Laser Interferometer Gravitational Wave Observatory (LIGO)

Proposal for an Australian Laser Interferometer Gravitational Wave Observatory

Members of the gravitational wave research community are seeking funding to transfer an Advanced Laser Interferometer Gravitational Observatory Detector from the United States LIGO Laboratory to the existing Australian International Gravitational Observatory (AIGO) in Gin-Gin, Western Australia.

This is intended to complement existing detectors in the US and provide more accurate observations by increasing distance between observatories. LIGO Australia refers to itself as the planned southern hemisphere link in a worldwide gravitational wave telescope. It is a partnership between Australia and the USA based Laser Interferometer Gravitational-Wave Observatory (LIGO).

The funding being sought would support the establishment and operation of a purpose built Laser Interferometer Gravitational Wave Observatory (LIGO) at AIGO to house the US detector. The construction itself would constitute a substantial engineering project, relying on the latest developments in large vacuum system engineering, welding techniques and technology.

The cost of this is provisionally estimated at $140 million (AUD) for building costs and $6-10 million per annum for 10 years for running costs; in other words, between $200 million and $240 million over 10 years.

LIGO Australia has proposed that the facility would be commissioned in about 2017, and operated thereafter, with LIGO-Australia forming a critical component of the world-wide gravitational wave observatory.

Recent discussions

In February 2011, a meeting was held in Washington DC with senior representatives from the DIISR and Ed Seidel, Jim Ulvestad, Vern Pankonin and Tom Curruthers from the National Science Foundation. The NSF stated that the current deadline for a decision is 10 October, but there may be some flexibility in this, which NSF is looking into.

DIISR representatives emphasised that there is no current funding mechanism to support a funding request of this scale. It was also noted that if the Australian Government was willing to spend the necessary investment on astronomy, the community's preference would be possible membership to the European Southern Observatory.

The Indian gravitational wave community is very interested, and is looking to raise about $20 million for the project, but it is unclear where this process is up to. We understand that, should Australia not agree to fund the establishment and operation of LIGO in Australia, this opportunity may be presented to India. If India is able to raise $20 million, this would fall considerably short of the funding being sought for the project, ie. $200 - $240 million over 10 years.

In March this year, Professor Robyn Owens, Deputy Vice-Chancellor Research at the University of Western Australia wrote to you on behalf of the Australia LIGO community seeking funding of the LIGO project in Australia as a Landmark Research Infrastructure. That prospectus, as it referred to on the LIGO website, is available here: http://www.aigo.org.au/aigo_web_docs/LIGO-AustraliaProposal.pdf

Indian Initiative in Gravitational-wave Observations (IndIGO)
(Source: http://www.ligo-australia.org/)

IndIGO, the Indian Initiative in Gravitational-wave Observations is an initiative to set up advanced experimental facilities, with appropriate theoretical and computational support, for a multi-institutional national project in gravitational-wave astronomy. The IndIGO collaboration is in the process of constructing a road-map and a phased strategy towards building a gravitational-wave observatory in the Asia-Pacific region.

The IndIGO collaboration has held several meetings of its members and international advisory committee over the past year, and has discussed a phased strategy for building a large-scale gravitational wave detector in the Asia-Pacific region. In the first phase, the Indian scientific community is planning to contribute active involvement and resources towards the proposed Australian detector AIGO. In the second phase, IndIGO intends to explore the possibility of building a km-scale interferometer in the subcontinent.

IndIGO – AIGO participation

A Memorandum of Understanding has been signed between IndIGO and the Australian Consortium for Gravitational Astronomy (ACIGA), which aims to initiate collaboration between scientists in India and Australia in the field of gravitational-wave detection. ACIGA and IndIGO will attempt to facilitate IndIGO participation in AIGO through visiting scientist programs, double-badged PhD programs and other scholarship schemes which will allow IndIGO PhD students to spend a considerable fraction of their time undertaking research related to AIGO.

A first phase of this activity was funded by a 2009 grant from the India-Australia Strategic Research Fund, *Establishing Australian-Indian Collaboration on Gravitational Wave Astronomy.* This $30,000 grant was matched by India's Department of Science and Technology. It enabled the organisation of three workshops during 2009-2010 to explore Indo-Australian cooperation in gravitational wave Astronomy, through a collaborative project with India's Raman Research Institute, Tata Institute of Fundamental Research and the Inter-University Centre for Astronomy and Astrophysics.

