

**Attachment Number A to the  
Memorandum of Understanding (LIGO-M950019-00-M)  
between the  
Caltech Relativity Group (CaRT)  
and the  
Laser Interferometer Gravitational Wave Observatory (LIGO)  
Laboratory  
August 15, 2002**

This Attachment to the Memorandum of Understanding LIGO-M950019-00-M covers the role of the Caltech Relativity Group (CaRT) 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, 2002 to August 15, 2003. 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 Caltech Relativity Group (CaRT) and the LIGO Laboratory concerning the activities of CaRT as a Collaborating Institution in the LIGO Scientific Collaboration (LSC) and in the LIGO I Development Group (LIDG), and as indicated in Items No. 8 and 9.

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 science 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 - CaRT 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 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-monthly 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 CaRT members are included in the Attachment Z to the Memorandum of Understanding LIGO-M950019-00-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. LAL Software Conventions - It is necessary that any delivered code conforms to the LAL style as laid out in the LAL 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 the period August 15, 2002 to August 15, 2003, the CaRT group will contribute as follows:
  - a) K. Thorne will continue to serve as an interface between LIGO and the astrophysics and relativity source-modeling communities, with the goal of facilitating the contributions of these theory communities to foundations for LIGO data analysis.
  - b) A. Buonanno and Y. Chen, and M. Vallisneri (now a member Tom Prince's research group but included on our MOU) will continue their effort to devise families of search templates for inspiraling BH/BH and NS/BH binaries that are large enough and diverse enough to deal with uncertainties in the true waveforms [caused by failure of the post-Newtonian expansion] and that include the effects of spin-orbit- and spin-spin-induced precession and waveform modulation.
  - c) A. Buonanno, Y. Chen, M. Vallisneri, and Y. Pan will initiate an effort to bring their new BH/BH and NS/BH template families into a form suitable for use in LIGO-I data analysis.
  - d) K. Thorne and E. Flanagan of CURG at Cornell University will return to writing a series of papers on light scattering noise in the LIGO beam tube and the geometric design of the baffles that control it. (This project has been on hold for several years due to more urgent work.)
10. During the period August 15, 2002 to August 15, 2003, the LIGO Laboratory will share, as requested and appropriate, 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 K. Thorne and Albert Lazzarini on behalf of CaRT and the 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.
  - a) Provide accommodations for CaRT investigators while on LIGO research assignment at LIGO sites.

Approved:

Barry C Barish  
Barry Barish  
LIGO Laboratory Director  
11-Jan-04  
Date

Kip S Thorne  
Kip S. Thorne  
CaRT Principal Investigator  
31 Jan 2004  
Date

Albert Lazzarini  
Albert Lazzarini  
LIGO Laboratory Data and  
Computing Group Leader  
6 Jan 2004  
Date