Attachment Number A to the

Memorandum of Understanding (LIGO-M000128-00-M)

between the

Elementary Particles and Relativity Group

Department of Physics, California State University Dominguez Hills

and the

Laser Interferometer Gravitational-Wave Observatory (LIGO) Laboratory

August 15, 2003

This Attachment A to the Memorandum of Understanding LIGO-M000128-00-M covers the role of the Elementary Particles and Relativity Group, Department of Physics, California State University Dominguez Hills (EPRG-CSUDH) as a member of the LIGO I Development Group (L1DG). The period of performance for the activities in this Attachment is from August 15, 2003 to February 15, 2004. This period may be modified by agreement to a revision of this Attachment.

1. LIGO Scientific Collaboration - The LIGO Scientific Collaboration (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 semi-annual 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 and approved, as appropriate, through the Collaboration Council. 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 Elementary Particles and Relativity Group, Department of Physics, California State University Dominguez Hills (EPRG-CSUDH) and the LIGO Laboratory concerning the activities of the EPRG-CSUDH as a Collaborating

Institution in the LIGO Scientific Collaboration (LSC) and in the LIGO I Development Group (L1DG), and as indicated in Items No. 8, No. 9 and No. 10.

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 - The EPRG-CSUDH 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 in Item No. 10 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 EPRG-CSUDH members are included in the Attachment Z to the Memorandum of Understanding LIGO-M000128-00-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. LSC Service Functions - Participation in LIGO I brings with it responsibility for service functions to support the overall effort in achieving high detector sensitivity and high data quality. In particular, each LIGO I group is expected to assist in the staffing of scientific

monitoring shifts during organized data runs. The staffing of these shifts is notable for both its importance and the travel burden it places on scientists. This burden makes an equitable shift allocation mechanism necessary.

A nominal guideline is that each LIGO I group should staff a fraction of the shifts comparable to its FTE fraction devoted to LIGO I activities. An eight-hour shift is assumed. The current count of FTE in the Collaboration is 127 (not including GEO FTE). The Elementary Particles and Relativity Group at the California State University Dominguez Hills (EPRG-CSUDH) has 2 FTE's associated with LIGO I and is expected to staff 1.6% of the scientific monitoring shifts during this MOU period.

Kenneth Ganezer will be responsible for interaction with the designated LSC Shift Organizer (currently Keith riles of Michigan Univ.) with respect to the EPRG-CSUDH's Service Function commitments.

Groups making extensive contributions to the LSC in other service efforts that involve a substantial travel burden may request a reduction in their nominal share of shift staffing. Those efforts can include:

1) Commissioning and instrument improvement

2) Participation in on-site detector characterization investigations

3) Development/operation of analysis software/hardware infrastructure and validation of analysis software that requires travel away from the home institution.

10. The EPRG-CSUDH consists of Professors Kenneth Ganezer, William Keig, George Jennings, and Samuel L. Wiley. Ganezer is the primary party to this agreement.

    During the period August 15, 2003 to February 15, 2004, the EPRG-CSUDH (CSUDH) will focus primarily on issues related to the signal detection and backgrounds for stochastic and short burst graviational radiation, Advanced LIGO, and the 40m LIGO prototype (40m) upgrade, as follows:

    LIGO I Data Analysis and Advanced LIGO Research and Development

    a) Ganezer will: undertake imperfect optics simulations that are related to non-uniformities, thermal effects, and other deformations for Advanced LIGO, LIGO I, and the upgraded 40m using LIGO-FFT and other software tools (Task-1); take steps to analyze S1 and S2 data to formulate upper limits on burst sources of gravitational waves and to correlate supernova, and cosmological neutrinos with graviational wave measurements at LIGO I (Task-2); and undertake scientific monitoring shifts for the S3 data run and maintenance of the anthropogenic noise monitor software (Task-3).

Milestones will include:

Task-1
CSUDH with undertake computation and documentation of computational results for imperfect optics simulations for Advanced LIGO, LIGO I, and the upgraded 40m using the LIGO-FFT program and other software. The LIGO I computations will involve the comparison of simulations based on as-built configurations and phase maps at H1, H2, and L2, when available, with the actual performance of the LIGO I IFOs.

Task-2
CSUDH will work with the burst source analysis group on burst source S2 and S3 data analysis, and on finalizing a burst manuscript for S1. CSUDH will help to refine methods for correlating cosmological neutrino measurements with LIGO I gravity wave data for a galactic supernova and other burst sources. CSUDH will work along with members of the burst source group on establishing upper limits on gravity waves from the S1 data run.

Task-3
CSUDH will undertake the required number of scientific monitoring shifts for the S3 data run occurring from November 2003- January 2004 and will make initial efforts into maintaining the seismic-BLRMS anthropogenic noise monitor software (whose results are displayed in the LHO and LLO control rooms).

b) Jennings will work on optical simulations for Advanced LIGO, the 40m, and LIGO I (Task-1), as described in paragraph a).

c) Keig will work on optical simulations for Advanced LIGO, the 40m, and LIGO I (Task-1), on burst source searches and upper limits with the burst source group, and on correlations among cosmological neutrinos and gravitational wave sources (Task-2), as described in paragraph a).

d) Wiley will work on imperfect optics simulations for Advanced LIGO, LIGO I and the 40m (Task-1), and scientific monitoring data taking shifts and maintenance of the anthropogenic noise monitor (Task-3), as described in paragraph a).

11. During the period August 15, 2003 to February 15, 2004, the LIGO Laboratory will provide, as requested and necessary, LIGO data of relevance to the research in item No. 10.

12. The research effort pursuant to this Attachment A will be coordinated by Kenneth Ganezer, and Albert Lazzarini and Alan Weinstein on behalf of EPRG-CSUDH and the LIGO Laboratory, respectively.

13. Resource Sharing

LIGO Laboratory will provide accommodations for EPRG-CSUDH investigators while on LIGO research assignment at Caltech, and /or LIGO sites.

EPRG-CSUDH will apply for external or internal monies to build a full 16 node Beowulf that meets LDAS standards at CSUDH.

Approved:

Barry C Barish
Barry Barish
LIGO Laboratory Director
30 March 04
Date

Kenneth Ganezer
Kenneth Ganezer
EPRG-CSUDH Principal Investigator
4/12/04
Date

A Lazzarini
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LIGO Laboratory Data and
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Jamie Rollins for Keith Riles
Keith Riles
LSC Shift Organizer
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Date

Alan Weinstein
Caltech Professor of Physics
3-1-04
Date