This relatively small-scale project was funded to support international research collaboration rather than as any commitment to funding large-scale infrastructure. Gravitational wave astronomy can be conducted without a detector being physically located in either Australia or India.

The project set out to:

- explore Indian and Australian capabilities; focus on possible major project concepts, collaborations and funding opportunities and develop a future collaboration plan and roadmap; and

- determine the technology requirements for the future detectors, including Indian components for ultra high vacuum systems, advanced vibration isolation systems developed in Australia and optical cavity control systems and identify future projects.

One of the activities undertaken by the project was participation in the Australian International Gravitational Observatory (AIGO) conference in Perth in 2010.

Indo-US joint centre

The participating institutions of the IndIGO collaboration have submitted a joint proposal with California Institute of Technology and Washington State University to start an active Indo-US research collaboration in gravitational-wave experiments and theory. The proposal for an Indo-US Joint Centre for Gravitational-Wave Physics and Astronomy was submitted to the Indo-US Science and Technology Forum. If funded, this centre will enable several inter-institutional visits of scientists and students from India and USA.

Background on funding for LIGO

Funding has been sought for different elements of the AIGO project on numerous occasions since the 1990s. This has included several requests for funding for the construction of a 5km long laser interferometer instrument similar to that proposed under the current LIGO proposal. Most of these requests for funding have been unsuccessful.

The Australian International Gravitational Observatory was considered for inclusion in the original National Collaborative Research Infrastructure Strategy (NCRIS) Strategic Roadmap developed by the NCRIS Committee in 2006.

Following national consultations with the research community, the NCRIS Committee considered that an enhanced gravitational wave research capability was not a high priority area for NCRIS in terms of strategic impact for Australian science and innovation, noting that:

- significant Commonwealth investment had already been made:
    - $4.83 million over three years from 2002 was provided under the Systemic Infrastructure Initiative, to enable the Australia Consortium for Interferometer gravitational Astronomy (ACIGA) to participate in the Advanced Laser Interferometer Gravitational Observatory. Funding was provided for equipment for the new High Optical Power Test Facility at AIGO;
    - Around $ 7.7 million has been provided through ARC grant funding, including LIEF and Linkage grants.
- a major instrument is already available for gravitational wave science; and
- an enhanced AIGO would support a relatively small research community, compared with the broad researcher base served by most NCRIS priority capabilities.

During the review of the NCRIS Roadmap in 2008, no responses were received from AIGO or other gravitational wave research groups to warrant further consideration.

Research Infrastructure – Future planning and priorities

If it were to be funded, the LIGO proposal would be one of the largest ever Australian Government research infrastructure investments. A commitment to this investment must be made by late 2011, or LIGO will most likely proceed with initial plans to build the third observatory in the US.

There is currently no Australian Government funding mechanism for research infrastructure which could support a project on the scale of the LIGO proposal.

Future national research infrastructure investment priorities are currently being determined through the development of the *2011 Strategic Roadmap for Australian Research Infrastructure*. The draft Roadmap was available for public comment between 27 June and 22 July.

The Department of Innovation, Industry, Science and Research has developed the draft Roadmap with strategic oversight by the National Research Infrastructure Council (NRIC) and through extensive consultation with the research community.

The Roadmap primarily identifies medium to large scale research. Where research infrastructure is of a larger scale - known as 'landmark' infrastructure - it will be identified where it is seen as a priority by the research community.

The LIGO Gravitational Wave Observatory proposed for Western Australia has not been identified as a research infrastructure priority for Australia's astronomy sector. Also, the level of investment required puts LIGO in the category of 'landmark infrastructure' and beyond the scope of the current Roadmap process.

There are several pressing research infrastructure priorities for investment identified in the draft Roadmap which offer greater potential benefit to Australia including the Square Kilometre Array (SKA) Radio Telescope. At this stage, Australia is therefore unlikely to host LIGO.

The Department has consulted extensively with the broader research community in developing the Roadmap. The Australian gravitational wave research community was encouraged to participate and provide their perspective on the level of priority this kind of capability may have within the wider research infrastructure context.

