not only because it is delivering an exceptionally high quantity and quality of research, but it is doing so for a relatively low investment. In the review period NITheP published 339 papers, of which 66% are in the top 30 journals in the field; and NITheP is ranked 3rd among institutions in Africa in the physical sciences\(^1\). In terms of investment, in 2016, between 4 and 6 core staff supported an extended network of 155 people\(^2\) across the nation.

NITheP has succeeded in becoming internationally respected and is attracting staff members, post-docs and students internationally. In South Africa, it has put together a network of three nodes and 71 individual associates. This network is most successful in Gauteng and Limpopo, and less successful in the Eastern Cape. The latter is attributable to increasing resource constraints of the last 5 years, an effect which is observed in several outputs.

In terms of education and training, over the review period, 43 MSc and 24 PhD students graduated, and the totals at present are 74 MSc and 40 PhD students. The recent graduation rate in the MSc is over 90%. In the review period 224 students were supported, including Honours students and interns.

NITheP is experiencing both achievements and challenges in the pressing national need for transformation in race and gender. The internship programme is over 80% black and currently over 10% female; the PhD programme is between 60% and 80% black, and 10% to 15 % female. Obstacles to be overcome are the numbers of female bursars, from 0% to 20% across the total programme, and the low number of 40% black MSc bursars in 2016. By implementing the strategic recommendations made in this report, transformation can be considerably improved.

In compiling the key recommendations, the Panel enquired vigorously into which actions in transformation have a proven track record of success, and which have only a moderate track record. Based on these, a set of detailed recommendations is also made which will radically improve the transformation record of NITheP.

The training record, through bursar workshops, Summer Schools, the African School Series, training workshops and research workshops is viewed as impressive. The internship programme, targeted at the transition from undergraduate to post-graduate studies – a well-known barrier – has a 80% success rate of interns continuing with a higher degree, of the 59 students over the review period. Mobility programmes, visitor programmes, short research programme, and the Request for Proposal Programme have proved to be frequently mentioned as successful and valuable by the students,

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\(^1\) Nature Weighted Fractional Index [16]  
\(^2\) [17]
post-docs, staff and associates with whom the Panel has interacted. From inception of the programmes in 2009 the contribution of the Associate network to papers has risen from 24% to 65%.

NITheP was moved to the CoE framework, without revision of contracts, in 2012. This was associated with an understanding that theoretical physics contrasts with the scope of COEs because it is interdisciplinary, and is not as close to application as the topics of other COEs within the framework. The action was taken in the absence of an appropriate funding instrument already in place at NRF. The Panel finds that this has caused damaging uncertainty about the lifetime of the Institute. This should not be allowed to influence the success and international standing of NITheP, nor the international branding that it brings to South Africa. It is the conclusion of this Panel that to discard an Institute of this standing because of a technicality arising from a convenient management categorisation would ultimately be a waste of government investment. The motivation for the Institute is enduring, and when economic recovery begins, and funding for the R&D Strategy returns to desirable levels, re-building would require the expenditure to be repeated. The solution is not to discard the Institute but to put the appropriate policy in place. The Panel suggests that costs can be managed by bridging this period, requiring, at the same time, a step change in transformation to best practices based on observation of successful and unsuccessful initiatives.

The strategic recommendations are therefore as follows; motivation and expansion of these into more targeted recommendations will be found in the report, particularly for transformation actions.

**Strategic Recommendations**

**Recommendation 1:** There is no doubt that the Panel finding is that NITheP should continue to operate and to grow. [action DST, NRF]

**Recommendation 2:** Move the “hub” node to UWC.

Since transformation in terms of race and gender is fundamental to the scientific enterprise, a step change in improving transformation shall be made. The “hub” node, currently hosted by Stellenbosch University, should move to the University of the Western Cape. UWC is proposed for its HDU status, the pool of students available, its proven track record in successful transformation practice in physics, the presence of key staff, and the low cost of moving. [action NITheP]

**Recommendation 3:** The pace of student transformation in terms of race and gender must be accelerated as a strategic priority. [action Director and Deputy Directors]

The Panel has collected seven parts of Recommendation 3 specifically based on transformation initiatives, which were sought out from the review process as being proven in practice.

**Recommendation 4:** Networks and awareness should be supported and expanded. [action NITheP]

**Recommendation 5.1:** NITheP, NRF and DST should react to these recommendations in a timely

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3 [6], [7]
4 [8]
manner, i.e. within 6 months. [action NITheP, NRF, DST]

Recommendation 5.2: We encourage future attempts of involving Black South Africans and women in future Panels. [action NRF Reviews and Evaluations]

The view of the Panel is that if these Recommendations are implemented,

- South Africa will be better positioned internationally,
- Theoretical Physics will be strengthened across South Africa, and
- access to the highest levels of achievement will open up for talented young people from the lowest income levels, addressing disparities in gender and race.
1. Introduction

The National Institute of Theoretical Physics was put in place in 2008 in order to fulfil the following functions:

- 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 optimizes communication and collaboration between the existing centres of expertise and stimulate 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.

As part of the first point above, the Panel explicitly recognised that one of the objectives is

- To educate and develop the emerging generation of highly qualified South African Theoretical Physicists.

1.1. Strategic context

UNESCO has published 17 Sustainable Development Goals. Two are most relevant.

**SDG 1** End poverty in all its forms everywhere.

**SDG 4** Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Education provides an exit strategy from poverty. It is established that among the poorest South Africans there are many with talent and aptitude for learning and for science, who have been held back by the acknowledged deficiencies of the schooling system [2] [3], and who still succeed against all the odds when they encounter opportunities. The transformation recommendations made by the Panel are aimed at lowering the barrier for the poor and the disadvantaged to enter Theoretical Physics.

Other SDGs are relevant, particularly that with respect to gender equality, which is addressed here in science. These goals are reflected in the National Development Plan [4], the National R&D Strategy and the DST vision [5] [6] [7], and NRF 2020 [8]. In terms of the global scientific community, especially with regards to developing countries, the Statements of the Universality of Science from ICSU and IUPAP [9] underpin universal participation in science, and universal access to science.

The NDP sets out goals for poverty reduction, economic growth, economic transformation and job creation. A well-developed science infrastructure, which develops excellent and renowned researchers, contributes to global competitiveness in economic terms and to the National System of Innovation. Recently, recommendations on improved levels of education and skills in Science,
Technology, Engineering and Mathematics (STEM) have been made, noting the demand at the professional level for STEM graduates [10] [11].

The Panel has proceeded with this background.

1.2. The value of Theoretical Physics

Theoretical Physics represents the very forefront of modern scientific research dealing with the most fundamental laws and phenomena of Nature. In terms of the fields of science, it is most closely engaged with the uncomfortable problem that we do not know what 95% of the universe is made of.

It is therefore a subject of potentially greatest interest to talented students and young researchers. Fundamental investigations in Theoretical Physics as a rule produce surprising new discoveries, with new visions of the Universe and major practical applications. Presently the outstanding major questions and challenges being pursued include the Quantum nature of Black Holes, Physics of Dark Matter, Statistical Physics and Phase Transitions, Quantum Matter and Quantum Computing, and Physics beyond the Standard Model. These questions fascinate not only the aspiring young researchers but also the general public.

Concentrated efforts in theoretical physics have in recent years been formalized and consolidated under the scheme of theoretical physics institutes built at leading Universities such as: Princeton, Harvard, MIT and KITP in the US, The Perimeter Institute in Canada, The Philippe Meyer Institute in France, The Newton Institute in England and also major Institutes in India (Mumbai [12] and Bangalore [13]) or in South Korea (KIAS [14] and IBS [15]) which have achieved notable success at scientific and educational levels.

The activities of such centres focus on most advanced theoretical studies and provide fruitful synergy between theoretical efforts in a range of fields including astrophysics, biophysics, climate physics, computational physics, nuclear physics, condensed matter physics, and elementary particle physics. While theorists in these fields study seemingly very distinct and disparate physical phenomena, there is substantial overlap in terms of shared theoretical and computational methodologies and physical insights. Important breakthroughs have been made in the past when theorists from different subfields of physics shared their expertise and common techniques.

Explorations pursued under the umbrella of theoretical physics institutes are greatly enhanced by the international nature of the field, which is manifested in international collaboration, free exchange of ideas and results, with post-doctoral researchers moving from one group to another and transmitting expertise through seminars, lectures and joint works. This international character of Theoretical Physics stands to offer a potentially most powerful benefit to newly created institutes in countries that are trying to reach the highest research level.

Studies in Theoretical Physics provide a most beneficial framework to develop, train and nurture new generations of students and researchers with capabilities to tackle and solve most complex problems. The highly analytical methodology of Theoretical Physics finds application in numerous other branches of Science, Industry and Business.

With the potential to attract and train the most talented students with relatively modest infrastructure Theoretical Physics offers results of great benefit to society. The Theory Institutes
represent an immense repository of talent and expertise. It is not surprising that Theoretical Physicists are greatly sought after for advanced positions in industry, finance and economy.
2. Methodology

The purpose of the evaluation is given in the draft Terms of Reference, Appendix 1:

- To assess the overall performance of NITheP from 1 April 2011 to 31 March 2016 in terms of its objectives and mandate clustered around the key performance areas as stated in the evaluation dimensions, and
- To make recommendations to enhance:
  - NITheP’s performance;
  - the funding model to ensure sustainability of NITheP as a CoE.

The scope covers (Appendix 1, Item 6)

- a summative retrospective view of NITheP covering the period 1 April 2011 to 31 March 2016,
- a prospective view with recommendations to enhance NITheP, its prospects as well as its sustainability.

