

Attachment OPT to the
Memorandum of Understanding (LIGO-M 050310 -00-M)
between the
Department of Physics of Southern University and A&M College (SUBR Physics)
and the
Laser Interferometer Gravitational Wave Observatory (LIGO)
August 15, 2006

This Attachment OPT to the Memorandum of Understanding LIGO-M 050310 -00-M defines the role of the **Department of Physics of Southern University and A&M College** as a Member of the LIGO Scientific Collaboration (LSC) and a member of the Optics Development Group (ODG). The period of performance for the activities in this Attachment is from August 15, 2006 to August 15, 2007.

1. Optics Development Group - The Optics Development Group (ODG) is the scientific collaboration for defining and developing instruments in optics for use in advanced subsystems for the initial LIGO interferometers or in entirely new advanced interferometers. MOU Attachments define the roles and responsibilities of groups in this development group.

2. During the period August 15, 2006 to August 15, 2007, the members of **SUBR Physics** will participate in ODG in the following areas:

a) Optics Characterization

Test mass multilayer coatings characterization:

The SUBR Physics Group will investigate the chemical and nano structural characteristics of test mass multilayer coatings under consideration for use in advanced versions of the interferometer. The goal of this work is to help identify and understand potential sources of 1064 nm absorption in the coatings. In pursuing this goal we will take advantage of synchrotron radiation probes and data analysis systems available at the Center for Advanced Microstructures and Devices (CAMD) in Baton Rouge, LA. Appropriate experiment proposals for beam time are being submitted for evaluation by CAMD. Experiments will be designed and carried out by SUBR Physics Group personnel in collaboration with senior CAMD scientists at the Double Crystal Monochromator (DCM) Beamline. Continuing studies focus on the determination of the titania (TiO₂) content within the Tantalum (Ta₂O₅) layers of coatings recently provided to SUBR by Caltech. Techniques to be employed include (1) X-ray fluorescence (XRF) for chemical content determination, and (2) X-ray absorption near edge spectroscopy (XANES) for information on atomic valence state, three-dimensional geometry and coordination environment of the element under investigation, and (3) Extended X-ray absorption fluorescence spectroscopy (EXAFS) for information on coordination environment and nearest neighbor atom environment. During the next performance period these measurements will be complemented with (a) grazing incidence XRF experiments designed to avoid possible interferences from the substrate and (b) nanometer-level atomic force microscope (AFM) imaging of the coatings to examine surface morphology features.

b) Other Contributions

Not Applicable

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 **SUBR Physics** 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.
 - c) Office and laboratory space previously made available at LLO for the LIGO-SUBR Advanced Optical Materials Laboratory and will be used in support of the activities described in item 2.

4. Coordination and Reporting -

SUBR Physics will perform this research within the structures established by the LIGO Laboratory and the LSC where appropriate. In particular activities described in Item 2 will be carried out within the Optics Development Working Group of the LSC. 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:



Jay Marx

LIGO Laboratory Director



Stephen C. McGuire

Principal Investigator

Department of Physics of Southern University



Peter Saulson

LSC Spokesperson