

Inquiry into Australia's international research collaboration

Submission on Australia's international research collaboration via international centres and institutes: the need for a *National Institute for Theoretical Physics (NITP)*

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1. The nature and extent of existing international research collaborations.

Theoretical physics is one of the most important disciplines in science, as it creates a universal language for the description of physical phenomena and forms a basis for school and tertiary education in physics. About one quarter of all Nobel prizes in physics have been awarded to theoretical physicists.

The discipline does not require any major equipment and infrastructure and traditionally displays a high degree of international collaboration which has rapidly increased due to the dramatic improvements in electronic communication (internet) over the last two decades.

To a large extent, research in theoretical physics is initiated and coordinated internationally by several major centres (or institutes) of theoretical physics, running short term (3-12 month) topical workshop programs led by the most prominent scientists in a given field. These programs bring world leading experts together with young scientists and research students.

Among these world centres of theoretical physics are those listed in Appendix A.

Australian theoretical physicists are well known internationally for expertise and leadership in their niche areas of activity. They regularly participate in activities organised by these centres, often having the opportunity to organise topical workshop programs.

A recent development at the university scale is the Perimeter Institute (PI) has signed an agreement with three Australian universities to strengthen collaborative research in quantum foundations. The new partnership, called the Perimeter Institute -- Australia Foundations Collaboration (PIAF), unites PI with the University of Sydney, the University of Queensland, and Griffith University, in a common effort to get at the heart of quantum mechanics.

2. The benefits to Australia from engaging in international research collaborations.

Among the chief benefits of engaging in research collaboration through participation in international centres and institutes for theoretical physics is that such participation opens up

easy access to world leading researchers and the most recent developments across a broad spectrum of theoretical activities. In this sense Australian researchers have immediate access to the “intellectual potential” of the country hosting a centre which is maintained by the constant flow of the most active and high profile scientists in various fields.

Conversely, if Australia were to be a focal point of such activities through the formation of a National Institute, then Australian researchers would benefit from access to the “intellectual potential” of the visiting high profile scientists. In this way Australian researchers gain exposure for their work along with an enhanced ability to choose and develop leading edge research topics. International exposure of this kind will also be a huge advantage for Australian early career researchers and students.

Such a National Institute would attract the most talented young researchers from around the world. Some of them may choose to stay permanently in the country. Centres of this kind are an inexpensive way to bring expertise to the country. The centres usually only pay modest local expenses and partially cover travel expenses of visiting scientists; their base salary is still paid by overseas institutions. From this point of view, the National Institute would arguably be the most cost-effective scheme for attracting talent from abroad.

Some countries have already appreciated the above benefits, others are starting their attempts to get a share of the precious time of world leading theoretical physicists. Australia is ideally suited to the formation of a National Institute and can provide attractive and comfortable infrastructure to visitors. Such an institute has the potential to become a major international centre serving the neighbouring region. It would also be the focal point for contact with the established centres for theoretical physics, with the capacity to run joint programs of activity.

3. The key drivers of international research collaboration at the government, institutional and researcher levels.

The key driver for international research collaboration at the individual researcher level is international travel, usually funded from ARC project grants. Various ARC Centres of Excellence, also provide support for international research collaboration of relevance to their specialist activity.

In 1993 the National Committee for Physics of the Australian Academy of Science in its strategic policy document “Physics: A Vision for the Future” recommended, inter alia, the establishment of an Australian National Institute:

“The National Institute for Theoretical Physics should be established to coordinate a research network for theoretical physics. This would involve universities, public sector research bodies and industry. It would organise formal visitor programmes and workshops and consolidate the theoretical base of experimental research programmes.”

However apart from a short pilot programme funded by the Australian Research Council (ARC) in 1994-95, and small scale activities funded at various times by The University of Adelaide, The Australian National University, The University of Melbourne, The University of Queensland and more recently Macquarie University, the National Institute has not been established so far.

There is strong national support within the Australian theoretical physics community for the

establishment of a National Institute. A National Planning Committee was formed and submitted a report to the Australian Academy of Science National Committee for Physics (Appendix B). A special interest group for theoretical physics has been set up within the Australian Institute of Physics membership.

4. The impediments faced by Australian researchers when initiating and participating in international research collaborations and practical measures for addressing these.

The main impediments faced by Australian researchers are geographical isolation, low density of researchers and absence of critical mass. These factors result in an insufficient volume of seminars, lectures and discussion, which are all vital ingredients for the progress of theoretical physics.

The number of visiting scientists routinely giving seminars in European and North American Universities is a few orders of magnitude higher than in Australia. Moreover, their scientists are geographically closer to the major centres of theoretical physics as listed in Appendix A. Australian researchers have to travel great distances to participate in international research collaboration and to keep in touch with and contribute to the latest developments. But in doing this, Australian researchers add to the "intellectual potential" of other countries.