The Panel has structured this report around the evaluation dimensions starting with the overall performance of NITheP in terms of its mandate clustered around the key performance indices (KPIs)(appendix 1, Item 7.4), :

- Research
- Education and Training
- Information brokerage
- Networking
- Service rendering
- Management in terms of
  - leadership
  - staffing
  - commitment of institution/s hosting NITheP
  - location of NITheP
  - funding and future plans.

The report then covers the additional dimensions (appendix 1, Item 7.1 to 7.3):

- performance of the host institution in
  - implementing and managing NITheP to date;
  - providing administrative and other logistical support for NITheP operations;
- the extent to which the recommendations of the 2011 evaluation have been implemented;
- and future plans of NITheP.

The Programme and list of people with whom the Panel met will be found in Appendices 2 and 3 respectively. Appendix 4 covers three points in connection with the process of review. One member of the Panel joined the review by Skype, after it had been ascertained form the Assignment Principal that the review should go ahead under these circumstances. On the third day of the review, it was brought to the Panel’s attention that the Panel did not include a black South African, and that a
number of stakeholders were not on the programme. The latter problem was resolved.

In the text of this report, the Panel’s evaluation questions and key findings are reported. Recommendations are formulated as the discussion is presented.
3. Evaluation Questions, Key Findings and Detailed Recommendations

3.1. Research

\[ \text{In the final analysis it is basically mastery and utilisation of modern science and technology that distinguishes the South from the North.} \]

Abdus Salam, quoted in A. Bilisel and Ö. Oral, Role of Education, Science and Technology in Developing Countries.

**Question:** Is the research output high quality?

**Key findings**

The Panel considered a number of indicators. The bibliometric data provided [16] indicate that NITheP as an Institute has performed at the highest level:

- research papers are highly cited compared to world standards
- papers are very highly cited compared to national standards
- international collaborations, fostered by the Institute, have significantly contributed to the increased visibility and quality of research publications
- South Africans of all races are increasing their scientific expertise and their publication records through the medium of NITheP
- a minority of papers are authored by Master’s and Doctoral students; this is attributed to the fact that students were not required to add their NITheP affiliation to publications until 2016.

The Panel also notes that, in terms of quality indicators,

- the NRF ratings of the staff are good or very good, and the ratings of some associates are in the NRF A bracket
- some of the Post-Docs and staff have been attracted to South Africa by the international reputation of NITheP
- patents have emerged from groups in which the NITheP resources have been leveraged (e.g. at UKZN).

The outputs achieved by NITheP on the current budget are proof of the value proposition of Theoretical Physics in terms of productivity and high profile. NITheP is very highly commended for having achieved the status for which it is working so actively.
**Question:** Should NITheP continue to operate?

**Key findings**

**Recommendation 1:** There is no doubt that the Panel finding is that NITheP should continue to operate and to grow. [action DST, NRF]

**Question:** is the COE model beneficial?

In 2004, an international Panel reviewing physics in South Africa recommended the founding of a National Theoretical Physics Facility [1], to contribute coherence, to enhance international competitiveness, and to link more effectively to national needs. The National Institute of Theoretical Physics was founded in 2008. In 2012, an attempt was made to set up a funding instrument specifically for National Instruments at a funding level lower than National Facilities, but this initiative was put forward at a time of declining funding. Since no appropriate funding instrument was in place at NRF, NITheP was moved into the Centre of Excellence, or CoE, framework in 2012, but without changes to its contracts.

The Panel finds that NITheP is valuable in the short and the long term not only because it is delivering an exceptionally high quantity and quality of research but it is doing so for a relatively low investment.

**Key findings**

It is a key finding of this report that the limited and short lifetime of a COE, as defined, is causing important difficulties. Specifically, two staff members have left under the pressure of uncertainty and it is difficult to attract top staff to a National Institute that, under COE rules, would close in 5 years. Administrative staff feels similar pressure and some are considering quitting for this very reason. Research is suffering and concern was expressed unanimously by staff speaking to the Panel. Theoretical Physics requires largely undistracted thought. Institutions against which NITheP is benchmarked are all treated as long-term enterprises. The time scale of a National Facility is appropriate.

A National Institute is differentiated from a COE in the following ways:

- it is not project-focussed, and therefore the 5-10 year horizon, for completion of programmes, is too short-term;
- it is a driver of a field applicable across the discipline, and therefore a long-term approach, such as used for National Facilities, is applicable;
- the budget must include a substantial portion for development of the community of practice, including workshops, summer and winter schools, visitors and mobility;
- COEs do not generally employ research staff, since the staff are usually drawn from existing expertise at a University, while a National Institute employs staff in the same way as a National Facility.

In view of the value that this National Institute is providing, the following important recommendation is made.

**Recommendation 1.1:** The lifetime of the National Institute of Theoretical Physics should be comparable to that of a National Facility to extract the most value from the investment. Continuation will depend on performance assessments at 5 year intervals. [action DST, NRF]
**Question:** is research capability expanding?

**Key findings**
The growth in capability is evident and is commended. Citations of NITheP publications are establishing a good and growing record [16]. The Associate network is expanding, but the contribution of Associates to publications is showing very healthy growth from 33% in 2010 to 65% in 2015 ([17], figure 17).

It is clear that the research scope broadens with the specialists involved. The original core scope is as follows (normal text), but evidence of growing scope (in italics) appeared during the review.

- Statistical and Condensed Matter Physics
  - phase transitions and transport
- **Energy materials (UV, UL)**
  - Density Functional Theory and DFT computation
- Quantum Information and Computation
  - Open Quantum systems (UKZN)
  - Biological Quantum systems (UKZN)
- High Energy Physics and field theory
  - String Theory and Matrix Models
  - Phenomenology (Wits, UCT)
  - Non-Perturbative Quantum Field Theory (Wits, UCT)
  - SA-CERN and SA-JINR data analysis
- Theoretical astrophysics and cosmology (UKZN, SKA).

Necessary work is also developing new knowledge in

- Computational physics (UP, UV, UL) and analysis and modelling of large datasets (Wits, iThemba, SKA)
- Information technology.

Broadening the scope is balanced with the necessity to keep critical mass intact in the core focus.

**Question:** Is the expansion of expertise including HDUs and rural Universities?

**Key findings**
Panel members consulted Associate representatives of U. Venda, U. Limpopo, NWU Mafikeng, who provided very enthusiastic reports on their experience (access to travel, visitors, seminars, workshops, summer schools, collaboration) and their growing expertise, with the following exceptions: freezing of funds in 2017 caused disruption of bursaries and considerable uncertainty among students who had been carefully head-hunted (UV); where only one Associate is working, a sense of isolation is felt (NWU Mafikeng).

A proposal was submitted in about 2012 to form a new node in the Eastern Cape, bringing in gravitational wave theory, based at Rhodes U. and including Fort Hare U., Walter Sisulu U. and Nelson Mandela Metropolitan U. This proposal was rejected at the time because of funding constraints. Since this time, the Panel understood, the response to participation from WSU and FHU has been relatively low.

There is a possible new node in Limpopo bringing in U. Venda, U. Limpopo and NWU Mafikeng. U.
Venda has enlarged the scope of NITheP by bringing in computational studies of energy materials involving photosynthesis.

The scope of NITheP research has to some extent been diminished by resourcing since 2012. The Panel notes that the existing scope has certainly been changed by strategic staff hiring decisions, e.g. phenomenology brought in at the Gauteng node; by the interests of Associates, e.g. computational biophysics brought in by U. Venda, and gravitational waves at a proposed Eastern Cape node. This is a natural growth and should be encouraged.

3.2. Education and Training

The properties of S were discovered by Clausius, and it was named by him ‘entropy’ from the Greek word for transformation. He regarded it as a measure of the ‘transformation content’ of a body, meaning presumably its capacity for change.


**Question:** is the degree qualification pipeline functioning?

**Key findings**

In terms of education and training, over the review period, 43 MSc and 24 PhD students graduated, and the totals to the present are 74 MSc and 40 PhD students.

With reference to the report commissioned by DST on the graduate pipeline [10], the MSc completion rate is very high, 90% to 95% [17], in comparison with 47% over 5 years across faculties [10]. NITheP MSc bursaries are held for 2 years and may be extended from other sources.

The PhD graduation rates over 5 years from 2010 to 2015 are between 56% and 65%, in comparison with 59% completion over 7 years across faculties [10]. The Panel notes that the international standard is for PhDs in theoretical physics to take typically a year longer than in experimental physics, and notes also that NITheP support is held for 3 years and may be extended from other sources. The pipeline therefore appears to be functioning very well indeed.

**Question:** is transformation functioning well?

**Key findings**

Transformation of the Theoretical Physics community of practice, and of NITheP and its people, is a key concern. It is abundantly clear that the NITheP Director and Deputy Directors are fully committed to race and gender transformation.

Since NITheP nodes are key structures, placing a node at an HDU would have the following advantages:

- the selection pool of transformation candidates is bigger
- the pipeline is less likely to lose transformation candidates
- the Associate programme benefits.

The Panel observed that representatives at all the Universities contacted expressed an appetite for hosting nodes and especially the Director’s node.
Recommendation 2: Move the “hub” node to UWC

Since transformation in terms of race and gender is fundamental to the scientific enterprise, a step change in improving transformation shall be made. The “hub” node, currently hosted by Stellenbosch University, should move to the University of the Western Cape. UWC is proposed for its HDU status, the pool of students available, its proven track record in successful transformation practice in physics, the presence of key staff, and the low cost of moving. [action NITheP]

The rationale is as follows:

- Recommendations on transformation and node location are addressed in a natural way.
- UWC has demonstrated an exceptionally fast growth of excellence in research
- an A-rated NITheP Associate is located at UWC
- UWC has demonstrated considerable success in education of previously disadvantaged individuals; it is globally recognised for its research in Physics Education; and it has successfully turned Physics Education research from many sources into implementation in teaching and learning, especially in overcoming the know barriers of transition from school to university, 1st to 2nd year, and 3rd year to Honours/Master’s courses
- UWC has successfully hosted the MANUS and MatSci Honours/Master’s curricula for nuclear and materials science qualifications; both are collaborative with U. Zululand and other universities. A theoretical counterpart could be envisaged
- The selection pool of transformation candidates is larger than at the current node
- Transformation candidates are less likely to be lost from the pipeline in this department
- UWC is within 30 km of Stellenbosch. It is likely that most staff will be willing to be seconded on this basis
- The staff should be transferred to the new institution with appropriate guarantees.