The National Committee for Astronomy of the Australia Academy of Science published the *Mid-Term Review of the Australian Astronomy Decadal Plan*, in July 2011.

The review states:

> "We anticipate considerable interest in gravitational wave astronomy once sources are finally detected. Until this time, ground-based gravitational wave instrumentation primarily resides in the realm of experimental physics. It is unlikely that gravitational waves will be detected by ground-based detectors before 2015, and therefore Australian astronomy's priorities remain primarily

focused on supporting our optical and radio portfolios, which continue to be the 28 Mid-Term Review of the Astronomy Decadal Plan 2006–2015 workhorse facilities for research on all types of cosmic phenomena, including future discoveries made by ground-based gravitational wave detectors like Advanced LIGO".

TALKING POINTS

- There is currently no funding mechanism available to support a research infrastructure facility of the scale of Laser Interferometer Gravitational Wave Observatory and it is not a high priority from Australia's perspective.

- The Laser Interferometer Gravitational Wave Observatory proposal fits the definition of landmark infrastructure.

- A process to identify and prioritise landmark research infrastructure projects is currently under consideration by Government. This process is not likely to be agreed by the Government, and a round finalised, before a commitment to the Laser Interferometer Gravitational Wave Observatory proposal is required from Australia towards the end of 2011.

- There are presently several more pressing priorities for investment which offer much greater potential benefit to Australia, including the Square Kilometre Array.

Document 2

C11/2441

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10 August 2011

The Hon Julia Gillard MP, Prime Minister
PO Box 6022
House of Representatives
Parliament House
Canberra ACT 2600

Dear Ms Gillard

RE Request for support for LIGO-Australia Initiative

I am writing to strongly support the new initiative by the Australian Consortium for Gravitational Astronomy. This project called ***LIGO-Australia*** (flyer enclosed) ranks with the Hadron Collider at CERN, the SKA and the Cosmic Microwave Background (CMB) project in its importance and in futuristic potential. I mentioned the CMB project because I shared a prize with John Mather in the USA who went on to win the Nobel Prize in Physics, as had many other physicists before him who worked on it, eg Penzias & Wilson 1978.

Gravitational Waves exploit yet another unexplored but rich area of cosmology and physics. As we approach the Centenary of Albert Einstein's Nobel Prize in physics in 2021, our scientists have a big role to play in new discoveries stemming from his revolutionary papers on gravitation 100 years ago. We already have a $30M facility in place at Gingin accompanied by 50km^2 of land supplied by the Western Australian Government for this development.

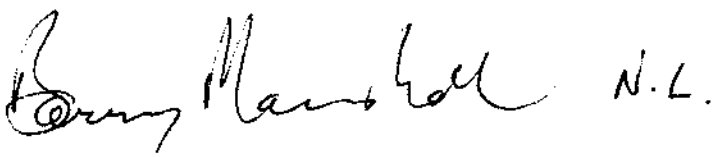
Internationally, the Australian team is highly respected as evidenced by the fact that the US National Science Foundation and President Obama's National Science Board has endorsed this project and earmarked $140M US matching funding for the Australian component. Incidentally, the Australian LIGO promises to give a further 10X magnification to the whole international system. A big plus for this project is that, unlike the SKA, this initiative is not a competition. Subject to our commitment to the science, the project is ready to go and very little funding is actually needed at this stage. It is also very likely that India and China will lend support to help defray costs.

In summary this project is:

1. A futuristic project
2. Certain to proceed if funded
3. Leveraging renowned and established infrastructure
4. A magnet for academics, especially mathematicians and engineers, and for associated electronics industries
5. Synergistic with the SKA and provides evidence that the SKA is not just a 'one off' for Australia
6. Consolidating an area of science with a track record of Nobel Prizes in Physics with many more expected.

The LIGO offers major academic benefits for Australia because it will be a magnet for top mathematicians and physical scientists from around the world. I expect that the Western Australian Government will wish to contribute to ensure that it we do not lose this wonderful opportunity.

