Memorandum of Understanding (LIGO-M050421-00-M -00-M)

between the

Department of Chemistry and Physics at Southeastern Louisiana University (DCP/SLU) Group

and the

Laser Interferometer Gravitational Wave Observatory (LIGO)

August 15, 2005

The purpose of this Memorandum of Understanding (MOU) is to establish and define a collaborative relationship between the Department of Chemistry and Physics at Southeastern Louisiana University (DCP/SLU) Group and the Laser Interferometer Gravitational-Wave Observatory (LIGO). Both parties to this agreement share the broad goals of developing the instruments and techniques for detecting and studying gravitational waves, and subsequently using them as an astrophysical probe. Under this MOU, the DCP/SLU Group will be a member group of the LIGO Scientific Collaboration.

1. The Department of Chemistry and Physics at Southeastern Louisiana University (DCP/SLU) Group consists of Professor Sanichiro Yoshida, who will serve as Principal Investigator for research in LIGO, Professor David Norwood, who will focus on mentoring undergraduate students, and two undergraduate students. The focus of the work done by the DCP/SLU Group under this agreement will be e2e modeling of LIGO detectors.

2. LIGO comprises two parts: the LIGO Laboratory and the LIGO Scientific Collaboration. These two entities report to the LIGO Directorate, consisting of the LIGO Director, the LIGO Scientific Collaboration Spokesperson, and the LIGO Laboratory Deputy Director. The design and construction of the LIGO Observatories were carried out by California Institute of Technology (Caltech) and the Massachusetts Institute of Technology (MIT) under a Cooperative Agreement between the National Science Foundation (NSF) and Caltech. The LIGO Oversight Committee supervises the realization of LIGO.

    A. The LIGO Laboratory is responsible for the operation of the LIGO Observatories, the development and implementation of future detector systems, and participates in all aspects of the research with the LIGO detectors. LIGO is a system of three interferometric Fabry-Perot antennas, two of them 4 kilometers long and the third one 2 kilometers long, aimed at the simultaneous detection of gravitational waves in the frequency range

40-6000 Hz. LIGO Observatories are located in Hanford, Washington and in Livingston Parish, Louisiana (USA) and began observations in the year 2002. The LIGO Laboratory is funded through a Cooperative Agreement between the National Science Foundation and Caltech, with the portion of the LIGO Laboratory at MIT funded through a subcontract from Caltech.

B. The LIGO Scientific Collaboration (LSC) is organized as a separate entity from the LIGO Laboratory. It includes scientists from the LIGO Laboratory, and those from collaborating institutions, and has its own governance and leadership (which includes the LSC Spokesperson as a member of the LIGO Directorate). The Collaboration ensures equal scientific opportunity for individual participants and institutions. It organizes the research, publications, and all other scientific activities. The Collaboration reports to the LIGO 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 Program Advisory Committee. The organization of the LSC and its governance are defined in its Charter.

3. As a member group of the LSC, the DCP/SLU Group will participate in the governance of the LSC and in setting its policies and procedures, as defined in the LSC charter. Similarly, it agrees to abide by the policies and procedures adopted by the LSC and posted on its website (http://www.ligo.org/policies.html), concerning publication, data access, software standards, and so on.

4. Membership in more than one collaboration active in the same area of research may present complications. Members of the LSC contemplating joining other gravitational wave collaborations or participating in data analysis efforts with collaborations outside a framework established by the LSC should inform and consult with LSC and the LIGO Laboratory to ensure that no conflicts of interest exist.

5. The LSC is the primary advocate of interferometric gravitational wave research in the U.S. To function effectively in this role, it needs to be informed in advance about major new initiatives. The Group agrees to inform the LSC of any major new proposals related to LIGO to be submitted to the NSF, and to consult with the LSC concerning the best approach to support the overall LIGO program. The final decision about the scope of any such proposal shall remain the prerogative of the DCP/SLU Group.