A practical and cost effective measure for addressing these impediments is the establishment of a fully funded National Institute for Theoretical Physics. The NITP would serve to enhance theoretical activity in Australia and also bring significant intellectual capital to Australia for the national benefit. Yet the main obstacle is that there are currently no mechanisms or funding schemes to support the establishment of a NITP in Australia.

5. Principles and strategies for supporting international research engagement.

It is thus clear that a mechanism needs to be developed to support international research engagement through a fully funded NITP. Many of the world centres for theoretical physics have been established with the generous help of private benefactors. However, government encouragement and financial support remains an essential ingredient in the overwhelming success of such centres. The establishment of a NITP will greatly enhance Australia's international reputation and capacity to engage in and to lead international research at the highest level.

Appendix A

List of major world centres of theoretical physics:

Asia-Pacific Centre for Theoretical Physics (APCTP), Pohang, Korea

<http://www.apctp.org>

The Abdus Salam International Center for Theoretical Physics (ICTP), Trieste, Italy

<http://www.ictp.it/>

Isaac Newton Institute for Mathematical Sciences, Cambridge, UK

<http://www.newton.ac.uk/>

Kavli Institute for Theoretical Physics (KITP), Santa Barbara, USA

<http://www.kitp.ucsb.edu/>

Pacific Institute of Theoretical Physics, Vancouver, Canada

<http://pitp.physics.ubc.ca/>

Perimeter Institute for Theoretical Physics, Waterloo, Canada

<http://www.perimeterinstitute.com/>

Appendix B

Report to the Australian Academy of Science National Committee for Physics, Nov 2007.

On rejuvenation of the National Institute for Theoretical Physics (NITP)

Report to the Australian Academy of Science

The National Committee for Physics

November 2007

1. Terms or Reference

2. Recommendations

3. Current activities

4. Background Material

1. Brief history of the NITP.
2. Other Centres/Institutes for Theoretical Physics.
3. Summary of web survey data capture.
4. The Asia Pacific Center for Theoretical Physics.

1. Terms or Reference

In 2006 the National Committee for Physics of the Australian Academy of Science, that time chaired by Prof G Milburn, has decided to undertake an informal review of the NITP, with the aim of reviewing its past, current and future operations and its current host location. There are a number of imperatives for re-establishing the NITP, not least of which is providing a national point of contact for the number of flourishing overseas centres and institutes, as listed further below.

To this end, a NITP National Planning Committee has been set up:

Co-Convenors: Murray Batchelor, Tony Williams and Vladimir Bazhanov

Members: Igor Bray, Peter Drummond, Peter Jarvis, Jason Twamley, Ray Volkas

With Terms of Reference:

To propose some alternative models of the NITP and suggested mechanisms for achieving those models for discussion by a meeting of the theoretical physicists of Australia to be held at AIP Congress in Brisbane, with the expectation that agreement will be reached on the next steps to be taken.

The present report summarizes view and recommendations of the Australian theoretical physics community expressed at the meeting at the AIP congress in Brisbane, as well at two preliminary meetings held in September 2006 during (i) the 10 year CSSM celebration Workshop at the University of Adelaide and (ii) the Meeting of the Australian Mathematical Society at Macquarie University. The report also summarizes responses from a small web-based survey made by Jason Twamley.

2. Recommendations

Recommendations and suggestions coming from the meetings are summarized below. It was agreed that the NITP National Planning Committee (NPC) would:

1. To establish a virtual NITP and develop its web page. This virtual NITP will serve as a first port of call for all theoretical physics based activities in Australia. It should also serve to highlight those activities

2. Over time would reconstitute the National Advisory Committee of the NITP perhaps in the form of an NITP Board with a view to being representative of region and discipline;
3. Summarise the key anticipated activities of a rejuvenated NITP agreed at the meeting and submit those to the National Committee for Physics for approval;
4. Once the National Committee for Physics approval has been obtained the NPC would begin a consultative process to establish an appropriate NITP operational structure;
5. In the meantime the NPC would continue to act in the role of interface between the wider theoretical physics community and the National Committee for Physics.

It was agreed that the key activities of the rejuvenated NITP would include:

1. Plan, coordinate and facilitate Summer Schools and other Schools on behalf of the theoretical physics community;
2. Coordinate and promote cooperation across the full range of Australian theoretical physics activities;
3. Act as the single point of contact for like overseas bodies such as the APCTP, Perimeter Institute, etc.;
4. Investigate the possibility of developing shared coursework at the honours and/or postgraduate level and the possibility of remote delivery of these where possible and appropriate;
5. Establish an NITP web page and construct a repository for shared coursework materials. Formulate a statement on what theoretical physics is and its potential benefits;
6. Fly a small set of lecturers around between NITP nodes and other sites to give one-day courses at multiple sites;

7. Look for long-term sources of funding for the NITP. Lobby politicians and the relevant bodies on behalf of the theoretical physics community – e.g., one suggestion was in promoting the Bologna/Melbourne model of physics education;
8. Provide and promote a list of experts available for consultation on the full range of topics of relevance to the NITP community;
9. Provide a coherent communication and marketing service for theoretical physicists;
10. Collect modest contributions from the various NITP nodes to provide a small amount of central NITP funding;
11. Develop a Strategic Long-Range Plan for Theoretical Physics in Australia.