Recommendation 2.1: For continuity, staff should be transferred to this node. [action NITheP]

Some good efforts have been made in transformation but very much more remains to be done.

Recommendation 3: The pace of student transformation in terms of race and gender must be accelerated as a strategic priority. [action Director and Deputy Directors]

This is a key recommendation of this report. The Panel investigated which actions have been successful in the experience of the people interviewed and which choices had been less successful. The question was asked of stakeholders, academics, and students, especially of black students and women, and care was taken to check written submissions as well as the data in the Self-Assessment [17].

Recommendation 3.1: The internship scheme appears to be giving results and should be retained. [action NITheP]

NITheP bursaries have been comparatively low; in one year, the bursary values lagged those of NRF, and transformation was visibly damaged [17]. All indications from the review are that the NITheP bursaries are too small to cover the full annual costs of postgraduate students and that supplements are required. This is a smaller problem for middle-class students than for students from poor
backgrounds, who may also be supporting their own families on the bursary. The size of the bursary is a key consideration.

At present, the supply of eligible disadvantaged South African students is low, and grant agencies compete for students. The institutions which win are those with the following advantages.

### 3.2.1. Full bursaries

Bursaries which cover the tuition, accommodation, transport and living costs of the student may leave some money, which can be used to help the family if the student is very careful. Numbers of graduates will drop and KPIs should be amended accordingly; but the retention of students and the relative numbers of disadvantaged students will improve.

**Recommendation 3.2:** NITheP should consider having fewer bursaries at higher values. With the available funds and hindsight over past experience, an optimum balance for success may be found. Key Performance indicators may be renegotiated. [action NITheP]

### 3.2.2. Certainty about grant decisions

Students must already have funds in hand in order to begin their academic year with travel to the University, registration, and finding accommodation, or they are lost to NITheP. The Panel heard that in some years funding has not been transferred to students until June. In 2017, uncertainty or administrative dysfunctions led to the freezing of NITheP funds. This simply does not aid reaching disadvantaged and poor students. Bursaries cannot be competitive and delivering race and gender transformation when they are hampered by slow decisions and slow financial transactions. Bursary decisions should be finalised in December. Transformation, for the reasons given above, cannot be successful when NRF decision and transfer dates are uncertain: the funds must be available to NITheP from December.

The Panel understands that successful students may have applied for multiple grants, and that decisions, proof of registration, and annual progress reports may be factors in delaying payment from NITheP. If these are the dominant circumstances, they will be alleviated by Recommendation 3.2.1 and by the implementation of cut-off dates.

**Recommendation 3.3:** Funding decisions and transactions connected with the bursary programme must be completed by December of each year. [action NRF]

### 3.2.3. Active scouting and fast decision-making

The pool of talented black and female candidates appears to be smaller than the funding pool can cover, and there is competition for talent. It has been shown by experience that active work by leaders, themselves, in making direct contact with candidates, and having enough flexibility to tailor opportunities for them, is one of the most successful tactics in transformation. The Panel recognises that the technique is already being used but wishes to emphasise the point.

**Recommendation 3.4:** Active scouting for candidates should be undertaken by the Director and Deputy Directors from the beginning of the third undergraduate year for internships. Leaders should extend invitations personally to top candidates, and maintain personal contact throughout
the student’s career. [action NITheP Director, Deputy Directors]

3.2.4. Undergraduate bursaries

The Self-Assessment shows that the pipeline of researchers is difficult to start from the Honours level [17]. Bursaries are needed to position theoretical physics earlier in the university pipeline. It is stated that DST does not provide undergraduate scholarships, but SKA has certainly negotiated successfully for them - the Panel heard the mechanism by which Dr Adam had released undergraduate bursaries for SKA – and this works well.

Recommendation 3.5: Within the next year, a source of undergraduate bursaries must be found to extend the pipeline coverage. [action NITheP]

3.2.5. Well-publicised job prospects

Students are attracted by job prospects that they understand and can convey to their families. Job prospects in physics are not as well publicised as those in engineering or chemistry. Some progress has been made by the SA Institute of Physics, which has worked with SAASTA, the South African Agency for Science and Technology Advancement, to produce career guidance material in physics and biophysics.

Recommendation 3.6: A sponsor, possibly from the financial sector, should be found to support a pamphlet specifically addressing careers in Theoretical Physics. [action NITheP]

3.2.6. A welcoming and responsive environment

A major factor is the education and social environment in each University Department, in NITheP, and in the wider community of practice. Prof Robert Lindsay, UWC, heads a department that specialises in applying physics education research with very successful results. Prof Roy Maartens, UWC, described the amount of time that is necessary for a supervisor, and possibly administrators, to engage with students on the significant problems they are facing in their work and in their home life. Brown U. has been successful in providing number of black graduates in the USA; Prof. Antal Jevicki engaged with Prof. S. (Jim) Gates on useful issues during the review. Several nodes are very successful with Departmental environment, notably UKZN.

The Panel advises that a shift of the hub to UWC, in terms of Recommendation 2.1 above, will place it in an environment that is successfully attractive to students at the major career decision points.

3.2.7. Opportunities

Students find the Bursar Workshops attractive, as well as opportunities to network with their peers and to travel together. Grants that enable them to present papers and network with the leaders in their field were particularly welcomed. This aspect is well-covered by
3.2.8. Gender

It has been established by research in the field of gender in science that the percentage of women in physics drops with seniority in every national pool across the world. This is attributable to a complex set of causes. It is also known that the leader of any given initiative can make changes by (1) active scouting and encouragement to join and to stay, (2) ensuring enough institutional flexibility to accommodate suggested changes (for example, career breaks), (3) making sure that institutional policy is geared to retaining women and primary parents, and (4) never giving up, since the underlying culture changes more slowly than departmental or institutional culture. The Recommendations above will assist. The Juno Charter [18], for example, links departments in undertaking to change the situation of women in physics in the UK.

Recommendation 3.7: The Draft IUPAP Waterloo Charter on women in physics should be obtained as a source of guidance, through the South African Institute of Physics. [action NITheP]

There are a number of related items of some importance: UKZN offers free tuition for MSc and PhD degrees, thereby effectively raising the bursary available to the student; and flexibility in topping up a grant at a University where, for example, residence costs are high (e.g. Rhodes U.) is a distinct advantage.

NITheP is commended for the considerable efforts to which it already goes in order to optimise bursaries and grants among its students; the results are evident. The Panel understood that if a student can obtain an alternative bursary, the NITheP bursary is freed up for another deserving candidate. This takes time and dedication from the staff, and the effort is bearing fruit.

Question: are graduates finding jobs and contributing to the economy?

Key findings
“Fate recording” for graduates indicates that they are finding not only work that contributes to the economy, but lucrative work. Of 8 graduates in industry for whom data was sourced, the employers are using the innovative approaches in theoretical physics in abstraction, modelling, and complex data science: SAP (management information systems), IBM Research Center, Vastech (data science), and Novare Investments, while two are in Sudan and Mauritius.

3.3. Information brokerage

Question: does NITheP function as an information broker?

Key findings
NITheP is not an information broker in terms of data, but the data from experiments and observations – including CERN, iThemba LABS and SKA (MEERKAT) – are sourced and used by the researchers at NITheP to generate new knowledge, as stated in the Self Assessment ( [17], 4.4.1). NITheP certainly does function well as a knowledge broker through its Schools, Training Workshops, Research Workshops, internships and public lectures.
3.4. Networking

3.4.1. South Africa

**Question:** what is the level of success of networking nationally?

**Key findings**

South African networking is run through the Associate programme and the Request for Proposal Programme (RFP).

The Panel requested that the review programme (Appendix 3) be expanded to include additional representatives of rural Universities, HDUs and the black physics community, and the members of the Panel express their gratitude to everyone concerned in being so very forthcoming at short notice.

Associates are mixed in their response. It appears that some are extremely positive (NWU Mafikeng, UV, UL). At UV, the NiTheP scope has been broadened to include computational studies of Energy Materials: Prof J. Kirui and Dr E. Maluta are keen to leverage the opportunities further. UL has a history of excellence in Computational Physics and Prof T. Mosuang would like to see further development. However, others (notably Rhodes U.) felt that communication had not been active, but had been based on email contact. However, attempts more recent than 2012 to draw the U. of Fort Hare and Walter Sisulu U. into closer communication have not met with much response.

While the roadshow initiative has continued [17], several Associates had not been contacted by NiTheP recently, except via email, or had not attempted to make contact of their own accord. The Panel frequently heard the suggestion voiced that NiTheP should improve its profile in the physics community. The Panel is aware that the popular roadshow programme is dependent on resources.

**Recommendation 4: Networks and awareness should be supported and expanded. [NiTheP]**

**Recommendation 4.1:** The Associate network should be further expanded, with special attention to rural universities and universities near the Western Cape node. The existing success of the Associate publications and the advantages of the NiTheP RFP should be exploited. [action NiTheP]

In some cases, contact with Associates was informal and low key (for example, Dr C. Chang, Astrophysics and Cosmology Unit, and Dr J. Sievers within the School of Chemistry and Physics at UKZN). Personal contact across departments in the same university, and across universities, could certainly be improved to the extent that resources are available.

