

**Attachment DAT to the**  
**Memorandum of Understanding (LIGO- M950059-00-M)**  
**between the**  
**Experimental Relativity Group of the Louisiana State University (LSUERG)**  
**and the**  
**Laser Interferometer Gravitational Wave Observatory (LIGO)**  
**August 15, 2005**

This Attachment DAT to the Memorandum of Understanding LIGO-M950059-00-M defines the role of the Louisiana State University Experimental Relativity Group (LSUERG) as a Member of the LIGO Scientific Collaboration (LSC), in particular, its activities in data analysis in support of the initial LIGO interferometers. The period of performance for the activities in this Attachment is from August 15, 2005 to August 15, 2006.

1. Together, the LIGO Laboratory and the LIGO Scientific Collaboration are responsible for implementing and exploiting the initial LIGO detector through its science data runs. The LSC has organized the data analysis effort into search groups which coordinate the analyses, perform detailed reviews, and prepare publications on behalf of the collaboration. LSC groups are encouraged to participate in one or more of these groups. MOU Attachments define the contributions of each participating group to the data analysis groups.
2. During the period August 15, 2005 to August 15, 2006, the members of LSUERG Group will participate in the analysis of initial LIGO data in the following areas:
  - a) Source Analysis

Jorge Pullin, Manuel Tiglio and Luis Lehner will work on the development of a three dimensional multipatch code for the evolution of the Einstein equations in situations of interest to black hole waveforms.

Joel Tohline will continue to simulate dynamically evolving astrophysical fluid systems and binary systems that are likely sources of gravitational radiation. In collaboration with Luis Lehner, he will continue the extension of the Newtonian and post-Newtonian treatment of such systems to include fully relativistic hydrodynamical models. Tohline will continue to participate as an active internal reviewer of LSC papers that focus on a search for burst sources; he will also continue to serve as a contact point at LSU for high-bandwidth network connections between LLO and Caltech. Jorge Pullin, Manuel Tiglio and Luis Lehner will continue work on various aspects of numerical relativity. Tiglio, in collaboration with Dorband, Schnetter and Diener will continue the development of a three dimensional multipatch code for the evolution of the Einstein equations in situations of interest to black hole waveforms. Lehner will continue development of an adaptive mesh code for neutron stars and fluids with Tohline and others. Pullin and Anderson will

concentrate on evolutions using unstructured meshes and finite elements.

Alexander Dietz, Ed Seidel and Gabrielle Allen will continue working on making LSU computing resources available to the LSC through grid computing technology.

## b) Search Groups

Gabriela Gonzalez will continue to act as co-chair of the inspiral search group.

Chad Hanna and Andres Rodriguez will finish the S3/S4 search of primordial black holes, and work on the analysis of S5 searching for the same sources.

Andres Rodriguez will work on the implementation of the new signal-based veto in S4 and S5 searches.

Chad Hanna will continue the investigation on a new technique for future MACHO searches which will optimize the matched filtering engine by a new Hierarchical search method. This will decrease the time required to analyze large parameter space regions and reduce the amount of data written to disks and memory required (all of which are limiting our current computational power.) Additionally it may lower the false alarm rate by 1-2 orders of magnitude. The initial plan is described here

<http://www.lsc-group.phys.uwm.edu/cgi-bin/enote.pl?nb=iags4macho&action=view&page=3>

Gabriela Gonzalez and Jacob Slutsky will work on veto strategies for the various inspiral searches.

Warren Johnson and Myungkee Sung will continue to work with the LSC Burst analysis group. They have concluded that they can be most productive by emphasizing the direct application of the methods of classical signal processing to burst analysis.

They are in the middle of a program to use "optimal linear filters" for a bank of burst-like signals, as an alternative to the "ETG-plus-postprocessing" model. Their filter bank includes most of the signal waveforms used in the burst group MDCs, and more can be added at little cost. They are part way through implementing this analysis for the S3 data, but now propose to switch to the S4 data: because the noise is much lower, and because the preprocessing is much better (the S4 data have already been transformed to the physical variable, strain, thanks to the work of Xavi Siemens at UWM.). They will be regularly present intermediate results to the burst-analysis group. Their goal is to have a first version of this analysis by the spring '06 LSC meeting.

Warren Johnson, Damon Nettles, Jon Hanson, and Phillip Miller will continue to run the ALLEGRO detector in coincidence with LIGO during Science Runs, provide data quality information, and participate in the data analysis of ALLEGRO and LLO data for stochastic sources.

A burst analysis, combining the ALLEGRO data from S4 with LIGO data, will be proposed to the burst analysis group.

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 LSUERG group members while on LIGO research assignment at any LIGO Laboratory site,
  - b) Access to LIGO data in support through established LSC channels in support of this work.
4. Coordination and Reporting – LSUERG Group will perform this research within the structures established by the LIGO Laboratory and the LSC where appropriate. In particular activities described in Item 2a) will be carried out within the LSC Inspiral Search Group, Item 2b) will be carried out within the LSC Burst Search Group, and Item 2c) will be carried out within the LSC Stochastic Search Group. 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:

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Barry Barish  
LIGO Laboratory Director

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Joseph A. Giaime  
LSUERG Principal Investigator

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Peter Saulson  
LSC Spokesperson

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Albert Lazzarini  
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