Yours sincerely



Barry Marshall AC, Nobel Laureate, FRACP FAA FRS
Clinical Professor

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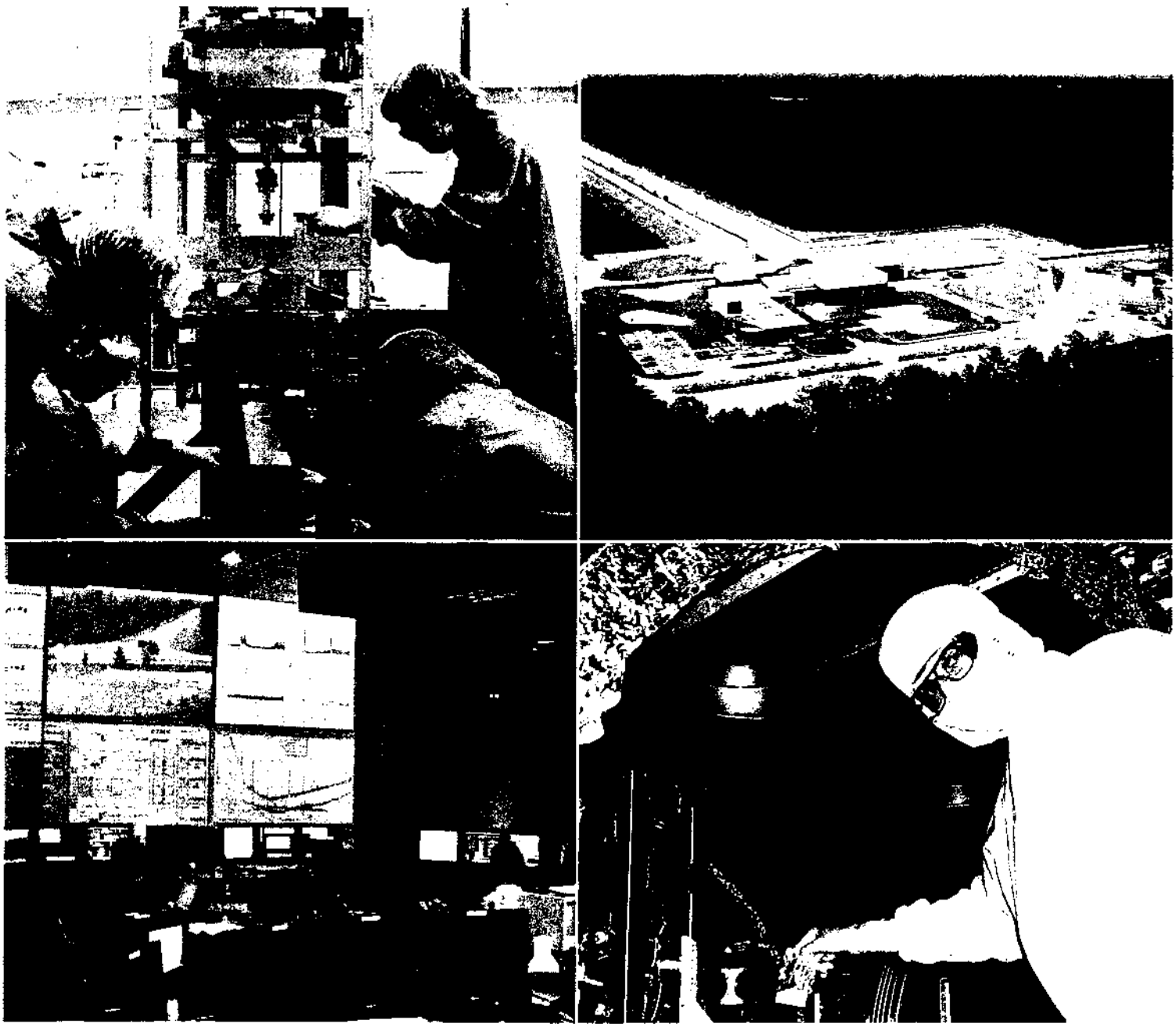
THE UNIVERSITY OF WESTERN AUSTRALIA

LIGO-Australia

Laser Interferometric Gravitational Wave Observatory



THE UNIVERSITY OF ADELAIDE AUSTRALIA

MONASH University

Laser Interferometer Gravitational Wave Observatory

The detection of Einstein's gravitational waves is a major international frontier of science. New technologies allow construction of detectors capable of directly observing black holes, testing theories about the origin and fate of the universe, and exploring of a new spectrum. A world-scale gravitational wave telescope is needed, and a southern hemisphere observatory is essential to achieve its ultimate potential. Western Australia is an ideal location for this observatory.

