

**Memorandum of Understanding (LIGO-M050315-00-M)**  
**between the**  
**Hobart & William Smith Colleges LIGO Group (HWSLG)**  
**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 Hobart & William Smith Colleges LIGO Group (HWSLG) 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 HWSLG will be a member group of the LIGO Scientific Collaboration.

1. The Hobart & William Smith Colleges LIGO Group (HWSLG) consists of Professor Steven Penn, who will serve as Principal Investigator for research in LIGO. While at any one time one or two undergraduate students do perform research with Professor Penn, the level of their work does not warrant full group membership. The focus of the work done by the Hobart & William Smith Colleges LIGO Group under this agreement will be the research and development of low thermal noise optical substrates and dielectric mirror coatings for use in Advanced LIGO, research and development of reduced thermal noise suspensions for large optics in Initial LIGO, and the development of a bicoherence data monitor for use in detecting bilinearity, non-Gaussianity and frequency/phase noise.
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 HWSLG 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 HWSLG 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 HWSLG.
  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. Steven Penn (HWSLG) will be responsible for interaction with the designated LSC Shift Organizer with respect to the HWSLG'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 HWSLG and to define any resources to be provided by the LIGO Laboratory to the HWSLG in support of those activities.
  9. HWSLG 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 HWSLG Group members will be updated at least every six months. HWSLG 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 HWSLG 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 HWSLG 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 HWSLG at LIGO facilities shall be owned by Hobart and William Smith Colleges, 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 HWSLG 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 HWSLG under this Attachment will be in accordance with the policies of Hobart and William Smith Colleges.

14. This MOU supersedes the previous MOU between the LIGO Laboratory and the HWSLG group (LIGO-M020307-00-M) 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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Steven Penn  
Principal Investigator  
Hobart and William Smith Colleges LIGO Group

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Peter Saulson  
LSC Spokesperson