6. LSC Service Functions - Participation in the LSC brings with it responsibility for service functions to support the overall effort in achieving high detector sensitivity and high data quality. In particular, each LSC 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 LSC group should staff a fraction of the shifts comparable to its FTE fraction devoted to LSC activities. Sanichiro Yoshida (DCP/SLU Group) will be responsible for interaction with the designated LSC Shift Organizer with respect to the DCP/SLU Group'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:

- Commissioning and instrument improvement
- Participation in on-site detector characterization investigations
- Development/operation of analysis software/hardware infrastructure and validation of analysis software that requires travel away from the home institution.

7. Each party to this agreement continues to be responsible for all support of its staff including travel costs associated with the activities under this agreement. Exceptional support of travel by the other institution may be allowed for travel requested by that institution.

8. Attachments to this MOU will be prepared annually to define the specific activities and responsibilities of the DCP/SLU Group and to define any resources to be provided by the LIGO Laboratory to the DCP/SLU Group in support of those activities.

9. DCP/SLU Group will provide an annual status report on its activities in support of LIGO. The report will consist of a summary status on research by topic as indicated in the Attachments for that period 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 by each member of the group. The report will be due one month before the close of the period of performance under the Attachments in question.

10. The LSC will review the progress report against the Attachments from the previous year and assess the Attachments for the up-coming year annually, under its established procedure, and recommend acceptance or rejection of each Attachment by the LIGO Director and the LSC Spokesperson.

11. A list of DCP/SLU Group members will be updated at least every six months. DCP/SLU Group members and appropriate contact information will be provided in electronic form as Attachment Z to this Memorandum of Understanding. In cases where individuals who leave the group have had access to LIGO data and this access should be terminated, the DCP/SLU Group Principal Investigator is responsible for timely notification to the Directorate and to the computing committee so access may be revoked.

12. The LIGO Laboratory is responsible for obtaining NSF approval of collaborative Memoranda of Understanding where required. All Memoranda of Understanding will

be provided to NSF for their information.

13. The rights to intellectual property developed under this Attachment using LIGO Laboratory resources will be subject to the National Science Foundation Grant Policy as indicated in Section 730, Intellectual Property.

    A. In the event a patentable invention is conceived or first actually reduced to practice during the work of a member(s) of the DCP/SLU Group at LIGO Laboratory facilities, he/she will:
       i) make prompt disclosure of the invention to the Director of the LIGO Laboratory; and
       ii) cooperate with LIGO Laboratory and supply all information and execute all papers including invention reports, records of invention, patent applications and powers of attorney, necessary and proper to fulfill the obligations of the LIGO Laboratory to the U.S. Government sponsor.
    B. The ownership of inventions conceived solely by members of the DCP/SLU Group at LIGO facilities shall be owned by the Southeastern Louisiana University, although the LIGO Laboratory shall be granted a license to use such invention for noncommercial research purposes at LIGO facilities. Inventions that are conceived by both members of the DCP/SLU Group and LIGO Laboratory staff as part of the LIGO project shall be jointly owned and any income from commercial licensing shall be shared in proportion to the number of joint inventors from each institution.

    In all other regards, the rights to intellectual property developed by members of the DCP/SLU Group under this Attachment will be in accordance with the policies of Southeastern Louisiana University.

14. This MOU supersedes the previous MOU between the LIGO Laboratory and the DCP/SLU group (LIGO-M990317-00) and its amendments and attachments. This MOU will remain in force until the parties mutually agree to terminate it, or until it is terminated in accordance with LSC procedures.

Approved:

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Barry Barish
LIGO Director

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Sanichiro Yoshida
Principal Investigator
Department of Chemistry and Physics at
Southeastern Louisiana University Group

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Peter Saulson
LSC Spokesperson

Attachment OPS to the

Memorandum of Understanding (LIGO-M050421-00-M)

between the

Department of Chemistry and Physics at Southeastern Louisiana University (DCP/SLU))

and the

Laser Interferometer Gravitational Wave Observatory (LIGO)

August 15, 2005

This Attachment OPS to the Memorandum of Understanding LIGO-M050421-00-M defines the role of the Department of Chemistry and Physics at Southeastern Louisiana University (DCP/SLU) as a Member of the LIGO Scientific Collaboration (LSC) in the areas of detector commissioning, detector characterization, and operations in support of the initial LIGO interferometers. The period of performance for the activities in this Attachment is from August 15, 2005 to August 15, 2006.