3. Current activities.

1. Vladimir Bazhanov is currently constructing the virtual NITP web page with capabilities of a distributed access for remote creation and editing of content from all relevant universities across Australia. It is expected that the web page will be operational sometimes in 2008. Currently there is no special funding for this work. An external funding of the order of \$15K would significantly speed up its completion.
2. The Australian National University organized the “First Asia-Pacific Summer School on Mathematical Physics (21st Canberra International Physics Summer School) From Classical to Quantum and Complex Systems”

<http://www.maths.anu.edu.au/research.programs/mathphys/sy2007/apss2007.html>

4. Background Material

1. Brief history of the NITP

“The (Adelaide) Institute for Theoretical Physics was formally opened on 24th March, 1995. In April 1995 this Institute began formal operations as the NITP, when with the support of its partner organisations, it was selected by the National Committee for Physics of the Australian Academy of Science, to be the host organisation for the formation of the national institute. The formation of the NITP was the result of a successful competitive bid by members of the Theoretical Physics and Mathematical Physics groups in the Department of Physics and Mathematical Physics at the University of Adelaide, our partners in the Department of Pure Mathematics at the University of Adelaide; the Department of Theoretical Physics at The Australian National University; Flinders University; and the University of New South Wales.”

The National Institute for Theoretical Physics (NITP):

<http://www.physics.adelaide.edu.au/itp/>

<http://www.physics.adelaide.edu.au/itp/background.html>

2. Other Centers for Theoretical Physics:

Asia Pacific Center for Theoretical Physics, Seoul, Korea (APCTP):

<http://apctp.org/>

Pacific Institute of Theoretical Physics, Vancouver, Canada:

<http://pitp.physics.ubc.ca/>

Kavli Institute for Theoretical Physics, Santa Barbara, USA (KITP):

<http://www.kitp.ucsb.edu/>

The Abdus Salam International Center for Theoretical Physics, Trieste, Italy (ICTP):

<http://www.ictp.it/>

Perimeter Institute for Theoretical Physics, Waterloo, Canada:

<http://www.perimeterinstitute.com/>

3. Summary of web survey data capture

NITP General and Personal Benefits

One point raised by several respondents was the desire to unify the national community of theoretical physicists. A unified voice should be a formidable force in raising the profile of theoretical physics based activities and seeking funding. The success of the astrophysicists in this regard was noted.

A major benefit of the NITP was seen to be as a body to make agreements with existing international centres and institutes in theoretical physics, thereby raising Australia's international profile and opening up collaborative research and funding opportunities. For example, the NITP is the ideal body to pay Australia's annual APCTP subscription.

Several responses stressed the importance of education in theoretical physics, particularly for honours and postgraduate students, with the possibility of pooling resources. It was suggested that the NITP should run one major Summer School per year. There should be a number of focused and extended workshops, subject to the level of any future funding.

One respondent pointed out that care should be taken not to overlap with AIP activities.

NITP Models

It was pointed out that there were excellent international institutes to emulate. Views ranged from a NITP fixed at one location to there being several nodes of an overarching institute. These models depend of course on the level of future funding that could be achieved. One suggestion was for an institute with no permanent staff, only visitors, with all Australian researchers having equal participation to invite visitors and to organize workshops. One respondent wrote that the temptation to attach the NITP to some research centre or network should be resisted. There was one view that the NITP itself should not involve a concentration of funding in one institution.

In the absence of significant funding, a distributed model was suggested with one or more nodes per state (as needed), a rotating Director with a non-renewable term, selected by a Board. Modest contributions could be obtained from member institutions. This entity would be the one to pursue NITP funding in the future. It could also oversee the establishment of a virtual web-based institute.

It was suggested that funding could perhaps be achieved with an endowment as a core for leveraging further university, state and government funds. An Australian NITP could perhaps even become part of Fred Kavli's dream of a series of institute's along the Pacific rim.

4. Asia Pacific Center for Theoretical Physics

Bruce McKellar's term as a member of the Board of the Asia Pacific Center for Theoretical Physics (APCTP) has formally ended on 18th November. While his Board seat is not earmarked for an Australian, Bruce has been invited to nominate a replacement. The current list of Board members and further information is given at apctp.org

The Executive Director of the APCTP has agreed to receive Bruce's nomination within a week of the Brisbane AIP meeting. A call for nominations for the position from interested parties resulted in a nomination from A/Prof Paul Pearce from the University of Melbourne. Paul has had a long association with the APCTP, through collaboration with APCTP members and involvement in a number of its topical research programs and workshops.

Australian membership of APCTP US\$10K p/a for 2006 and 2007 is currently supported by COSNet, the ARC funded research network on Complex Open Systems and the ANU on the 50% basis. Australian researchers are particularly encouraged to play an increasing role in the APCTP's activities. Currently there are no sources of funding for APCTP membership in 2008.

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