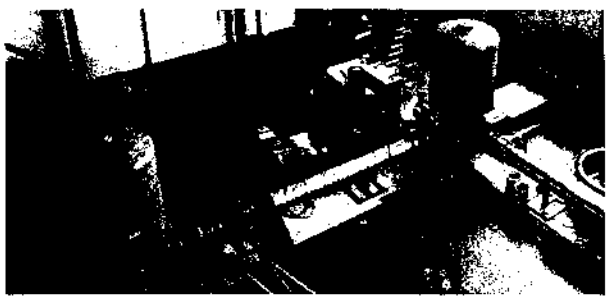
LIGO-Australia will be a key component of the international network of gravitational wave detectors. Its construction and operation is being proposed in collaboration between the Australian Consortium of Interferometric Gravitational Astronomy (ACIGA) and the US LIGO Laboratory. The ACIGA universities have agreed that The University of Western Australia will be the lead Australian institution. Located at Gingin in regional Western Australia, this facility will house an ultra sensitive Advanced LIGO detector and will enable cutting edge research in physics and astrophysics.

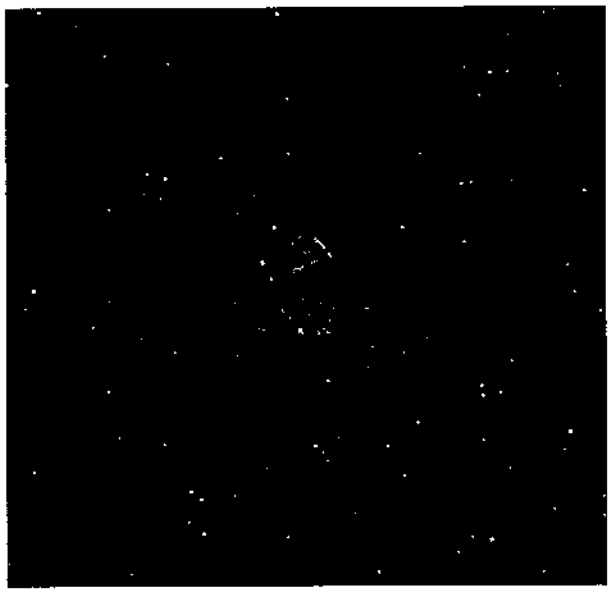
The LIGO project is an international effort involving 800 researchers from 12 countries. Existing observatories in the US at Livingston, Louisiana and Hanford, Washington were constructed and are operated through support from the US National Science Foundation (NSF). LIGO-Australia will enable a five to tenfold increase in ability to identify and study sources of gravitational waves.

Gravitational Waves

Gravity is one of four fundamental forces of nature that structure the universe. It shapes space and alters time. The existence of tiny gravitational ripples in the fabric of space are a fundamental prediction of Einstein's General Theory of Relativity.

Gravitational scientists worldwide, including a dedicated team in Australia, aim to detect the new gravitational spectrum to enable humanity to directly 'listen' to black holes and possibly even the birth of the universe itself. Australian researchers, together with their international collaborators, are certain to detect known powerful signals produced when super dense neutron stars spiral together and merge to create a black hole.





The LIGO-Australia Project

LIGO-Australia will be located at the existing UWA site which was provided by the WA Government at the Wallingup Plain in the Shire of Gingin. The US LIGO Laboratory funded by the US National Science Foundation has proposed to supply a fully instrumented gravitational wave detector. The University of Western Australia, on behalf of its Australian partners, will construct the infrastructure to house the detector. The LIGO-Australia collaborators will install, commissions and operate the LIGO-Australia detector as part of the international network.

The LIGO-Australia facility will be modelled on the two LIGO observatories constructed in the USA. It will consist of a pair of 4 km long stainless steel vacuum pipes containing high powered lasers beams. Two orthogonal arms meet at a corner station and terminate at end stations. There are additional buildings for offices, control room, clean rooms, plant and storage. This facility will incorporate sustainable and environmentally sensitive features wherever possible, including low energy consumption geothermal cooling systems for high efficiency air conditioning.

