

**Attachment Number A to the  
Memorandum of Understanding (LIGO-M950073-00-M)  
between the  
Michigan Gravity Wave Group (MGWG) in the Department of Physics of the  
University of Michigan  
and the  
Laser Interferometer Gravitational Wave Observatory (LIGO) Laboratory  
August 15, 1999**

This Attachment to the Memorandum of Understanding LIGO-M950073-00-M covers the role of the Michigan Gravity Wave Group (MGWG) in the Department of Physics of the University of Michigan as a Charter Member of the LIGO Scientific Collaboration (LSC) and a member of the LIGO I Development Group (LIDG). The period of performance for the activities in this Attachment is from August 15, 1999 to February 15, 2000. This period may be modified by agreement to a revision of this Attachment.

1. LIGO Scientific Collaboration - The LIGO Scientific Collaboration is organized as a separate organization from the LIGO Laboratory. It includes scientists from the LIGO Laboratory, and those from collaborating institutions, and has its own leadership and governance. The Collaboration will ensure equal scientific opportunity for individual participants and institutions. It will organize the research, publications, and all other scientific activities. The Collaboration will report to the Laboratory Directorate for final approval of its research program, technical work, observational physics publications, and talks announcing new observations and physics results. This will be done through regular reports to the Directorate and its PAC.
2. Charter Membership - An initial period for formation of the Charter group of institutions in the LIGO Scientific Collaboration commenced on March 1, 1997 and ended following the first full meeting of the Collaboration at which the Collaboration Council assumed its role.

Following the charter period proposals will be evaluated through the Collaboration Council. With Collaboration approval, an MOU with the LIGO Laboratory, including Attachments defining specific work, will be required for any participating institutions.

3. This document is an agreement between the Michigan Gravity Wave Group (MGWG) in the Department of Physics of the University of Michigan and the LIGO Laboratory concerning the activities of MGWG as a Collaborating Institution in the LIGO Scientific Collaboration (LSC) and in the LIGO I Development Group (LIDG), and as noted in Item No. 9 below.
4. LIGO I Development Group - The LIGO I Development Group is the scientific collaboration for implementing and exploiting the initial LIGO detector and physics through the initial sci-

ence data run. Only groups who establish a specific Attachment approved by the LIGO Laboratory, which defines a sufficient contribution and participation in LIGO I development, implementation or data analysis, will be part of this initial LIGO data run and science. Participation in future data runs and science that follow LIGO I will be possible for other groups, with guidelines to be determined by the LIGO Scientific Collaboration. It is anticipated that LIGO I data will only be made available through formal collaboration within the LIGO I Development Group during the first two years following its collection.

The general guideline for institutional membership in the LIGO I Development Group is that the contribution per collaborator of any new group to the design, construction, and implementation of the initial LIGO detector and to the first data run be comparable to that of the LIGO Laboratory scientists.

5. Report of Progress - MGWG will provide a status report on its activities in support of LIGO every six months. The report will consist of: a) a summary status on research by topic as indicated Item No. 9 below 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, b) updated List of Collaborators, and c) a plan of activities for the succeeding six-month period. The report will be due one month before the close of the period of performance under the Attachment in question.
6. Term of Membership - The Membership will be renewed every six months upon evidence of satisfactory performance of agreed upon duties.

The coordinates of MGWG members are included in Attachment Z to the Memorandum of Understanding LIGO-M950073-00-M.

7. Intellectual Property Rights - The rights to intellectual property developed under this Attachment will be subject to the National Science Foundation Grant Policy as indicated in Section 730, Intellectual Property.
8. LLAL software conventions - It is necessary that any delivered code conforms to the LLAL style as laid out in the LLAL specification T990030. This includes; 1) coding style, headers, etc; 2) use of function calls, etc; 3) organization of software in the directory structures indicated in the document; 4) inclusion of test codes and validation tests to enable users to verify successful installation of implementation; and 5) documentation and users manuals (html or pdf) to enable users to understand and adopt code.
9. Keith Riles chairs the LSC Detector Characterization working group. During August 15, 1999 to February 15, 2000, K. Riles will continue coordinating the group's efforts, together with LIGO Laboratory liaison Daniel Sigg and subgroup leaders Fred Raab, Jim Brau and Sam Finn. The coordination effort will include performance characterization, transient analysis, data set reduction, and data set simulation.

K. Riles will be working with the LIGO Laboratory physicists, primarily John Zweizig, to facilitate efficient contributions to Detector characterization by LSC members. He will con-

tribute directly to software algorithms to the on-site Data Monitor Tool in the areas of performance characterization and transient analysis. K. Riles and students will also begin work on algorithms to be used in searches for periodic sources of gravitational radiation.

R. Gustafson will complete operations at the 40-m facility and MGWG will start analysis of the collected data. The 40-m facility serves as a diagnostic tool to anticipate potential problems with the full LIGO detector, but also as a scientific instrument for carrying out broadband searches for gravitational waves.

The planned work on the CW sources will be coordinated with the ASIS group activities.

MGWG collaborators will continue setting up a laboratory at the University of Michigan (UM) for LIGO controls & electronics development and testing, exploiting the substantial electronics lab facilities already established by UM's high energy physics research groups.

The MGWG will carry out or begin the following specific tasks in support of LIGO I:

- a. Richard Gustafson and Justin Dombrowski will finish noise studies and development of lock acquisition diagnostics with the 40-m interferometer.
- b. R. Gustafson and J. Dombrowski will finish testing of the recycled 40-m.
- c. R. Gustafson will test and refine alternate "carrier independent" servo controls for the Michelson cavity longitudinal degrees of freedom.
- d. R. Gustafson and J. Dombrowski will record 40-m data in a fully recycled LIGO-like configuration.
- e. K. Riles will develop and implement an algorithm for characterizing the operational state of the LIGO interferometers.

Note: The LLAL style software development conventions in Item No. 8, will apply to the above algorithm development and implementation.

- f. K. Riles will develop and implement an algorithm for identifying the onset of instability and the excitation of out-of-band resonances in LIGO servos.

Note: The LLAL style software development conventions in Item No. 8, will apply to the above algorithm development and implementation.

- g. K. Riles, David Chin, and J. Dombrowski will begin development of algorithms to discriminate between true periodic sources of gravitational radiation and instrumental wandering oscillators.

Note: The LLAL style software development conventions in Item No. 8, will apply to the

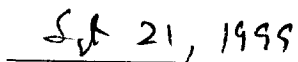
above algorithm development.

- h. K. Riles, D. Chin, and J. Dombrowski will begin analysis of the 40-m data to test algorithms for detector characterization and periodic source discrimination.
10. During the period August 15, 1999 to February 15, 2000, the LIGO Laboratory will share, as requested and appropriate, the LIGO data of relevance to the research topics in Item No. 9 above.
11. The research effort pursuant to this Attachment A will be coordinated by R. Gustafson and Albert Lazzarini on behalf of MGWG and LIGO Laboratory, respectively.
12. 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. 9 as indicated below. These resources will be in addition to the coordination effort and data to be made available per Item No. 10 above.
  - a. Provide accommodations for investigators in Item No. 9 above while on research assignment at LIGO facilities.

Approved:



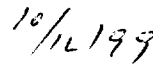
Barry Barish  
LIGO Laboratory Director



Date



Ctirad Uher  
Chair, Department of Physics



Date