Attachment DAT to the Memorandum of Understanding LIGO-M050280-00 between the Australian Consortium for Interferometric Gravitational Astronomy (ACIGA) and the Laser Interferometer Gravitational Wave Observatory (LIGO)

For The Period

August 15, 2007 - August 14, 2008

This Attachment DAT to the Memorandum of Understanding LIGO-M050280-00 defines the role of the Australian Consortium for Interferometric Gravitational Astronomy (ACIGA) as a Member of the LIGO Scientific Collaboration (LSC). In particular, it addresses data analysis activitites in support of the initial LIGO interferometers. The period of performance for the activities in this Attachment is from August 15, 2007 - August 14, 2008.

1. Collaboration

Together, the LIGO Laboratory and the LIGO Scientific Collaboration (LSC) are responsible for implementing and exploiting the initial LIGO detector through its science data runs. The LSC has organized the data analysis effort into search groups which coordinate analysis, review, and publication on behalf of the collaboration. LSC groups are encouraged to participate in one or more of these groups.
MOU Attachment DAT defines the contributions of each participating group to the data analysis development groups.

2. Participation

During the period August 15, 2007 - August 14, 2008, the members of ACIGA will participate in the analysis of initial LIGO data in the following areas:

a. Binary Inspirals

Not Applicable

b. Bursts

ANU

i) Complete Bayesian paper unifying previous work in the field

ii) Complete Bayesian treatment testing on simulated and real data

iii) Submit code for review and run as production search

.

CSU

Detecting chirping signals in coloured noise.

The paper [1] covers the case where the support of the signal is known ie. when we have a segment of noisy data that is approximately the same length in time as the signal, and we wish to determine if there is a signal present or not. The ongoing work 2007-2008 is to adapt the method for detecting signals at unknown times in a long stream of noisy data. The noise may be coloured, and for concreteness we are using a simulated LIGO noise model.

[1] E J Candes, P R Charlton and H Helgason, "Detecting highly oscillatory signals by chirplet path pursuit" Applied and Computational Harmonic Analysis, in press, available online 4 May 2007.

UWA

Coward (UWA), Howell (UWA, Regimbau (VIRGO)

The Probability Event Horizon (PEH) filter, developed by Coward et al., makes use of the unique temporal distribution of increasingly brighter events in a time-series. A PEH filter preferentially selects events in the tail of a probability distribution function. By definition these are rare, and for time dependant events, the filter output depends on the temporal and brightness distribution of a particular event type. This filter extracts the temporal signature of rare events from a time series. Models that describe this evolution are constructed from the filter output. The models are used to characterize the data and to predict trends in the strength of transients as a function of data length. We will work with the working group to better understand the application of the PEH to LIGO data with a view to submitting an approved and supported work plan in 2008.

Host galaxy localization of merger & burst sources using a global network of Advanced interferometers (Bursts)

Wen (UWA, Caltech, Max-Plank, Coward (UWA), Regimbau (VIRGO), Howell (UWA)

1. Employ recent galaxy survey data, rate estimates from observations of gamma ray bursts and GW detector network analysis methods to develop models for host galaxy identification of binary merger and burst sources.

2. Use simulations based on the above models to quantify the uncertainty in host galaxy localization.

3. Use results from above to determine optimal strategies for performing joint EM and GW observations of short gamma ray bursts.

This work is perhaps outside the scope of the bursts working group and consideration should be given to where such activities should be supported.

c. Stochastic

Not Applicable

d. Continuous

Within ACIGA, there are a number of activities related to continuous wave sources. Research is being carried out at ANU,and by new members from the astrophysics community at the University of Melbourne and Monash University. The program is overseen by Dr Scott (ANU) and with Prof Ben Owen (PSU) helping to link the programs together.

ANU

i) Searches for isolated neutron stars (ANU) (with Ben Owen, PSU)
We plan to have our search codes reviewed and a final publishable search for Cas A, using a segment of V4 calibrated data from the first year of S5, running by the end of the year. We expect the search will take on the order of a few months, and will possibly be left to run over the Australian summer. We expect that, within a year, the search will be fully completed and ready to be considered for publication by LIGO.

ii) PowerFlux using full polarization information (with Greg Mendell (LHO))
We plan to write a paper including the new results and submit it to the proceedings of Amaldi 7.

