

**Attachment Number C to the**  
**Memorandum of Understanding (LIGO-M970020-00-M)**  
**between the**  
**Institute of Applied Physics (IAP) of the Russian Academy of Sciences at**  
**Nizhny Novgorod**  
**and the**  
**Laser Interferometer Gravitational Wave Observatory (LIGO) Laboratory**  
**August 15, 1999**

This Attachment to the Memorandum of Understanding LIGO-M970020-00-M covers the role of the Institute of Applied Physics (IAP) of the Russian Academy of Sciences at Nizhny Novgorod as a member of the LIGO Scientific Collaboration (LSC) and a member of the Lasers/Optics Development Group (LODG). The period of performance for the activities in this Attachment is from August 15, 1999 to February 15, 2000. 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 Institute of Applied Physics (IAP) of the Russian Academy of Sciences at Nizhny Novgorod and the LIGO Laboratory concerning the activities of the Institute of Applied Physics (IAP) of the Russian Academy of Sciences at Nizhny Novgorod as a Collaborating Institution in the LIGO Scientific Collaboration (LSC) and in the Lasers/Optics Development Group (LODG), and as noted in item No. 8 below.
4. Lasers/Optics Development Group - The Lasers/Optics Development Group (LODG) is the

scientific collaboration for defining and developing future high power lasers and required improvements in optics 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 in 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 - IAP 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.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. Report distribution should be to the Collaboration Council and to the LIGO Laboratory Director.
6. Term of Membership - The Membership will be renewed every six months upon evidence of satisfactory performance of agreed upon duties.

The coordinates of IAP members are included in the Attachment Z to the Memorandum of Understanding LIGO-M970020-00-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, 1999 to February 15, 2000, the IAP research group will pursue the following goals as its contribution to the LIGO development:
  - a.) Enhancement of sensitivity and completion of software support for the advanced phase-modulated white light interferometer to characterize the surface quality of the LIGO core optics (clear aperture up to 25cm, absolute accuracy better than  $/1000$ , measurement radius of curvature 3000m and more).
  - b.) Experimental investigation (at 1064nm wave length) of novel designs of Faraday isolators at high average power radiation.
  - c.) Development of experimental techniques based on nonlinear optical effects for high precision remote (in situ) probing of LIGO optics components, including:

Comparison of solid and liquid nonlinear mediums from the viewpoint of measurement of small wave front distortion with absolute precision up to  $/2000$ ;

Investigation of stimulated Raman scattering projection image receiver for remote measurement of large-scale surface deviation and phase bulk non-uniformity of LIGO core optics.

9. During the period August 15, 1999 to February 15, 2000, the LIGO Laboratory will coordinate the IAP effort with in-house effort in research areas in item No. 8 above, as appropriate.
10. The research effort pursuant to this Attachment C will be coordinated by A. Sergeev and Syd Meshkov on behalf of IAP and 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. N/A

Approved:

Barry Barish  
Barry Barish  
LIGO Laboratory Director

July 27, 1999  
Date

Alexander Sergeev  
Alexander Sergeev  
IAP Department Head

Aug. 31, 1999  
Date