NiTheP is commended on the national success of its Schools, particularly the popular annual Chris Engelbrecht Summer School, the Training Workshops aimed at skills in mathematical modelling, computational methods, and numerical methods aimed at 3rd year and Honours level, and the Research Workshops targeted at MSc and PhD students. These have been found to be valued by the students and by the academic community. The regular Friday seminars at UKZN are highly valued.

**Recommendation 4.2:** The Chris Engelbrecht Summer School, Training Workshops and Research Workshops form a valuable part of the transformation of the physics landscape and should be retained and strengthened, and sited at HDUs more frequently. [action NiTheP]
### 3.4.2. New nodes

**Question:** should a new node be recommended?

**Key findings**

The Panel seriously considered recommending a new node based in Thohoyandou (U. Venda) based on the successful expansion of the Associate network and, with it, the research scope of NITheP mentioned above.

A determined attempt was made in 2012 to motivate a new node by Rhodes, with inclusion of the U. of Fort Hare, Walter Sisulu U. and NMMU. This was declined at the time due to lack of resources. The potential for this node includes broadening the scope to gravitational waves. Several invitations from the LIGO community (Laser Interferometry Gravitational-Wave Observatories) have been made through the SA Institute of Physics, and directly, for South Africa to join in computational and theoretical aspects of the gravity wave field, and these have also occurred at a time of low resources. The potential is excellent and should be considered.

Prof. R. Maartens, holding an SKA Chair at UWC, is well-resourced by SKA. However, his description of the conditions that have been created at UWC and the advantages of operating there, together with the success of the Physics Department and the profoundly innovative view of undergraduate education there, supported the Panel’s hypothesis that moving to this location would prompt a step change in NITheP’s transformation success.

### 3.4.3. Africa

**Question:** what is the status of NITheP within Africa?

**Key Findings**

The African School Series on Electronic Structure Methods and Applications (ASESMA) was initiated by NITheP. This workshop is well-known to young physicists across Africa and is known internationally for its invitations to high level guest speakers. ASESMA has now successfully found additional sponsors.

**Recommendation 4.3:** Every effort should be made to sustain ASESMA, and to initiate at least one similar school in the broader NITheP scope, since this is a valuable and recognised tool in building physics in Africa. [action NITheP]

AIMS, the African Institute of Mathematical Sciences, has a number of partners in Ghana, Senegal, Cameroon, and Tanzania. Liaison between NITheP as a National Institute, and AIMS, in a pan-African role, is good.

### 3.4.4. International

**Question:** what is the status of NITheP in international terms?

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5 including MARVEL [http://nccr-marvel.ch/en/project](http://nccr-marvel.ch/en/project), ICTP, IUPAP, APS, and the US Liaison Committee for IUPAP.
Key findings
It is abundantly clear from the Panel interactions that NITheP has become a respected Institute in international terms. This is supported by the level achieved in publishing [16], the level of the contract staff that have been attracted, the fact that international post-docs and graduate students have chosen to come specifically to South Africa. This achievement is not a trivial one and NITheP is to be congratulated on attaining this level within 10 years of inception, an unusual feat.

Simultaneously, invitations to international meetings and conferences, numbers of invited talks and presentations and participations in international collaborations have increased through the activities associated with the Institutes.

South African students and Associates are attracted by this aspect and are able to attend international conferences in circumstances where they would not otherwise have done so, not only because of the proposal funding mechanism (RFP), but because they have reached a level at which their publications are accepted at well-established international conferences.

3.5 Service Rendering

Question: does NITheP provide services?

Key findings
The services described include internships and workshops, and an annual speaker for the entire physics community, but are most notably contributions to Public Understanding of Science through invited lectures, outreach at schools, engagements in the National Science Expo, National Science week, job shadowing and career guidance. Advice to government and policy provision has taken place [19]. Consulting to industry has taken place.

3.6 Management

3.6.1 Leadership

Prof F. Scholtz is an internationally respected South African physicist with outstanding leadership qualities. He is one of the 3 top publishing authors at NITheP [16]. In interviews the Panel established that he, as well as NITheP in general, is significantly hampered by the management model in terms of dealing with short-term COE goals and long term National Institute goals. He has coped extremely well with the resulting uncertainty among staff. His personal vision for the future is of radical change in the way that NITheP functions and his vision is driven fundamentally by transformation in race and in gender.

Prof J.P. Rodrigues, as well as being Head of the School of Physics at Wits, has been most successful in broadening the Gauteng node to Limpopo and North-West provinces, and he has positioned the northern region very well for further development. He is an author of one of the top 5 cited papers in NITheP [16]. He was instrumental in greatly advancing Theoretical Physics at Wits and South Africa in recent years.

Prof F. Petruccione has grown the KZN node significantly and the Panel established through the interviews that his capacity for capturing students and broadening the research scope of the node, while increasing the research standards of output, is regarded as astonishing. He is the top publishing author of NITheP: 53 papers between 2008 and 2014, with a rising stream of both cited
publications [16].

In terms of succession plans on the medium time scale, for the Director and Deputy Directors, a number of senior candidates exist who are black South Africans.

3.6.2. Staffing – academic

Excellent staff have proved themselves through the two media of research publication and training researchers. Two serious comments arise:

1. Two positions are vacant, and both resignations were explicitly due to uncertainty about the length of term that applies to NITheP.
2. The employment process has already started for the two vacant positions, but attracting people who will transform the staff profile is a long-term ongoing proactive search. These positions and those arising in the future should be staffed by black South Africans, and preferably women.

The Panel notes that appointments stretch and broaden the physics scope: a good example is the particle physics phenomenology field brought into NITheP node at Wits. This process should be continued.

3.6.3. Commitment of hosting institution/s hosting the CoE

The Deputy Vice Chancellors – Research and Deans with whom the Panel met see Theoretical Physics and NITheP very much as the original vision intended – a necessary long-term interdisciplinary and collaborative development of South African expertise in an African and international context. All were eager to host nodes and to host the hub node.

The Panel noted that among the administrative staff there were members who actively remove obstacles from the paths of the students and researchers, and this is commended.

3.6.4. Location

The Panel has recommended that the Western Cape node should be moved to UWC; the rationale is given below, and is based on translating the hub into an HDU context with an abundant pool of black South African students from poorer backgrounds. It is of course necessary to check whether UWC is able to provide a significant and convenient space for hosting NITheP, its staff and some of its activities.

While a new node or nodes are desirable as well as the enlargement of theoretical themes studied by staff members, the hub transformation is deemed to be more viable in the present resource climate.

3.6.5. Funding and future plans

A crucial finding is that NITheP funding has been considerably leveraged at all nodes. A particular source of gearing is the SARCHI research chair position; NRF competitive funding and funding for rated researchers, host University resources, local institutes (STIAS at SU and the Mandelstam Institute at Wits), and collaborations such as SA-CERN have been effectively used.
This review is undertaken in a time of resource constraint. Nevertheless, signs of economic recovery are surfacing: the low Gross Domestic Product growth rate of 0.5% in 2016 is predicated to rise to 1.3% in 2017, with positive trends in commodity prices and exchange rates, accompanied by revival after drought, production stoppages and electricity supply outages.\(^6\)

It is often the case that R&D is cut when times are hard, and it is also known that rebuilding research capabilities from scratch is more expensive than maintaining them through period of adversity.

Theoretical Physics is possibly the most cost-effective form of science, and the content lends itself to a surprising variety of applications (for example, quantum mechanics is fundamental to electronics, computing, and chemistry). In order to understand the logic behind the facts of the nature, theoretical physics develops people with extraordinary skills in abstraction, mathematical and computational modelling, the handling of very complex data, and the test and validation of theory. These men and women are often leaders not only in the world of physics, but of science and thinking worldwide. This spearhead has a role in providing long-term coherent stability to the physics and science communities [1] and should be fostered accordingly.

In terms of sustainability, the Panel advises that continuity of the core is a key national science issue and the responsibility should be that of national agencies, more particularly the NRF [8]. Expansion, diversification of the scope, addition of new nodes, and finance for undergraduates could possibly be supported by appeals to private entities, but the Panel cautions against expecting long-term investment, from this source, and emphasises the national benefit brought by core continuity.

4. Additional dimensions of evaluation

4.1. Performance of the host institutions

Following the Terms of Reference, the following points cover the performance of the host institution in

- implementing and managing NITheP to date
- providing administrative and other logistical support for NITheP operations.

The institute is organized in three geographical nodes: the Western Cape node with Stellenbosch University as centre, the KwaZulu-Natal node with the University of KwaZulu-Natal as centre and the Gauteng node with the University of Witwatersrand as centre. Currently the centre at Stellenbosch acts as the hub and Stellenbosch University as the host.

Stellenbosch University representatives expressed considerable support for theoretical physics in general, and for NITheP in particular. SU pays the rent for the facilities at STIAS occupied by NITheP. There was an ambiguity whether SU contributes more than this, for example, 10% of the associated costs if the National Institute is a COE.

NITheP is hosted at STIAS. The Panel heard unanimous agreement that this venue, while well-

designed, is isolated from the main campus, which effectively lowers student scouting, and student attendance at valuable seminars. It is particularly important that the hub node should have a welcoming look and feel for all South African students as part of the process of attraction.

**Recommendation 4.4:** NITheP nodes should always be embedded in host environments with a vigorous student population. [action NITheP]

### 4.1.1. Gauteng and Western Cape nodes

Both nodes are well supported by the University structures.

The Panel noted that the split of academic staff across the current nodes is as follows (March 2017).

**Table 1 Academic staff 2017**

<table>
<thead>
<tr>
<th>Node</th>
<th>Academic staff members (100% time) 2017</th>
<th>Directors and Deputy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hub and Director, Western Cape</td>
<td>3.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Gauteng</td>
<td>1.0</td>
<td>0.25</td>
</tr>
<tr>
<td>KZN</td>
<td>1.0</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Each node is functioning with vigour but the Panel recommends a more even balance of academic staff.

