

**Attachment ACF to the
Memorandum of Understanding (LIGO- M050306-00-M)
between the
National Astronomical Observatory of Japan TAMA (NAOJ-TAMA)
and the
Laser Interferometer Gravitational Wave Observatory (LIGO)
August 15, 2005**

This Attachment ACF to the Memorandum of Understanding LIGO-M050306-00-M defines the role of the National Astronomical Observatory of Japan TAMA (NAOJ-TAMA) as a Member of the LIGO Scientific Collaboration (LSC) and a member of the Advanced Detector Configurations Development Group (ADCDG). The period of performance for the activities in this Attachment is from August 15, 2005 to August 15, 2006.

1. Advanced Detector Configurations Development Group - The Advanced Detector Configurations Development Group (ADCDG) is the scientific collaboration for defining and developing entirely new advanced interferometers. It is expected that this development group will pursue research in dual recycling, resonant sideband extraction, Sagnac interferometers, systems with non-transmitting optics and other advanced configurations. MOU Attachments define the roles and responsibilities of groups in this development group.
2. During the period August 15, 2005 to August 15, 2006, the members of NAOJ-TAMA Group will participate in ADCDG in the following areas:

a) The 4-m suspended-mirror RSE interferometer

F. Kawazoe, K. Kokeyama, S. Sato, and S. Kawamura will demonstrate the new signal extraction method in the 4-m suspended RSE interferometer at NAOJ. This signal extraction method, which would be a backup method for Advanced LIGO interferometer, uses two modulations: one phase modulation and one amplitude modulation. The phase modulation sidebands will transmit through the Michelson interferometer because of the Michelson asymmetry, while the amplitude modulation sidebands will be completely reflected back because of the Michelson asymmetry. This contrast of the behavior between the two sets of the sidebands makes it possible to extract most effectively the length signal of the signal extraction cavity. We will start with building the Mach-Zender interferometer for the double modulation without producing the sidebands of the sidebands. Then we will try to lock the central part of the RSE interferometer and will proceed to the whole interferometer.

b) Homodyne detection experiment

S. Sakata, S. Sato, and S. Kawamura will investigate the possibility of making very light mirror (less than 1 mg) in order to make it possible to observe the radiation pressure effect, thus the ponderomotive squeezing effect without employing an extremely high power laser

nor a cavity of extremely high finesse. As soon as we obtain a conceptual design of the mirror, we will develop the mirror as well as its suspension system. We will then install them into the existing interferometer. We also will develop the interferometer control scheme for the simple Michelson interferometer with the homodyne detection. We will try it in the real set-up.

c) The 40m RSE prototype at Caltech

S. Kawamura will visit Caltech for two months in summer of 2006 to work on the 40m prototype. He will work on either characterization of the RSE interferometer, DC readout, or output mode cleaner, whichever is the most important research topic at that time.

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 NAOJ-TAMA 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 – NAOJ-TAMA Group 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 Advanced Detector Configurations Development 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.

Approved:

Barry Barish
LIGO Laboratory Director

Seiji Kawamura
NAOJ-TAMA Principal Investigator

Peter Saulson
LSC Spokesperson

Ken Strain
ADCDG Leader