The stainless steel vacuum pipes and chambers will become the largest volume ultra-high vacuum system in the Southern Hemisphere. It will be manufactured onsite by a specialist pipe manufacturer using an innovative, cost effective, state of the art manufacturing technology.

LIGO-Australia will be connected to the optical fibre link established under the Regional Broadband Blackspots program and will ensure that additional researchers at UWA's Crawley Campus and worldwide have prompt access to data to permit rapid targeting of gravitational wave sources with radio and optical telescopes such as SKA and SkyMapper.

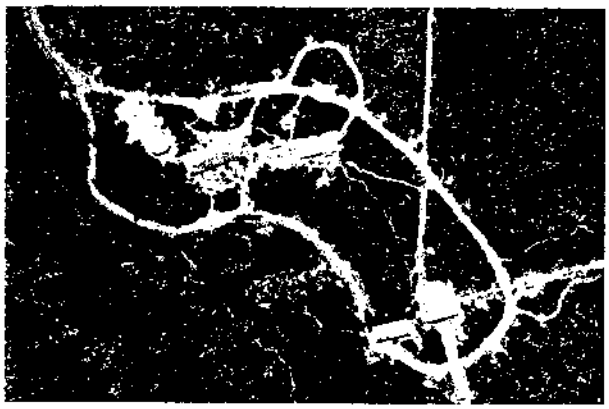
LIGO-Australia will be operated by a staff of 25 and will support a steady stream of Australian and international visiting researchers. The project capital cost is $140 million, with annual operating costs of $6 million.

LIGO-Australia

Gingin Site

The Australian International Gravitational Observatory at Gingin was established in 1990. It has an 80 m interferometer facility, workshops, offices, a seminar room and visitor's accommodation. The Eureka-Prize-winning Gravity Discovery Centre, which supports educational and public outreach, is located on the large site.

The Zadko Telescope, also located on the site, is currently supporting research programs for the Australian International Gravitational Research Centre and the International Centre for Radio Astronomy Research.

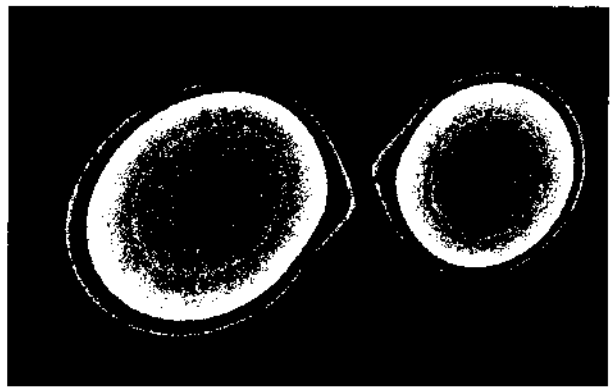


LIGO Laboratory's co-investment

The LIGO Laboratory will contribute a complete Advanced detector representing a design cost of $70 million and a hardware cost of $70 million. This detector incorporates ultra stable lasers, high precision optics (some of which have been produced by CSIRO), low vibration platforms and low noise suspensions. With the development of LIGO-Australia, ACIGA will become a major partner with the LIGO Project, with full access to the LIGO data collected by the two US facilities.

Our Collaborations

- Australia's gravitational wave researchers are members of the Australian Consortium for Interferometric Gravitational Astronomy. Members include The University of Western Australia, Australian National University, University of Adelaide, Monash University and the University of Melbourne.
- The LIGO Scientific Collaboration – a worldwide team of LIGO scientific collaboration of over 800 researchers from more than 60 universities and institutions.
- The LIGO Laboratory, a joint effort between the Massachusetts Institute of Technology (MIT) and the California Institute of Technology (Caltech) ranked second and third in Physics research worldwide.
- Possible international partners include the China Gravitational Wave Working Group and the Indian Consortium in Gravitational Astronomy.



Impacts of Australian Gravitational Wave Research

Gravitational wave research requires exceptional technology and innovation, and Australian gravitational wave science has already had a significant positive impact on world science and the Australian economy.