Univ. of Melbourne (A. Melatos)
This subgroup is just beginning in GW data analysis. The plan for the next year is to prepare ground work by:

i) Installing LIGO data analysis software (lal and lalapps)

ii) Gaining familiarity with existing search software for continuous wave sources with (approximately) known frequency and sky position

iii) Verifying search software against fake data (and S4 data if appropriate) to quantify sensitivity to source parameters (e.g. frequency drift rate)

iv) Setting up a search for accreting millisecond pulsars, in collaboration with AEI-Potsdam (Papa, Krishnan) and Penn State (Owen).

Item iv) will be undertaken towards the end of the 1-year period covered by the MOU, pending satisfactory completion of Items 1-3 and official confirmation by the LSC Continuous Wave Search Group.

Item iv) includes setting up the search only. Running the search (on S5 data) is not guaranteed within the 1-year period covered by the MOU.

At present, the University of Melbourne group has zero discretionary funding. It is therefore unable to commit to any LIGO activities incurring direct expenses, such as travel to LIGO sites/meetings. This unavoidable constraint has been communicated to the leadership of ACIGA and the LSC Continuous Wave Search Group, as well as the collaborators named in the data analysis program above.

Monash University (D. Galloway)
Searches for accreting neutron stars

i) in collaboration with Hans Krimm & Craig Markwardt (Goddard Space Flight Centre) and Deepto Chakrabarty (MIT), we derived a timing solution for the recently-discovered 182 Hz accretion-powered pulsar Swift J1756.9-2508 covering the 13 d interval in 2007 June when it was X-ray active. We will supply this timing solution to the LIGO team via Ben Owen (PSU) in order to enable a coherent search for gravitational waves from the new pulsar in data from the S5 run.

ii) in collaboration with Deepto Chakrabarty (MIT) and Ben Owen (PSU) we will investigate the feasibility for further searches for GW from known accretion-powered millisecond pulsars in earlier LIGO data, including previous science runs. There are presently 8 known accretion-powered millisecond pulsars, all of which have been active during transient outbursts within the previous 5 years.

iii) ongoing RXTE target-of-opportunity observations in collaboration with Deepto Chakrabarty and Ed Morgan (MIT) are intended to observe repeat outbursts of known pulsars as well as outbursts of previously unknown sources. Where possible, we will usetiming solutions determined from X-ray observations during these transient outbursts to allow coherent searches for GW from these sources.

e. Other Contributions

Not Applicable

3. Resource Sharing

The LIGO Laboratory will contribute resources including allocation of appropriate scientific and engineering personnel, research facilities, and funding in support of the effort in Item No. 2, as indicated below.

a. Research accommodations for ACIGA group members while on LIGO research assignment at any LIGO Laboratory site.

Research accommodations for ACIGA group members while on LIGO research assignment at any LIGO Laboratory site.

b. Access to LIGO data through established LSC channels in support of this work.

Access to LIGO data through established LSC channels in support of this work.

4. Coordination and Reporting

ACIGA will perform research within the structures established by the LIGO Laboratory and the LSC where appropriate.
In particular, with reference to activities described above:

2a will be carried out within the LSC Inspiral Search Group.

2b will be carried out within the LSC Burst Search Group.

2c will be carried out within the LSC Stochastic Search Group.

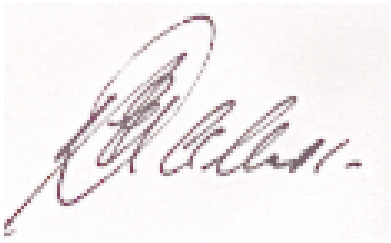
2d will be carried out within the LSC Continuous Waves search Group.

This includes keeping the Group leaders informed of activities and plans, reporting to the group at meetings and telecons, and through technical documents submitted to the LIGO Document Control Center.
In addition, an annual report will be submitted with the update to this Attachment, giving a summary status on research by topic as indicated in Item No. 2, including progress against the milestones if any, significant accomplishments such as new insights/discoveries or publications, issues of concern if any, and an indication of invested time.
This Attachment will be updated at least annually with a plan of activities for the succeeding one-year period. These documents will be due one month before the close of the period of performance under this Attachment.

5. Computer Code

All computer code delivered to the LSC under this Attachment must be developed in consultation with the LSC Data Analysis Software Working Group (DASWG) and archived, documented and reviewed as determined by that group.

Jay Marx
LIGO Laboratory Director



David Ernest McClelland
Principal Investigator(s)
ACIGA

David Reitze
LSC Spokesperson