**Recommendation 4.5:** The number of members between different nodes should be better balanced. [action NITheP]

### 4.2. The 2011 Review implementation

The 2011 Review [20] and a response from NITheP management [21] were submitted to the NRF and to the NRF Board. In detailed responses [21] [22], NITheP management found the recommendations positive and that they had either been implemented already or would be implemented. Rec. 4.1 (National Facility) was welcomed and action was taken: a submission was made by Dr Albert van Jaarsveld, previous CEO of the NRF, and Dr Gansen Pillay to the NRF Board and DST some time ago regarding Institutes. The idea was put on hold due to funding constraints. NITheP explained in detail its opposition to phasing out core positions, and welcomed a multi-node model and broadening of the research focus in the context of a growth scenario. A response from NRF to NITheP was requested, but on enquiry the current Panel could find no existing document. There is evidence that NITheP did adopt the majority of the recommendations on its own initiative.

A criticism was raised with the Panel that the Institute concept might allow other fields to request similar structures in a time of constrained resources, but would it be a defensible policy position to cancel a successful scientific venture in order to prevent others from developing?
4.3. Future Plans of NITheP

**Question:** What disruptive technologies adopted now will lead to the most employment opportunities in South Africa in 70 years’ time?

**Answer:** Research in Basic Sciences.

Jan van Toor, Vice President and Head of Disruptive Innovation, Airbus Defence and Space, 2016

The present Panel strongly advises that NRF and NITheP adopt bold changes to the NITheP Strategic Plans for the future [23]. These are detailed in the present document.

Two scenarios are set out in the Business Plan: “status quo” and “accelerated growth”. The accelerated growth scenario is clearly preferable and can be adopted as a basis with the recommendations in the present document; if funding constraints persist, the status quo plan may have to be adopted, but not without considered incorporation of the recommendations in the present document, especially in connection with the hub node transfer.

4.4. Implementation

Some reviews lead to action and innovation, and some disappear quietly. The Panel hopes that this is one of the former kind.

**Recommendation 5.1:** NITheP, NRF and DST should react to these recommendations in a timely manner, i.e. within 6 months. [action NITheP, NRF, DST]

4.5. Coverage of the items in the Terms of Reference

This report has been organised according to the Terms of Reference in Appendix 1. It has covered retrospective evaluation (Appendix 1, 5.1 and 6.1) and recommendations to enhance the role of NITheP (Appendix 1, 5.2, 6.2), as well as commenting on the nature of the Institute in the context of the CoE (Appendix 1, 5.2), using the evaluation dimensions set out (Appendix 1, section 7).

4.6. Future reviews

Changing the future of science in Africa requires a balanced and inclusive approach. The following recommendation is a response to a complaint that the current Panel contained no black South African.

**Recommendation 5.2:** We encourage future attempts of involving Black South Africans and women in future Panels. [action NRF Reviews and Evaluations]

5. Conclusions

5.1. General summary

Having reviewed the research output and the reports provided, and interviewed stakeholders and
participants, this Panel concludes that NITheP has achieved a remarkably high quality of research output, has engaged with significant success in education and training, and has developed an enviable international reputation and branding. These points all benefit the South African scientific community. Much additional work is however needed in continuing the transformation and this report provides major recommendations below based on the innovative ideas of the people interviewed and on the observations of the Panel members.

Although the intention is to foster the development of physics and human capital in South Africa in the long term, the Institute has been managed for convenience, in the absence of an appropriate instrument, in the portfolio of Centres of Excellence in the NRF. This has led to several difficulties in view of the perception that the limited lifetime in the COE contracts will apply to NITheP: ambitious projects in theoretical physics are long term, innovative transformation processes are critically needed. Significant uncertainty about time scales has developed among the staff, and is affecting research. A solution has to be found within 6 months. This report provides several recommendations, which will take NITheP into the longer-term future.

None of the stakeholders at DST or NRF, or in the physics community itself, were in favour of closing the Institute now or after 5 years. To meet its mandate, NITheP must replace its current transformation practices by (1) adopting a bolder strategy and (2) making use of practices that have recently emerged as successful.

The Panel heard a vigorous call for the need of renewed attention to including rural and historically disadvantaged Universities. This implies a broadening of the scope within theoretical physics to place emphasis on topics already relevant within these departments.

The Panel members have analysed the aspects listed in the mandate, suggesting several detailed recommendations, supported by the evidence gathered by the Panel. We propose a decisive recommendation which addresses many of the recommendations at once, including the three main items of sustaining long-term quality, a new approach to transformation, and a more inclusive scope.

The investment in NITheP has been leveraged well by the participants in terms of Research Chairs, additional funding, transformative student funding and collaborative relationships. The international conferences and the visitor programme have put South African students in direct contact with the best physicists in the world and they have highlighted these opportunities specifically. The national workshops and events have moved around the country and the Panel met with a strong and active network of Associates from all universities, disadvantaged or not.

5.2. List of Recommendations

Recommendation 1: There is no doubt that the Panel finding is that NITheP should continue to operate and to grow. [action DST, NRF]

Recommendation 1.1: The lifetime of the National Institute of Theoretical Physics should be comparable to that of a National Facility to extract the most value from the investment. Continuation will depend on performance assessments at 5 year intervals. [action DST, NRF]
Recommendation 2: Move the “hub” node to UWC

Since transformation in terms of race and gender is fundamental to the scientific enterprise, a step change in improving transformation shall be made. The “hub” node, currently hosted by Stellenbosch University, should move to the University of the Western Cape. UWC is proposed for its HDU status, the pool of students available, its proven track record in successful transformation practice in physics, the presence of key staff, and the low cost of moving. [action NITheP]

Recommendation 2.1: For continuity, staff should be transferred to this node. [action NITheP]

Many of the Recommendations above can be implemented, at least partially, by strengthening NITheP’s relationship with HDUs. The Panel has considered the relative benefits of either opening a Fourth node, or moving the hub within the Western Cape. In view of the current constrained funding climate, the Panel makes Recommendation 2 above.

Recommendation 3: The pace of student transformation in terms of race and gender must be accelerated as a strategic priority. [action Director and Deputy Directors]

Recommendation 3.1: The internship scheme appears to be giving results and should be retained. [action NITheP]

Recommendation 3.2: NITheP should consider having fewer bursaries at higher values. With the available funds and hindsight over past experience, an optimum balance for success may be found. KPIs may be renegotiated. [action NITheP]

Recommendation 3.3: Funding decisions and transactions connected with the bursary programme must be completed by December of each year. [action NRF]

Recommendation 3.4: Active scouting for candidates should be undertaken by the Director and Deputy Directors from the beginning of the third undergraduate year for internships. Leaders should extend invitations personally to top candidates, and maintain personal contact throughout the student’s career. [action NITheP Director, Deputy Directors]

Recommendation 3.5: Within the next year, a source of undergraduate bursaries must be found to extend the pipeline coverage. [action NITheP]

Recommendation 3.6: A sponsor, possibly from the financial sector, should be found to support a pamphlet specifically addressing careers in Theoretical Physics. [action NITheP]

Recommendation 3.7: The Draft IUPAP Waterloo Charter on women in physics should be obtained as a source of through the South African Institute of Physics. [action NITheP]

Recommendation 4: Networks and awareness should be supported and expanded. [action NITheP]

Recommendation 4.1: The Associate network should be further expanded, with special attention to rural universities and universities near the Western Cape node. The existing success of the Associate publications and the advantages of the NITheP RFP should be exploited. [action NITheP]

Recommendation 4.2: The Chris Engelbrecht Summer School, Training Workshops and Research Workshops form a valuable part of the transformation of the physics landscape
and should be retained and strengthened, and sited at HDUs more frequently. [action NITheP]

Recommendation 4.3: Every effort should be made to sustain ASESMA, and to initiate at least one similar school in the broader NITheP scope, since this is a valuable and recognised tool in building physics in Africa. [action NITheP]

Recommendation 4.4: NITheP nodes should always be embedded in host environments with a vigorous student population. [NITheP]

Recommendation 4.5: The number of members between different nodes should be better balanced. [action NITheP]

Recommendation 5.1: NITheP, NRF and DST should react to these recommendations in a timely manner, i.e. within 6 months. [action NITheP, NRF, DST]

Recommendation 5.2: We encourage future attempts of involving Black South Africans and women in future Panels. [action NRF Reviews and Evaluations]
Acknowledgements

The Panel gratefully acknowledges the excellent support in the review by NRF. In particular, Anke Rädel anticipated the needs of the Panel in every respect, sourced additional documents in minutes, and provided support at the level of excellence that is required of a well-developed science infrastructure.

All the people of NiTheP opened the doors of the institution and invited inspection of any given detail of its functioning. In particular, administrative staff, especially René Kotze, organised precise and effective connections and introductions at all times for the days that the Panel was hosted by NiTheP.

We wish to thank our scribes, Robyn Arnold and Alice Ashwell, without whom the Panel would not have been able to verify items from the interviews.

The Panel would like to thank every person who made themselves available for the review, all of whom, without exception, provided frank and open observations in our interactions. Their time away from research is deeply appreciated. Many stakeholders were generous with the considerable time and attention they spent on the interaction. The Panel expresses special gratitude to Prof Bharuthram who firmly set the feet of the Panel on the intended path, and to all those who participated at short notice.
References


Appendix 1

TERMS OF REFERENCE

SECOND EVALUATION OF THE
NATIONAL INSTITUTE FOR THEORETICAL PHYSICS

1. Assignment title

Second evaluation of the National Institute for Theoretical Physics (NITheP)

2. Background

In August 2006 a contract was signed between the Department of Science and Technology (DST) and the National Research Foundation (NRF) to establish the National Institute for Theoretical Physics (NITheP). It was created to promote and coordinate research programmes and to foster education in theoretical physics. As theoretical physics is a fundamental scientific field that provides the conceptual framework for the natural sciences, NITheP also provides a support platform for all natural science disciplines within South Africa. Support is rendered in terms of bursaries, postdoctoral fellowships, high profile visits and workshops, internship programmes and outreach activities.

