The ANITA Charter:
1. Support the professional development of the theoretical astrophysics community within Australia
2. Promote the discipline of theoretical astrophysics
3. Linkage with the national and international astronomical community
4. Education

ANITA membership is open to all ASA members and is free to join.

From the ANITA Steering Committee

On behalf of ANITA, we welcome the reader to our second ANITA newsletter. As ever, the goals of this newsletter are threefold: to inform, to promote, and to unify the dispersed astronomy theory community of Australia. In supporting these aims this newsletter covers the latest news and research relevant to those interested in Australian-led theory.

In this issue, and as the first article in a regular series showcasing particular projects or research groups within Australia, we cover the theoretical developments within the CSIRO built ASKAP facility. We also showcase a number of important news items related to our community, including the announcement of the next ANITA workshop, which will be held at ICRAR in Perth in February 2011.

We are keen to hear your news stories and research developments. This especially includes abstracts for newly accepted publications. Please don’t hesitate to contact us! As always, contact and all other ANITA information can be found at our website: http://anita.edu.au/. This includes the online ANITA membership registration form, and we encourage those who are interested (both observers and theorists) to become members if you are not already.

Finally, you may have noticed the revamped style of the newsletter. We’d love to hear your thoughts and suggestions!

Alan Duffy (editor), Darren Croton, Greg Poole.

This quarter... Theorists within ASKAP, News, Papers and Perth 2011

The new Australian Square Kilometer Array Pathfinder currently under construction at the Murchison Radio Observatory. This next generation facility will challenge Australia’s theorists to develop new analysis software and perform simulations of increasingly advanced complexity. (Image credit Prof Martin Meyer, ICRAR)
Latest news

Thinking Inside the Box: Supercomputing @ iVEC
Although it may look like an ordinary shipping container on the outside, iVEC’s new POD (Performance Optimised Data Centre) from Hewlett-Packard will launch iVEC into the top 100 supercomputing centres on the planet.

The supercomputer system is part of the Commonwealth government’s $1.1 billion Super Science Initiative and will result in a massive increase in iVEC’s supercomputing capability, providing a major boost to the resources available to the radioastronomy, nanoscience, geoscience and other leading computational communities.

The POD design incorporates a modified shipping container architecture to create a ‘plug and play’ containerised server cluster that will allow the first phase of the Pawsey Centre project to be online by November 2010, only four months after the acquisition deal was finalised.

This purchase is the first step in creating a world-leading supercomputing architecture to enhance Australia and New Zealand’s bid to host the Square Kilometre Array (SKA).

The supercomputer, part of the $80M Pawsey Centre project, will be located at Murdoch University’s Centre for Comparative Genomics and will complement the $1 million iVEC infrastructure already housed at the Centre.

An energy-efficient 107 Teraflop system (1 Teraflop = One trillion floating point operations per second), the cluster uses HP ProLiant Blade servers with 9,600 cores and 500 terabytes of high performance storage. It will be part of iVEC’s data network, which operates at 10 gigabits per second.

For further information contact iVEC Media Officer, Brad Coleman on 08 6436 8920 or bradc@ivec.org

ANNA Annual Meeting 2010
On Nov 3 Monash University hosted the 2010 Annual Meeting of the recently formed Australian Network for Nuclear Astrophysics, or ANNA. The aim of ANNA is to provide a focus and identity for all of the people working in the many separate sub-disciplines that comprise nuclear astrophysics, which is actually a very active research area within the Australian scientific community.

The meeting at Monash began with half a day of scientific presentations focussed on high energy astrophysics and AGB stars. Talks given included:

- Anthony Thomas (U Adelaide) Effect of Hyperons and Quarks on Neutron Star Properties
- Andrew Melatos (U Melbourne) High-Precision Nuclear Physics Experiments with Gravitational Wave Detectors
- Duncan Galloway (Monash) Thermonuclear X-ray bursts as probes of nuclear burning in neutron stars
- Maria Lugaro (Monash) Zirconium in stardust grains from asymptotic giant branch stars
- Herbert Lau (Monash) Nucleosynthesis of Super Asymptotic Giant Branch stars
- Chiaki Kobayashi (ANU) Updates on HERMES, the high resolution multi-object spectrograph for the Anglo-Australian Telescope
- Max Spolar (AAO) The mass-metallicity gradient relation of early-type galaxies

NCI Computing Time
Additional supercomputing access for Astronomy Flagship projects is now available on the National Computational Infrastructure (NCI) Supercomputer, located at the Australian National University.

Earlier this year NCI initiated a program of specialised support for computational astronomy and astrophysics and accepted a proposal, developed through Astronomy Australia Limited, to provide for two additional support positions – one based at ANU at the NCI National Facility, and the other at the Centre for Astrophysics and Supercomputing at Swinburne University. In addition 1,000,000 CPU core hours per annum have been made available on each of the NCI and Swinburne supercomputers for Astronomy Flagship projects. These allocations are intended to support projects for which the computational power of peak facilities is essential for internationally competitive, scientific progress.

