

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
February 15, 2000

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 February 15, 2000 to August 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 indicated 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-

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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. During February 15, 2000 to August 15, 2000, the MGWG group will participate as follows:

Keith Riles chairs the LSC Detector Characterization Working Group. K. Riles will continue coordinating the group's efforts, together with LIGO 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 LIGO Laboratory physicists, primarily John Zweizig, to facili-

tate efficient contributions to detector characterization by LSC members. K. Riles will contribute directly to software algorithms for the on-site Data Monitor Tool in the areas of performance characterization and transient analysis. K. Riles and students will also continue work on algorithms to be used in searches for periodic sources of gravitational radiation. The ongoing work on the periodic sources is being carried out as part of the LSC ASIS working group effort.

Richard Gustafson will begin residence at the LIGO Hanford Observatory on February 15. He will finish and document analysis of alternative servo schemes (developed at the 40 Meter) that may be of value to LIGO I. R. Gustafson will also investigate changes in servo controls electronics & software needed to implement the alternative servos. R. Gustafson will serve as a liaison between the LSC Detector Characterization Working Group, testing, interpreting and enhancing diagnostics developed by LSC members. In addition, R. Gustafson will investigate systemic noise in the Hanford interferometers and continue development of new diagnostics and controls.

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

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

- a) R. Gustafson will document and submit for publication the new amplitude modulation servo schemes for controlling the short Michelson cavity, developed at the 40 Meter.
- b) R. Gustafson will serve as Hanford site liaison to the Detector Characterization Working Group in on-site interpretation and enhancement of diagnostics developed by LSC members.
- c) R. Gustafson and D. Chin will investigate and reduce systemic noise in the Hanford interferometers, especially that associated with electronics and non-linear couplings among servos.
- d) R. Gustafson will analyze and document the potential performance improvement for LIGO I offered by alternative Michelson servo schemes and will investigate the infrastructure changes required to implement the new servos.
- e) R. Gustafson will continue development of new controls and diagnostics applicable to LIGO I and LIGO II. For LIGO I, R. Gustafson will investigate a "lock stepper" for controlled stepping from one fringe to another, relaxing the test mass lock positions. The testmass LSC gain matrix strategy for lock acquisition and robustness will be investigated. Note: this was important at the 40M.
- f) K. Riles will continue coordination of the LSC Detector Characterization Working Group.
- g) K. Riles will continue implementing algorithm for characterizing the operational state of

the LIGO interferometers.

h) K. Riles will continue implementing algorithms for identifying the onset of instability and the excitation of out-of-band resonances in LIGO servos.

i) K. Riles, D. Chin and J. Marsano will continue implementing algorithms to discriminate between true periodic sources of gravitational radiation and instrumental artifacts.

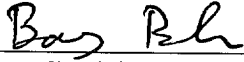
j) K. Riles, D. Chin and J. Marsano will continue analysis of the new 40 Meter data to test algorithms for detector characterization and periodic source discrimination. This work is being carried out as part of the joint 40 Meter - Tama coincidence analysis team effort.

k) K. Riles and J. Dombrowski will investigate the potential value of alternative phase-phase modulation schemes for controlling the short Michelson cavity.

l) MGWG will interact strongly with the LIGO commissioning process at the sites to contribute the energy and acquired expertise to matters and problems arising in the LIGO project and conceptual evolution.

10. During the period February 15, 2000 to August 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 MGWG investigators while on LIGO research assignment at Caltech, and/or LIGO sites.

Approved:



Barry Barish
LIGO Laboratory Director

3/1/00

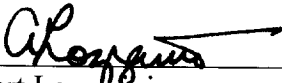
Date



Ctirad Uher
Chair, Department of Physics

3/9/00

Date



Albert Lazzarini
LIGO Staff

29 FEB 2000

Date

Note 1, Linda Turner, 03/30/00 10:55:34 AM
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