NITheP operates as a geographically distributed institute with headquarters at the Stellenbosch Institute for Advanced Studies (STIAS), and regional nodes at the University of the Witwatersrand (Wits) and the University of KwaZulu-Natal (UKZN).

It is governed by a management steering committee mandated by legally binding agreements between the host institution, i.e. Stellenbosch University (SU), the funder, i.e. DST, and the implementing agency, i.e. NRF.
During the inception and bedding down period from August 2006 until August 2008, NITheP was managed by an interim director and management committee with DST and NRF representation. This committee reported to the Vice-President: Research Infrastructure and the National Research Facilities of the NRF. After the establishment of NITheP in May 2008 and the appointment of a full-time director and management in August 2008, this situation changed and NITheP has since been managed as a Centre of Excellence (CoE) with reporting line to the Executive Director: Knowledge Fields Development and since 2013 to the Executive Director: Research Chairs and Centres of Excellence (RCCE) of the NRF. RCCE also manages the DST-NRF Centres of Excellence. By definition, Centres of Excellence are physical or virtual centres of research which concentrate existing capacity and resources to enable researchers to collaborate across disciplines on long-term projects that are locally relevant and internationally competitive in order to enhance the pursuit of research excellence and capacity development.

3. **Assignment Principal**

5.3.

5.4. The Assignment Principal is the NRF represented by the Deputy CEO: Research and Innovation Support and Advancement.

5.5. The role of the Assignment Principal will be to:

5.6.

- Approve the terms of reference (ToR);
- Approve the budget;
- Approve the members of the international evaluation panel;
- Consider and suggest suitable interviewees for the evaluation panel;
- Approve the evaluation programme and time frame for the evaluation process;
- Accept the draft and final report by the evaluation panel;
- Accept the response of the management of NITheP to the report;
- Ensure that the evaluation report addressed the ToR.

4. **Service provider**

The Reviews and Evaluations (RE) Directorate of the NRF will act as the service provider to manage the evaluation process. The responsibilities of RE will be to:

- Develop the terms of reference for the evaluation;
- Prepare the letters of invitation for the approved members of the evaluation panel for the Assignment Principal’s signature and to distribute them;
- Develop a programme for the evaluation, including a budget;
• Coordinate and manage the entire evaluation process, including logistics;
• Provide support to the evaluation panel;
• Source the necessary documents stipulated in the Appendix with the help of the staff of RCCE and NITheP and make them available to the evaluation panel six weeks prior to the commencement of the evaluation in South Africa;
• Receive the draft and final report by the evaluation panel and submit them to the Assignment Principal for further action;
• Place the final evaluation report and the management response by NITheP on the NRF website within one month of the acceptance of the evaluation report by NRF management.

5. Purpose of the evaluation

The purpose of the evaluation will be twofold:

5.1 To assess the overall performance of NITheP from 1 April 2011 to 31 March 2016 in terms of its objectives and mandate clustered around the key performance areas as stated in the evaluation dimensions below (see Item 7); and

5.2 To make recommendations to enhance:

- NITheP’s performance; and
- the funding model to ensure sustainability of NITheP as a CoE.
6. **Scope of the evaluation**

The focus of the evaluation will be a summative retrospective view of NITheP covering the period 1 April 2011 to 31 March 2016.

The prospective view will cover recommendations to enhance NITheP, its prospects as well as its sustainability.

5.7.7. **Evaluation dimensions**

The panel is requested to assess the

7.1 performance of the host institution in

- implementing and managing NITheP to date;
- providing administrative and other logistical support for NITheP operations;

7.2 extent to which the recommendations of the 2011 evaluation have been implemented;

7.3 future plans of NITheP;

7.4 overall performance of NITheP in terms of its mandate clustered around the key performance areas (KPAs) given below:

7.4.1 **Research**

The work should be focused on the creation and development of new knowledge and/or technology.

7.4.2 **Education and training**
Human resource development is to be done through masters and doctoral programmes, post-doctoral support, joint ventures in student training, etc. In creating, broadening and deepening research capacity, the Institute needs to pay particular attention to racial and gender disparities.

7.4.3 **Information brokerage**

NITheP is to provide access to a highly developed pool of knowledge, maintaining data bases, promoting knowledge sharing and knowledge transfer, etc.

7.4.4 **Networking**

NITheP is expected to actively collaborate with reputable individuals, groups and institutions. Equally it must negotiate and help realise national, regional, continental and international partnerships, etc.

7.4.5 **Service rendering**

NITheP is to provide information, analysis, policy, and other services, including informed and reliable advice to government, business and civil society.

7.4.6 **Management of NITheP** in terms of:

- leadership;
- staffing;
- commitment of institution/s hosting the CoE;
- location of the CoE;
- funding and future plans.

8. **Evaluation structure and process**

- A panel consisting of three members (i.e., two from abroad and one from South Africa) with appropriate experience of innovation systems and knowledge of the broad disciplines in the area of Theoretical Physics will be appointed for the evaluation. The panel will be requested to compile a report.

- The panel will base its evaluation on the self-evaluation report of NITheP as well as interviews with a selection of critical stakeholders.
• The resource documents for the evaluation listed in the Annexure will be made available to the panel well in advance of the commencement of the evaluation.

• The service provider will draw up a programme for the evaluation in consultation with the Assignment Principal, the management of the DST-NRF CoE Funding Instrument within RCCE as well as NITheP. The panel will have the opportunity to interrogate the proposed programme and to recommend amendments and additions should the need arise.

• The panel will have the opportunity to interview a selection of relevant stakeholders (beneficiaries), staff of NITheP, DST and NRF representatives as well as selected NITheP steering committee members and students.

• The logistical arrangements for the reviewers will be made by the staff of the RE Directorate. All arrangements for the on-site programme, including the logistical arrangements for the interviewees invited to interact with the reviewers, will be made by NITheP.

• The evaluation panel will decide on and pursue its own line of questioning during interviews.

9. Deliverables by:

9.1 NITheP

9.1.1 A self-evaluation report by NITheP for transmission to the evaluation panel at least eight weeks prior to the commencement of the evaluation programme in South Africa. The report should address the terms of reference and should cover the period from 1 April 2011 to 31 March 2016 and should not exceed 40 pages with annexures.

9.1.2 Names, affiliations and contact details of possible reviewers for consideration on the template to be provided by RE.

9.1.3 List of documents considered to be essential reading for the evaluation panel and other documentation which should be accessible to reviewers during the evaluation. Documents listed on the Annexure to the terms of reference for the evaluation which are not in the public domain are to be supplied to RE for onward transmission to the evaluation panel seven weeks in advance of the commencement of the programme in South Africa.
9.1.4 Details of stakeholders on the template to be provided by RE; Appointments/discussions with stakeholders will be arranged by NITheP in conjunction with the NRF RE Directorate to facilitate the task of the evaluation panel. NITheP is therefore requested to supply the names of stakeholders with whom it has interacted since inception, will be interacting in the future and should be interacting but for some reason has not been able to do so yet. It would be helpful, if the names could be clustered under the headings research, education and training, information brokerage, networking, service rendering and management and if they could be ranked according to importance.

9.1.5 Concise information on the funds received by NITheP from national (including all sources in the NRF) and international sources per year for the period under review.

9.1.6 A written response to the final evaluation report. This will also be placed on the NRF website.

9.2 Evaluation panel

- Verbal feedback to the Assignment Principal, NITheP Director, members of the NITheP steering committee as well as representatives of DST and NRF;

- Draft report on completion of the stakeholder interviews; and

- Final report within two weeks of completion of the stakeholder interviews. The report should include:
  - an executive summary;
  - background to the evaluation;
  - evaluation questions that were addressed;
  - key findings;
  - recommendations;
  - conclusions; and
  - appendices containing, e.g., terms of reference, persons interviewed, etc.

10. Time frame

Preparations for the evaluation will commence in 2016 and the on-site programme involving the reviewers will take place during 2016/17 depending on the availability of suitable reviewers.

11. Budget
The service provider will submit a budget for the evaluation to the management of the DST-NRF CoE Funding Instrument for approval and payment.