Specifically, the time on the NCI system is to encourage and support applications that scale up to a high processor count to build expertise and demand for these applications in the future.

The CPU hours at Swinburne for 2010 have been allocated. The purpose of this announcement is to inform you that 250,000 CPU core hours (service units - SU) are available for October - December 2010 on the NCI machine at ANU.

Best regards, Geoff Bicknell (Chair, Astronomy Flagship Time Allocation Committee).
In the afternoon there was a general discussion about ANNA and how best to advance the goals of the community. Later in the day we held the first LOC meeting to plan for the 2012 Nuclei in the Cosmos meeting to be held in Cairns (see Upcoming Events in this Newsletter). An ANNA website is being developed to assist the nuclear astrophysics community. If you would like to be a part of ANNA then please send an email to Maria.Lugaro@monash.edu

John Lattanzio on behalf of ANNA.

Upcoming events

e-Science Challenges in Astronomy and Astrophysics
A one-day workshop to be held on 7 December 201 as part of the IEEE e-Science 2010 conference Queensland University of Technology Brisbane, 7-10 December 2010
See http://astronomy.swin.edu.au/esscience2010astros/ for workshop information and abstract submission. We are particularly interested in talks from representatives of large survey and simulation projects (current and future).

The focus of the workshop will be on e-Science challenges within astronomy and astrophysics, the innovations that these challenges are producing now and the innovations that will be required in the near future. A particular aim is to discuss the needs of large survey and simulation projects in terms of data management, data distribution and data characterisation/analysis. The opportunity to have this discussion amongst the broader e-Science community, and the associated crossover of knowledge and ideas, will hopefully enhance existing efforts in these areas.

The organising committee would welcome hearing from anyone interested in attending the workshop and/or making a presentation related to these themes.

Regards, Jarrod Hurley (on behalf of the Organising Committee)

Dark Matter Awareness Week!

Dark Matter Awareness Week, 1st - 8th December 2010: A journal club seminar at your institute. This event is set up to increase the basic knowledge on the phenomenology of "The mass discrepancy phenomenon in galaxies" of scientists that currently work (with a theoretical, observational, experimental or simulation approach) on issues involving dark matter.

Full details at http://darkmatteringalaxies.selfip.org.

Astroinformatics School

In February 16th - 18th, 2011 at ICRAR, Perth we are running the 4th Astroinformatics School. This year we have an exciting new addition to the program - a day of high performance computing (including GPU programming). The School will be hosted by the International Centre for Radio Astronomy Research in Perth.

Computational techniques are becoming increasingly important in astronomy. In order to support the development of such techniques in our current and future generation of astronomers, we are hosting a 3 day school that will provide an introduction to a selection of common tools and techniques that we believe can facilitate and enhance research productivity. The program will consist of lectures and practical exercises. All exercises will be tailored specifically to astronomy applications.

The intended audience is postgraduate students and other interested astronomers. We also encourage honours students to attend. This is a great opportunity to develop or update your IT skills! Topics (from previous years) include:

* Introduction to programming in Python
* Scientific Python
* Advanced Unix skills - scripting, regular expressions
* Version control with Subversion
* Writing CGI scripts
* Querying databases with SQL
* Creating databases with MySQL
* Introduction to XML and web services
* Data processing
* Doing science with the Virtual Observatory

This year we will include some special sessions of high performance computing and GPU programming - more information will follow in later announcements. Participants should bring their own laptop to work on. Windows, Mac OS and Linux will be supported, and the relevant software will be provided for download beforehand.

Information on last year’s program is available on the website www.physics.usyd.edu.au/sifa/astroinformatics

Please email tara@physics.usyd.edu.au to express your interest in attending.

Tara Murphy, on behalf of the organising committee.

The 2011 ANITA Workshop

To be held at ICRAR Perth, February 14th - 15th, 2011. See the featured news section below for an announcement.

Nuclei in the Cosmos, ‘12

The Australian (and New Zealand) astronomy, nuclear physics, and earth science community has won the bid to have Australia host the 12th Nuclei in the Cosmos (NICXII) meeting in 2012. This is a prestigious multi-disciplinary symposium and the premier international meeting on Nuclear Astrophysics. It is held every two years and attracts about 300 scientists from around the world. Nuclei in the Cosmos brings together nuclear experimentalists, nuclear theorists, astronomers, theoretical astrophysicists, cosmochemists, and others interested in the scientific questions at the interface of nuclear physics and astrophysics.

For more information on the conference you can visit the webpage for this year’s event which was held in Heidelberg, Germany: http://www.lsw.uni-heidelberg.de/nic2010/index.phtml Sessions covered topics such as: the Big Bang, chemical evolution, stars, compact objects, supernovae, meteoritic analysis, and gamma-ray observations.

Australia has a large and growing community in Nuclear Astrophysics; 19 researchers from 7 different institutions and several major sponsors, including ANU, Monash, Swinburne, and AAO, were involved in the preparation of the bid.

The conference will be held at the Cairns Convention Centre from 5/8/2012 to 10/8/2012. The meeting will be contiguous with the Meteoritical Society meeting in Cairns (the week after) and close to the International Astronomical Union General Assembly in China (starting on the 20/8/2012). Preceding NICXII there will be a week-long school for PhD students.

