

**Attachment ACF to the  
Memorandum of Understanding (LIGO- M050297-00-M)  
between the  
Stanford Advanced Gravitational Wave Interferometry (SAGWI) Group  
and the  
Laser Interferometer Gravitational Wave Observatory (LIGO)  
August 15, 2005**

This Attachment ACF to the Memorandum of Understanding LIGO-M050297-00-M defines the role of the Stanford Advanced Gravitational Wave Interferometry Group (SAGWI) 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 SAGWI Group will participate in the ACF (Advanced Detector Configurations Development Group) in the following areas:

Advanced Configurations

(R. Byer, M. Fejer, E. Gustafson, P. Beyersdorf, K-X. Sun, A. Bullington, S. Sinha , S. Zappe)

- a) Study all-reflective topologies and gratings for application to future ground-based detectors;
- b) Investigate the relationship between transverse displacement noise of gratings and the phase noise it produces for various interferometer configurations. This will be used to specify an additional constraint on suspension system designs that would be used for suspending diffractive optics.
- c) Construct a quantum-noise test-bed to simulate the effects of shot noise and radiation pressure noise on suspended mass interferometers in the regime where both effects are of comparable magnitude. This test-bed will be used to explore the effects on the quantum noise caused by having multiple carrier frequencies injected into an interferometer. Externally induced amplitude and phase noise will simulate quantum noise, but with much larger amplitude to ease the challenge of observation. The goal is to develop an RF readout scheme that can have a frequency dependent readout phase to take advantage of

squeezed light, while avoiding the "non-stationary" shot noise that typically accompanies configurations with RF readout.

- d) Measure the thermal distortion of an existing mode-cleaner with high circulating powers (incident powers of over 20 W); This will involve measuring the mode structure of the mode-cleaner output with increasing incident power. The results can then be compared with MELODY's theoretical predictions of the mode-cleaner's expected behavior.
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 SAGWI 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 – SAGWI 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:

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Barry Barish  
LIGO Laboratory Director

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Robert L. Byer  
SAGWI Principal Investigator

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Peter Saulson  
LSC Spokesperson

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Ken Strain  
ADCDG Leader