The ToR may be amended should the need arise.
DOCUMENTS FOR THE EVALUATION PANELS

ESSENTIAL READING

- Self-assessment report by the National Institute for Theoretical Physics (NITheP)
- Annexures to above NITheP Self-evaluation report:
  - SUPD4: Management response to 2011 review report
  - SUPD5: Bibliometric analysis of NITheP publications 2008-2014
  - SUPD12: NITheP Business Plan 2017-2021
- Summary of Income and Expenditure of NITheP
- NITheP Proposal: A National Theoretical Physics Facility for South Africa, November 2004
- NITheP Research Strategy
- NITheP Business Plan 2007-2011
- NITheP Business Plan 2012-2016
- NITheP Business Plan 2017-2021

ADDITIONAL READING

- Annexures to NITheP Self-assessment report:
  - SUPD1: Agenda of Evaluation Committee meetings
  - SUPD2: Surveys
  - SUPD6: Human Capital and the South African Knowledgebase
  - SUPD7: List of Associates (as at 31.3.2016)
  - SUPD8: Reports received on Workshops, Visitors, Mobility
  - SUPD9: Minutes of Management Committee, Scientific Advisory Committee and Steering Committee Meetings
  - SUPD11: Staff assessment framework and Staff Assessments
- NITheP Annual Report 2011
- NITheP Annual Report 2012
- NITheP Annual Report 2013
- NITheP Annual Report 2014
- NITheP Annual Report 2015
- NRF Strategy 2020
- White Paper on Science and Technology
- Review of White Paper on Science and Technology (if available yet)
- South Africa’s National Research and Development Strategy
- OECD report on the National System of Innovation in South Africa
- Ten-year Innovation Plan of the Department of Science and Technology

END
Appendix 2

PROGRAMME

EVALUATION OF THE NATIONAL INSTITUTE FOR THEORETICAL PHYSICS (NITheP)

REVIEW PANEL MEMBERS:

- Prof Thierry Dauxois, École Normale Supérieure, Lyon, France
- Dr Igle Gledhill, (Convener), Council for Scientific and Industrial Research, South Africa
- Prof Antal Jevicki, Brown University, USA (participating remotely)

Sunday, 5 March 2017 (Johannesburg)

Arrival of review panel members at Protea Hotel Johannesburg Wanderers

17:30 – 20:00 Venue: Protea Hotel Johannesburg Wanderers (see address below)
(incl. supper)

Welcome and briefing of reviewers by Assignment Principal Representative

Dr Rocky Skeef, NRF Executive Director: Reviews and Evaluations (RE)

Also present:

Ms Anke Rädel, NRF Professional Officer: RE

Accommodation: Protea Hotel Johannesburg Wanderers, Cnr Corlett Drive and Rudd Road 2196 Illovo, tel. +27 11 770-5500 http://www.marriott.com/hotels/travel/jnbwa-protea-hotel-wanderers/?scid=bb1a189a-fec3-4d19-a255-54ba596febe2

Monday, 6 March 2017 (Johannesburg/Durban)

09:00 – 10:30 Venue: Physics Video Conferencing Room, P102, Physics Building, University of the Witwatersrand (Wits)
Session for panel members to prepare their strategy and to allocate tasks among themselves

10:00 – 10:30 Refreshments

10:30 – 11:15 Venue: NiTheP Board Room, Mezzanine floor, Physics Building, Wits

Department of Science and Technology
Dr Daniel Adams, Chief Director: Basic Sciences and Infrastructure (by teleconference)
Dr Phethiwe Matutu, Chief Director: Human Capital and Science Promotion (by teleconference)

11:15 – 12:15 Venue: NiTheP Board Room, Mezzanine floor, Physics Building, Wits

NiTheP Management Committee Members
Prof Alan Cornell, NiTheP Associate Representative and ex NiTheP staff member
Prof Francesco Petruccione, NiTheP Deputy Director, UKZN
Prof João Rodrigues, NiTheP Deputy Director, Wits
Prof Frikkie Scholtz, NiTheP Director, Stellenbosch University

12:15 – 12:45 Venue: NiTheP Board Room, Mezzanine floor, Physics Building, Wits
(incl. lunch)

NRF NiTheP Management representative
Dr Andrew Kaniki, Executive Director: Knowledge Fields Development (by teleconference)

13:15 – 14:00 Venue: Physics Board Room, P215, Physics Building, Wits

University of the Witwatersrand: Research Management
Prof Helder Marques, Dean: Faculty of Science
Prof Zeblon Vilakazi, Deputy Vice-Chancellor: Research

14:00 – 15:00 Venue: Physics Board Room, P215, Physics Building, Wits

Parallel session 1: NITheP Associates and staff members: Gauteng/North-West/Limpopo

Dr Amare Abebe, NITheP Junior Associate, North-West University
Prof Kevin Goldstein, NITheP Associate and ex Associate Representative, Wits
Dr Joseph Kirui, NITheP Strategic Associate and Steering Committee Member, also Head: Physics Department, University of Venda (UV)
Dr Eric Maluta, NITheP Junior Associate and co-organiser of Summer School, UV
Dr Thuto Mosuang, NITheP Associate and Head of Dept, University of Limpopo

14:00 – 15:00 Venue: NITheP Boardroom, Mezzanine floor, Physics Building, Wits

Parallel session 2: Students under supervision of NITheP staff/NITheP bursary holders/NITheP staff

Mr Gerhard Hamsen, PhD student, Wits (NITheP supervised student)
Dr Mukesh Kumar, Postdoctoral fellow, Wits (NITheP staff member)
Mr Yannick Mvondo-She, PhD student, UP (NITheP bursary holder)
Dr Catherine Whiting, Postdoctoral fellow, Wits NITheP node (NITheP staff member)

15:00 – 15:30 Refreshments

18:00 – 19:05 Flight BA 6221 Johannesburg/Durban


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Tuesday, 7 March 2017 (Durban/Stellenbosch)
Venue: School of Chemistry and Physics, H-Block, 3rd Floor, Chemistry boardroom, Westville campus, University of KwaZulu-Natal (UKZN)

09:00 – 10:00  University of KwaZulu-Natal: Research Management

Prof Deresh Ramjugernath, Deputy Vice-Chancellor: Research

Prof Ross Robinson, Dean and Head: School of Chemistry and Physics

10:00 – 10:15  Refreshments
10:15 – 11:15 **NITheP Associates: University of KwaZulu-Natal**

Dr Cynthia Chiang, NITheP Associate

Prof Jonathan Sievers, NITheP Associate (by Skype)

Dr Ilya Sinayskiy, NITheP Associate and ex staff member, UKZN

11:15 – 12:15 **Staff/students at UKZN under supervision of NITheP staff**

Dr Nkosinathi Dlamini, Lecturer, Physics & ex-NITheP bursary holder

Dr Yaseera Ismail (externally funded Postdoc)

Dr Vinayak Jagadish, Postdoctoral fellow & NITheP staff member, UKZN NITheP node

Mrs Neli Mncube, Administration

Mr Henry Qwabe, NITheP supervised MSc student

14:40 – 16:50 Flight BA 6312 Durban/Cape Town


Wednesday, 8 March 2017 (Stellenbosch)

**Venue:** STIAS, Wallenberg Research Centre, 10 Marais Street, Stellenbosch, 33°56'6.36"S 18°52'24.20"E

09:00 – 10:00 Venue for the day: NITheP Seminar Room

**Research Management in the Cape**

Dr Rob Adam, Director: South African Square Kilometre Array (SKA) Project

Prof Eugene Cloete, Deputy Vice-Chancellor: Research, Stellenbosch University (SU)

Prof Louise Warnich, Dean: Faculty of Science, SU
10:00 – 10:30 Refreshments

10:30 – 12:00 **NITheP Associates and Steering Committee members: Western and Eastern Cape**

Prof Nigel Bishop, NITheP Associate, Rhodes University (by teleconference plus written submission)

Prof Barry Green, NITheP Strategic Associate, Director: AIMS

Dr Will Horowitz, NITheP Associate, University of Cape Town (UCT)

Prof Herbert Weigel, NITheP Associate, SU (possibly joining at 11:00)

Prof Konstantinos Zoubos, NITheP Associate and Supervisor of the two Bursary workshop prizewinners, University of Pretoria (UP)

12:00 – 13:00 **Staff members at SU NITheP node**

Dr Fabio Cinti, Researcher

Prof Michael Kastner, Chief Researcher

Mrs René Kotze, Administration

Ms Monique Louw, Financial Officer

Dr Daniel Nickelsen, Postdoctoral fellow

Prof Hugo Touchette, Chief Researcher

13:00 – 14:00 Lunch

14:00 – 15:00 **Students in the Western Cape under supervision of NITheP staff/NITheP bursary holders**

Ms Isobel Kolbe, PhD student, UCT (NITheP bursary holder)

Mr Ryan Sweke, PhD student (ex NITheP supervised student and ex Bursary holder and 2013 s2A3 medal winner)

Mr Phillip Uhrich, MSc student, SU (NITheP supervised student)

Mr Paul Williams, PhD student, SU (NITheP bursary holder)

15:00 – 15:30 Refreshments
15:30 – 16:15 Convener of 2011 Review of NITheP
Prof R Bharuthram, Executive Special Projects, Office of the Vice-Chancellor,
University of the Western Cape & Convener of 2011 Review of NITheP

16:45 – 17:00 Staff/students at UKZN under supervision of NITheP staff (cont.)
Dr Adriana Marais, Head of Innovation at SAP Africa, previously a NITheP PhD bursary holder with the Quantum Research Group at UKZN (by Skype plus written submission)

Accommodation: Protea Hotel, Stellenbosch

Thursday, 9 March 2017 (Stellenbosch)

09:00 – 09:45 NRF NITheP Management representative (cont.)
Dr Makobetsa Khati, Executive Director: Research Chairs and Centres of Excellence (by teleconference at tel. 012 481 4022)

10:00 – 10:15 Research Management in the Cape (cont.)
Dr Faiçal Azaiez, Director: iThemba Laboratory for Accelerator Based Science (by Skype Azaieza)

Representatives of Physics Community
10:30 – 11:15 Prof Robert Lindsay, Dept. of Physics, University of the Western Cape (UWC) (by teleconference)
11:30 – 12:00 Prof Richard Mace, Dept of Physics, University of KZN (by teleconference)

12:20 – 12:45 NRF Executive Management representative
Dr Nithaya Chetty, NRF Deputy CEO: Astronomy (by teleconference)

13:00 – 14:00 Lunch
14:00 – 14:45 NITheP Associates and Steering Committee members: Western and Eastern Cape (cont.)