For more information please contact maria.lugaro@monash.edu
**WALLABY TWG 1**

**Numerical Simulations and Mock Surveys**

1. **ASKAP**
The Australian Square Kilometer Array Pathfinder (ASKAP) telescope is currently under construction in the Murchison Radio Observatory in Western Australia. An array of 30 dishes, each of which is 12m across, give ASKAP a large collecting area and hence sensitivity to the faint signal of HI at a rest wavelength of 21cm. The dishes are spread over 6km to create an ‘artificial’ dish with extremely high angular resolution, this technique is known as interferometry.

2. **Simulations**
Two main types of simulations are used to help plan the WALLABY survey and design the source finding pipelines: Smoothed Particle Hydrodynamics (SPH) and Semi-Analytic Models (SAMs). The latter trace the Dark Matter (DM) evolution within enormous volumes of the universe relying on analytic calculations to create the galaxies inside the DM haloes. The former trace both the gas and DM, this is typically more computationally costly and hence the volumes simulated are usually smaller. Therefore, in TWG1 we need to combine the distribution of gas from SPH (which ASKAP detects) with the large cosmic volumes from SAMs (which ASKAP probes) to create a realistic sky.

**Want to know more?**

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**Article written by Chris Power and Alan Duffy**

Theorists within WALLABY - a flagship ASKAP survey

The Australian SKA Pathfinder is a revolutionary new concept in radio astronomy. It will utilise an enormous Field-of-View (30 deg$^2$) to quickly map the entire Southern Hemisphere at unrivalled sensitivity of the faint, but ubiquitous, signal of neutral hydrogen, HI. This is the plan but there’s a great deal of work before this ambitious survey can be realised, not least of which before the telescope is even built! The efforts of theorists in supporting this phase of the project is being led by Dr Chris Power, head of the cryptically termed working group ‘TWG1’, somewhat more informatively known as “Numerical Simulations and Mock Surveys”.

The goal of this working group is to use realistic galaxy formation models to predict the HI sky as it might be seen by ASKAP. As Chris explains “this requires modelling of the abundance and clustering of HI sources in cosmological volumes over a range of redshifts and so we’re using the complementary approaches of semi-analytical models and hydrodynamical simulations to construct mock HI surveys.”

**Numerical Efforts - SAMs and SPH**

by Chris Power

Semi-analytical modelling has been exploited successfully in conjunction with optical surveys (e.g. 2dFGRS, SDSS) but is largely unexplored in the context of cold gas surveys. Recent work by Chris Power, Carlton Baugh & Cedric Lacey (2010, MNRAS, 406, 43) and Hansik Kim et al. (2010, arxiv:1003:0008) has established basic predictions for the mass function and clustering of HI galaxies in current ‘best-bet’ semi-analytical models. This work has underpinned the development of mock catalogues of HI in galaxies, tailored specifically to the WALLABY survey parameters, by Hansik Kim and Alex Merson at Durham University; the first of these catalogues is now available. Such mocks will provide important information about the clustering and detectability of HI sources with redshift.

Hydrodynamical simulations allow us to study the spatial and kinematic distributions of gas in and around galaxies in a way that semi-analytical models cannot. A good example of this can be seen in the image above from recent work by Alan Duffy at ICRAR using the suite of OverWhelmingly Large Simulations (hereafter OWLS; Schaye et al. 2010). On scales of 2 Mpc/h the HI distribution is filamentary (left) but on the scale of the galaxy the HI occupies a well-defined disc (right) Rob Crain at Swinburne is re-simulating individual galaxies drawn from both OWLS and the Galaxy-Intergalactic Medium Interaction Calculation (hereafter GIMIC; Crain et al. 2009), at much higher resolution and using radiative transfer to predict accurate HI column densities. These kind of simulations will be crucial for testing ASKAP’s imaging capabilities and HI source detection algorithms.
Featured News Item: The Next ANITA Workshop is in Perth, February 14-15 2011

Following on from the success of the ANITA meeting in Swinburne earlier this year (see last quarters newsletter for the summary of this meet) the 2011 meeting will be held in the ICRAR facilities in Perth. We are aiming for a larger student presence this year than previous and to that end are twining the ANITA meeting with the Astro-informatics workshop later in the week (as advertised in the upcoming events section). Expect an email announcement soon but registration can be found at: http://anita.edu.au/workshop2011/

Featured News Item: Galaxy simulations grace the cover of Nature

“Using Australian telescopes, Swinburne University astronomy student Andy Green has found ‘living dinosaurs’ in space: galaxies in today’s Universe that were thought to have existed only in the distant past. The report of his finding – Green’s first scientific paper – appears on the cover of the 7 October issue of Nature. “We didn’t think these galaxies existed. We’ve found they do, but they are extremely rare,” said Professor Karl Glazebrook, Green’s thesis supervisor and team leader.”

See http://www.nature.com/nature/journal/v467/n7316/full/nature09452.html for more information.