

Attachment Number B
to the
Memorandum of Understanding (LIGO-M000016-00-M)
between the
Eddy-Current Subgroup (ECSG) in the Center for Nondestructive Evaluation
of the Iowa State University
and the
Laser Interferometer Gravitational-Wave Observatory (LIGO) Laboratory
August 15, 2000

This Attachment to the Memorandum of Understanding LIGO-M000016-00-M covers the role of the Eddy-Current Subgroup (ECSG) in the Center for Nondestructive Evaluation of the Iowa State University, as a member of the Isolation/Suspension/Thermal Noise Development Group (ISTNDG). The period of performance for the activities in this Attachment is from August 15, 2000 to February 15, 2001. 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 Eddy-Current Subgroup (ECSG) in the Center for Nondestructive Evaluation of the Iowa State University and the LIGO Laboratory concerning the activities of the ECSG as a Collaborating Institution in the LIGO Scientific Collaboration (LSC) and in the Isolation/Suspension/Thermal Noise Development Group (ISTNDG), and as indicated in Item No. 8 below.

4. Isolation/Suspension/Thermal Noise Development Group - The Isolation/Suspension/Thermal Noise Development Group (ISTNDG) is the scientific collaboration for defining and developing future isolation and suspension improvements for use in advanced subsystems for the initial LIGO interferometers or in entirely new advanced interferometers. A specific Attachment will define the roles and responsibilities of groups in this development group. Members of this group will normally be authors on publications reporting the work of the group and will normally be eligible to participate in data runs and science beyond the LIGO I data run.
5. Report of Progress - The ECSG 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. 8 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-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 ECSG members are included in the Attachment Z to the Memorandum of Understanding LIGO-M000016-00-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. During the period August 15, 2000 to February 15, 2001, Norio Nakagawa of ECSG will accomplish the following modeling tasks:
 - a) Thermal Noise Formulas

Develop a general Green's function method for computing the optical phase noise induced in a light beam reflected from a mirror, reflected from a Fabry-Perot, or passed through a delay line. Apply this general formalism to the case of a half infinite mirror with uniform loss, and derive analytical phase-noise expressions for these three cases.
 - b) Phase Noise of a Mirror with Lossy Surface Layer

Calculate the Green's function for a half infinite mirror with a slab of excess loss, and then derive the phase noise of a light beam reflected from a mirror with a thin lossy surface layer.
 - c) Numerical Thermal Noise Calculations

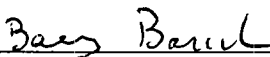
Initiate the development of software to compute the Green's function numerically for right circular cylindrical mirrors using the boundary element method. Use this Green's function based numerical computation code to calculate the phase noise produced upon reflection from the said type of a mirror. Compare the results to those of Gillespie and Raab, and Bondu. Perform parametric studies of the thermal noise for the target dimensions and material parameters of the LIGO II mirror design.

d) Analytical Expressions

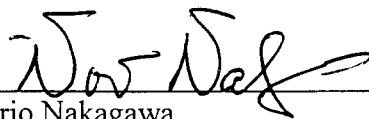
Develop analytical expressions for simple 2 dimensional problems designed to provide intuition about the nature of spatial correlations of mirror surfaces driven by thermal noise.

9. During the period August 15, 2000 to February 15, 2001, the LIGO Laboratory will share, as requested and appropriate, LIGO data of relevance to the research topics in Item No. 8 above.
10. The research effort pursuant to this Attachment B will be coordinated by Norio Nakagawa and Gary Sanders on behalf of the ECSG and the LIGO Laboratory, respectively.
11. 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. 8, as indicated below. These resources will be in addition to the coordination effort and data to be made available per Item No. 9 above.
 - a) Provide accommodations for ECSG investigator(s) while on LIGO research assignment at Caltech, and/or LIGO sites.

Approved:



Barry Barish
LIGO Laboratory Director



Norio Nakagawa
ECSG Principal Investigator
Iowa State University