ACIGA researchers have invented diverse new technologies with broad practical benefits. Innovative vibration isolation systems have been used to improve airborne mineral exploration. The sapphire clock, developed to improve vibration sensing in gravitational wave detectors, has provided dramatic improvements to the sensitivity of radars, and is being developed to improve Global Positioning Systems. Work on frequency stable lasers for gravitational wave detection applies to coherent laser radar, remote sensing and new approaches to coherent wind-field mapping. The Hartmann wave-front sensor developed for Advanced LIGO grew out of work on wave-front sensors for the ophthalmic industry. Readout technology developed for gravitational wave detectors has been adapted to fibre based optical cavities producing the world's most sensitive fibre strain sensor arrays for ocean floor oil field monitoring. Related techniques are being applied to measure molecular absorption with high sensitivity for applications from monitoring greenhouse gases to testing for performance enhancing drugs. LIGO-Australia data analysis will speed the adoption of innovative software solutions in distributed (grid and cloud) high-performance computing and resource virtualisation.

Since 1995, more than 50 students have earned their PhD working with ACIGA. These students now hold positions in industry and academia, contributing to economic growth, education and research. This number will grow several-fold with the opportunities opened by LIGO-Australia.

LIGO-Australia will enhance the international research capabilities of Australian scientists, increase the number of scientists living and working in Australia, inspire new generations of students in science and develop greater collaborations throughout the research community.

Revealing a Hidden Universe

In the vast darkness of space, two black holes orbit each other, invisible as they creep inexorably closer. They are the remnants of massive stellar explosions more than a hundred million years ago, objects so dense that not even light itself can escape the grip of their gravitational pull. When they reach a separation of only 100 km, they are moving at nearly half the speed of light, distorting nearby space and time in almost unimaginable ways. In a final rush lasting only seconds, they spiral together, merging to form a single black hole which vibrates rapidly for a fraction of a second, and then settles into its final quiescent state, never to be seen or heard again.

This entire drama plays out in darkness—no light or x-rays or radio waves mark the end of this dance. Yet, in the final seconds before their collision, these two black holes emit more energy than all the stars in the observable universe—in a strange form of radiation called gravitational waves. First predicted by Einstein in 1916 as a part of his General Theory of Relativity, gravitational waves are enigmatic, carrying great energy, yet producing infinitesimally small effects as they pass through space at the speed of light.

In the coming decade, an international network of multi-kilometre scale gravitational wave detectors will come into operation in the US, Europe and Japan. Working together, these ultra-sensitive detectors will begin to unravel the mysteries of gravity as a fundamental force, elucidate the astrophysics of gravitational wave sources, and probe the quantum limits to measurement. LIGO-Australia is our opportunity to raise Australia to the first ranks in this scientific quest.

Further information:
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SENATOR THE HON KIM CARR

MINISTER FOR INNOVATION, INDUSTRY, SCIENCE AND RESEARCH

Professor Robyn Owens
Pro Vice-Chancellor (Research and Research Training)
The University of Western Australia
35 Stirling Highway
CRAWLEY WA 6009

04 APR 2011

Dear Professor Owens

Thank you for your letter of 10 March 2011 and your submission of a proposal from the Australian Gravitational Wave Physics community, concerning a partnership with the United States Laser Interferometer Gravitational Wave Observatory (LIGO).

The scale and nature of the proposal mean it falls within the definition of landmark research infrastructure. There is currently no funding available for projects of this kind. A process to identify and prioritise landmark research infrastructure projects has been developed by the National Research Infrastructure Council (NRIC) but is still under consideration by the Australian Government.

During 2011, my Department will be developing a new *Strategic Roadmap for Australian Research Infrastructure* as the centrepiece of evidence for future research infrastructure funding in Australia. This will include reviewing and refining the capabilities identified in the 2008 Roadmap, and determining whether the current mix of capabilities continues to meet researchers' needs.

While landmark scale proposals fall outside the scope of the roadmap process, the Australian Gravitational Wave Physics community may still wish to participate in the process to help develop a refreshed view of the level of priority this kind of capability has within the wider research infrastructure context.