1. 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. LSC groups are encouraged to contribute to the commissioning, characterization, and operation of the LIGO detectors, as members of working groups established by the LIGO Laboratory and the LSC.

2. During the period August 15, 2005 to August 15, 2006, the members of DCP/SLU Group will participate in the initial LIGO detector research program in the following areas:

   a) *Commissioning* – In close collaboration with the LIGO LAB numerical simulation group, will continue development of e2e modeling of the LIGO I suspension with dynamics associated with the suspension wires' violin mode, optic's side, bounce and roll modes into consideration. As an extension of this activity, will support LIGO LAB numerical simulation group in developing e2e model of Advanced LIGO, focusing on mechanical modeling. The development will start with integration of existing seismic isolation models into e2e modeling, followed by parameterization and modification of e2e modeling of triple/quadruple suspensions, and modeling of more detailed mechanical effects such as locations of each suspension on HAM/BSC table.

   b) *Detector Characterization* – Will continue e2e modeling of LIGO I Input Optic's (IO) dynamics. Development of mechanical modeling of IO (Mode Cleaner and Mode Matching Telescope) will be completed and results will be integrated to the e2e model of the other LIGO I subsystems developed by the LIGO LAB numerical simulation group. Will continue numerical analysis of LIGO I detector. Focus will be on understanding of the effect of IO's beam pointing fluctuation on the interferometer's performance.

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 DCP/SLU 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.

4. Coordination and Reporting – DCP/SLU Group will perform this research within the structures established by the LIGO Laboratory and the LSC where appropriate. In particular activities described in Item 2a) and 2b) will be carried out in coordination with the LIGO Laboratory Commissioning Leader. Coordination will include 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 on-year period. These documents will be due one month before the close of the period of performance under this Attachment.

5. 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.

Approved:

Barry Barish LIGO Laboratory Director	Sanichiro Yoshida DCP/SLU Principal Investigator
Peter Saulson LSC Spokesperson	Peter Fritschel LIGO Lab Commissioning Leader

Attachment Number Z to the

Memorandum of Understanding (LIGO-M050421-00-M)

between the

Department of Chemistry and Physics at Southeastern Louisiana University

(DCP/SLU)

Laser Interferometer Gravitational Wave Observatory (LIGO) Laboratory

August 15, 2005

This Attachment to the Memorandum of Understanding LIGO-M050421-00-M lists the coordinates of the members of the Department of Chemistry and Physics at Southeastern Louisiana University (DCP/SLU) who will participate in the LIGO Scientific Collaboration (LSC) as members of LIGO Development Groups. The period of performance for the activities in this Attachment is from August 15, 2005 to August 15, 2006. This period may be modified by agreement to a revision of this Attachment.

Name	Address	E Mail	Phone Nos.	Begin Date	End Date
Yoshida, Sanichiro, Faculty FTE (05-06) 75% FTE (04-05) 75% Author	Dept. of Chemistry and Physic Southeastern Louisiana Univ. Hammond, LA 70402	syoshida @selu.edu	985-549-3943 Off 985-549-3943 Lab Fax: 985-549-5126	Aug 15, 2005	Aug 15, 2006
Norwood, David Faculty FTE (05-06) 10% FTE (04-05) 10% Non Author	Dept. of Chemistry and Physic Southeastern Louisiana Univ. Hammond, LA 70402	dnorwood @selu.edu	985-549-3938 Off Fax: 985-549-5126	Aug 15, 2005	Aug 15, 2006

Approved:

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Barry Barish
LIGO Laboratory Director

Sanichiro Yoshida
DCP/SLU Principal Investigator

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Peter Saulson
LSC Spokesperson