Prof Azwinndini Muronga, NITheP Steering Committee member & President: South African Institute of Physics & Executive Dean: Faculty of Science

Nelson Mandela Metropolitan University (by teleconference)

14:45 – 15:15 Refreshments

15:15 – 16:30 Preparation of review report

Accommodation: Protea Hotel, Stellenbosch
Friday, 10 March 2017 (Stellenbosch)

09:00 – 09:30  **Representatives of Physics Community (cont.)**  
Prof Ahmed Bawa, Chief Executive Officer (CEO): Universities South Africa (by teleconference)

09:30 – 10:00  **NRF Executive Management representative (cont.)**  
Dr Gansen Pillay, NRF Deputy CEO: Research and Innovation Support and Advancement (by teleconference)

10:00 – 10:30  Refreshments

10:30 – 11:30  Preparation of review report

11:30 – 12:00  **Representatives of Physics Community (cont.)**  
Prof Sunil Maharaj, Dept of Mathematics, UKZN (by teleconference)

12:00 – 13:00  Preparation of review report

13:00 – 14:00  Lunch

14:00 – 14:45  **NITheP Associates and Steering Committee members: Western and Eastern Cape (cont.)**  
Prof Roy Maartens, Square Kilometre Array Chair & NITheP Associate and ex Steering Committee member, UWC by teleconference

14:45 – 16:30  Preparation of review report and end of on-site review
Appendix 3

DISCUSSIONS BY EVALUATION PANEL WITH STAKEHOLDERS FOR THE

EVALUATION OF THE NATIONAL INSTITUTE FOR THEORETICAL PHYSICS (NITheP)

Department of Science and Technology
Dr Daniel Adams, Chief Director: Basic Sciences and Infrastructure (by teleconference)
Dr Phethiwe Matutu, Chief Director: Human Capital and Science Promotion (by teleconference)

Research Management
Dr Rob Adam, Director: South African Square Kilometre Array Project
Dr Faïçal Azaiez, Director: iThemba Laboratory for Accelerator Based Science (by Skype)
Prof Eugene Cloete, Deputy Vice-Chancellor: Research, Stellenbosch University
Prof Helder Marques, Dean: Faculty of Science, University of the Witwatersrand
Prof Deresh Ramjugernath, Deputy Vice-Chancellor: Research, University of KwaZulu-Natal
Prof Ross Robinson, Dean and Head: School of Chemistry and Physics, University of KwaZulu-Natal
Prof Zeblon Vilakazi, Deputy Vice-Chancellor: Research, University of the Witwatersrand
Prof Louise Warnich, Dean: Faculty of Science, Stellenbosch University

NITheP Management Committee Members
Prof Alan Cornell, NITheP Associate Representative and ex NITheP staff member, Wits
Prof Francesco Petruccione, NITheP Deputy Director, University of KwaZulu-Natal
Prof João Rodrigues, NITheP Deputy Director, University of the Witwatersrand
Prof Frikkie Scholtz, NITheP Director, Stellenbosch University

NITheP Associates and staff members
Dr Amare Abebe, NITheP Junior Associate, North-West University
Prof Nigel Bishop, NITheP Associate, Rhodes University (by teleconference plus written submission)
Dr Cynthia Chiang, NITheP Associate, University of KwaZulu-Natal
Prof Kevin Goldstein, NITheP Associate and ex Associate Representative, University of the
Witwatersrand

Prof Barry Green, NiTheP Strategic Associate. Director: African Institute for Mathematical Sciences

Dr Will Horowitz, NiTheP Associate, University of Cape Town

Dr Joseph Kirui, NiTheP Strategic Associate and Steering Committee Member, also Head: Physics Department, University of Venda

Prof Roy Maartens, Square Kilometre Array Chair & NiTheP Associate and ex Steering Committee member, UWC (by teleconference/Skype)

Dr Eric Maluta, NiTheP Junior Associate and co-organiser of Summer School, University of Venda

Dr Thuto Mosuang, NiTheP Associate and Head of Dept, University of Limpopo

Prof Azwinndini Muronga, NiTheP Steering Committee member & President: South African Institute of Physics & Executive Dean: Faculty of Science, Nelson Mandela Metropolitan University (by teleconference)

Prof Jonathan Sievers, NiTheP Associate, University of KwaZulu-Natal (by Skype)

Dr Ilya Sinayskiy, NiTheP Associate and ex staff member, University of KwaZulu-Natal

Prof Herbert Weigel, NiTheP Associate, Stellenbosch University

Prof Konstantinos Zoubos, NiTheP Associate and Supervisor of the two Bursary workshop prizewinners, University of Pretoria

Students under supervision of NiTheP staff/NiTheP bursary holders

Dr Nkosinathi Dlamini, Lecturer, Physics & ex-NiTheP bursary holder, University of Kwa-Zulu Natal

Mr Gerhard Hamsen, PhD student, Wits (NiTheP supervised student)

Dr Yaseera Ismail (externally funded Postdoc), University of Kwa-Zulu Natal

Dr Vinayak Jagadish, Postdoctoral fellow & NiTheP staff member NiTheP node, University of Kwa-Zulu Natal

Ms Isobel Kolbe, PhD student, University of Cape Town (NiTheP bursary holder)

Dr Mukesh Kumar, Postdoctoral fellow, Wits (NiTheP staff member)

Dr Adriana Marais, Head of Innovation at SAP Africa, previously a NiTheP PhD bursary holder with the Quantum Research Group at University of Kwa-Zulu Natal (by Skype plus written submission)

Mrs Neli Mncube, Administration, NiTheP at University of Kwa-Zulu Natal

Mr Yannick Mvondo-She, PhD student, UP (NiTheP bursary holder)

Mr Henry Qwabe, NiTheP supervised MSc student, University of Kwa-Zulu Natal
Mr Ryan Sweke, PhD student (ex NITheP supervised student and ex Bursary holder and 2013 s2A3 medal winner), University of Kwa-Zulu Natal

Mr Phillip Uhrich, MSc student, Stellenbosch University (NITheP supervised student)

Mr Paul Williams, PhD student, Stellenbosch University (NITheP bursary holder)

**Staff members at Stellenbosch University NITheP node**

Dr Fabio Cinti, Researcher

Prof Michael Kastner, Chief Researcher

Mrs René Kotze, Public Relations Officer

Ms Monique Louw, Financial Officer

Dr Daniel Nickelsen, Postdoctoral fellow

Prof Hugo Touchette, Chief Researcher

**Representatives of Physics Community**

Prof Ahmed Bawa, Chief Executive Officer (CEO): Universities South Africa (by teleconference)

Prof R Bharuthram, Executive Special Projects, Office of the Vice-Chancellor, University of the Western Cape & Convener of 2011 Review of NITheP

Prof Robert Lindsay, Dept. of Physics, University of the Western Cape (UWC) (by teleconference)

Prof Richard Mace, Dept of Physics, University of KZN (by teleconference)

Prof Sunil Maharaj, Dept of Mathematics, UKZN (by teleconference)

**Representatives of the National Research Foundation**

Dr Nithaya Chetty, NRF Deputy CEO: Astronomy (by teleconference)

Dr Andrew Kaniki, Executive Director: Knowledge Fields Development (by teleconference)

Dr Makobetsa Khati, Executive Director: Research Chairs and Centres of Excellence (by teleconference)

Dr Gansen Pillay, NRF Deputy CEO: Research and Innovation Support and Advancement (by Skype)

Dr Rocky Skeef, NRF Executive Director: Reviews and Evaluations
Appendix 4

Additional notes on the Review Process

The Panel would like to note the following.

Prof. Antal Jevicki was denied boarding the plane for South Africa on visa grounds. At the Briefing Session on 2 June 2017, the question was addressed of whether the review should go ahead under these circumstances. On enquiry, Prof Gansen Pillay gave his permission, and all the Panel members agreed to work to overcome this difficulty. Prof Jevicki made himself available over Skype and telephone, as well as examining the documentation in detail, and the remaining Panel members would like to express their gratitude to him for altering his working hours so that he could join the meetings, and for his wisdom and advice.

During the Panel Review, serious concern was expressed by one stakeholder that

1. the Panel included no black South African,
2. about eight SA Theoretical Physicists, predominantly black, were not on the programme.

The Panel, through the quick action of the NRF staff, was fortunate in being able to engage with 7 of these 8 people, of whom 5 are Associates, and include their responses in their findings throughout this report. Some had been contacted but had replied that they were unavailable, and all were generous in responding at short notice to the call to participate. The Panel thanks the stakeholder for his intervention.
Appendix 5

Acronyms and Abbreviations

AIMS  African Institute of Mathematical Sciences
APS  American Physical Society
ASESMA  African School Series on Electronic Structure Methods and Applications
CERN  European Organization for Nuclear Research
COE  Centre of Excellence
DST  Department of Science and Technology, SA
FHU  Fort Hare University
IBS  Institute for Basic Science
HDU  Historically Disadvantaged University
ICSU  International Council for Science
ICTP  International Centre for Theoretical Physics
iThemba LABS  iThemba Laboratory for Accelerator-Based Sciences
IUPAP  International Union of Pure and Applied Physics
KIAS  Korea Institute of Advanced Study
KITP  Korea Institute of Theoretical Physics
KPI  Key Performance Index
KZN  KwaZulu-Natal
LIGO  Laser Interferometer Gravitational-Wave Observatory
MatSci  Materials Science
MIT  Massachusetts Institute of Technology
NDP  National Development Plan
NITheP  National Institute of Theoretical Physics
NRF  National Research Foundation
NWU  North-West University
R&D  Research and Development
RFP  Request for Proposal
SA  South Africa
SAASTA  South African Agency for Science and Technology Advancement
SARCHI  South African Research Chairs Initiative
SDG  Sustainable Development Goal
SKA  Square Kilometre Array
STEM  Science, Technology, Engineering and Mathematics
STIAS  Stellenbosch Institute of Advanced Studies
SU  Stellenbosch University
U.  University
UCT  University of Cape Town
UKZN  University of KwaZulu-Natal
UL  University of Limpopo
UP  University of Pretoria
USA  United States of America
UV  University of Venda
UWC  University of the Western Cape
Wits  University of the Witwatersrand
WSU  Walter Sisulu University

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