Yours sincerely

Kim Carr

Telephone (02) 6277 7580 PO Box 6022, Parliament House, Canberra ACT 2600 Facsimile (02) 6273 4104

SENATOR THE HON KIM CARR

MINISTER FOR INNOVATION, INDUSTRY, SCIENCE AND RESEARCH

Professor Barry Marshall AC
Clinical Professor
School of Biomedical, Bimolecular
and Chemical Sciences
The University of Western Australia
M502 35 Stirling Highway
CRAWLEY WA 6009

11 SEP 2011

Dear Professor Marshall

Thank you for your letter of 10 August 2011 to the Prime Minister, the Hon Julia Gillard MP, expressing your support for the LIGO-Australia project proposed by the Australian Consortium for Gravitational Astronomy. The Prime Minister has referred the letter to me as the Minister with responsibility for research.

I am pleased to be able to write to you on this matter as it allows me to highlight the Australian Government's approach to research infrastructure.

Identifying the Australian Government's priority investments in research infrastructure is critically important. My Department is currently developing the *2011 Strategic Roadmap for Australian Research Infrastructure*. The Roadmap is being developed in consultation with the research sector and will identify strategic priorities for medium to large scale research infrastructure investment for the next five to ten years.

The Roadmap will form one of the key policy inputs to the Australian Government's consideration of future investment in medium to large scale research infrastructure.

Research infrastructure projects of the scale proposed for LIGO-Australia, which would exceed $200 million over 10 years, fall within the category of 'landmark' infrastructure and are outside the scope of the Roadmap process. There is currently no funding available for 'landmark' research infrastructure. However, a process to identify and prioritise landmark infrastructure is under consideration by the Australian Government and will be considered in the context of future investment in research infrastructure for Australia.

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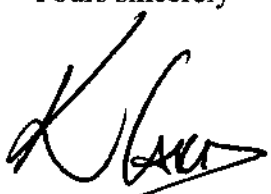
In the current circumstances of fiscal restraint, the Government must establish firm priorities based on the likely benefits to Australia. Investing in medium to large scale research infrastructure, with the aim of maintaining and enhancing access to the medium to large scale research infrastructure required by a majority of Australian researchers, is likely to return the highest benefits to Australia.

I would be very pleased to discuss research infrastructure investment further with you should an opportunity present itself.

Yours sincerely



Kim Carr

Document 5

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THE UNIVERSITY OF WESTERN AUSTRALIA
Achieve International Excellence

OFFICE OF THE VICE-CHANCELLOR

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Deputy Vice-Chancellor (Research)

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Ref: F30303

10 March 2011

Senator the Hon Kim Carr
Minister for Innovation, Industry, Science and Research
Parliament House
Canberra ACT 2600

Dear Minister

I am pleased to submit for your consideration a proposal from the Australian Gravitational Wave Physics community for Australia to take advantage of an opportunity to take a leading role in a high profile international effort in frontier science. Gravitational waves offer a new way to study the universe, and the 50 year quest to detect them has produced, and will continue to produce, technological breakthroughs with wide reaching application in science, engineering and high technology industry.

The US LIGO Laboratory has offered to partner with Australia to create the crucial Southern Hemisphere node in the growing global array of gravitational wave interferometers. LIGO will transfer to Australia an ultra-sensitive gravitational wave detector, valued at approximately $140M, provided Australia creates a national facility to house the detector (estimated to cost $140M) and commits to funding operations for at least 10 years (operating costs estimated at $6M p.a.). This offer has the approval and support of the National Science Foundation, the primary funding agency for Advanced LIGO, and the approval of the President's National Science Board, provided Australia makes a commitment by October 2011.

On behalf of the partner universities and the US LIGO team, I would be pleased to answer any questions or provide further additional material as required.

You may also be interested in viewing the following video link:
http://www.youtube.com/watch?v=aQW6knhLxGE

Yours sincerely

Robyn Owens

Professor Robyn Owens
Deputy Vice-Chancellor (Research)

MINISTER FOR INNOVATION, INDUSTRY SCIENCE AND RESEARCH
SIGNATORY - FOR REPLY BY:
☑ Minister ☐ Parl. Secretary
☐ Advisor ..... ☐ Department

DATE RECEIVED 15 MAR 2011

FOR ACTION BY: SID .
☐ Urgent Reply ☑ Copy to: KC, JCA .
☐ Appropriate Action ☐ Referral to: .....
☐ For Info (NFA) ☐ Other: .....
☐ Briefing Required