

**Attachment Number A to the  
Memorandum of Understanding (LIGO-M020265-00-M)  
between the  
Balearic Islands University Relativity Group (UIBRG)  
and the  
Laser Interferometer Gravitational-Wave Observatory (LIGO) Laboratory  
February 15, 2004**

This Attachment A to the Memorandum of Understanding LIGO-M020265-00-M covers the role of the Balearic Islands University Relativity Group (UIBRG) as a Member of the LIGO Scientific Collaboration (LSC), and a member of the LIGO I Development Group (L1DG). The period of performance for the activities in this Attachment is from February 15, 2004 to August 15, 2004. This period may be modified by agreement to a revision of this Attachment.

1. LIGO Scientific Collaboration - The LIGO Scientific Collaboration (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 semi-annual 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 and approved, as appropriate, through the Collaboration Council. 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 Balearic Islands University Relativity Group (UIBRG) and the LIGO Laboratory concerning the activities of UIBRG as a Collaborating Institution in the LIGO Scientific Collaboration (LSC) and in the LIGO I Development Group (L1DG), and as indicated in Items No. 8 and No. 9.
4. LIGO I Development Group - The LIGO I Development Group is the scientific collaboration for implementing and exploiting the initial LIGO detector and physics through the initial sci-

ence data run. Only groups who establish a specific Attachment approved by the LIGO Laboratory, which defines a sufficient contribution and participation in LIGO I development, implementation or data analysis will be part of this initial LIGO data run and science. Participation in future data runs and science that follow LIGO I will be possible for other groups, with guidelines to be determined by the LIGO Scientific Collaboration. It is anticipated that LIGO I data will only be made available through formal collaboration within the LIGO I Development Group during the first two years following its collection.

The general guideline for institutional membership in the LIGO I Development Group is that the contribution per collaborator of any new group to the design, construction, and implementation of the initial LIGO detector and to the first data run be comparable to that of the LIGO Laboratory scientists.

5. Report of Progress – UIBRG 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. 9 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.
6. Term of Membership - The Membership will be renewed every six months upon evidence of satisfactory performance of agreed upon duties.

The coordinates of UIBRG members are included in the Attachment Z to the Memorandum of Understanding LIGO-M03tbd-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. LAL Software Conventions - It is necessary that any delivered code conforms to the LAL style as laid out in the LAL specification T990030. This includes: 1) coding style, headers, etc.; 2) use of function calls, etc.; 3) organization of software in the directory structures indicated in the document; 4) inclusion of test codes and validation tests to enable users to verify successful installation of implementation; and 5) documentation and users manuals (html or pdf) to enable users to understand and adopt code.
9. During the period February 15, 2004 to August 15, 2004, the agreed upon research plan and commitments for UIBRG will be as follows:

#### Detector Characterization

a) Sintes together with Martin Hewitson (AEI-Hannover) will be leading the GEO detector characterization efforts and serve as liaison between GEO and LIGO/LSC on detector characterization matters. Sintes will also organize the Spring 2004 GEO Meeting at UIB (April 5-7) and LIGO representatives will be invited.

## LIGO I Data Analysis

## b) Periodic Sources Upper Limit Group

Sintes is a member of the PSUL group and therefore will participate in that group's activities on analyzing LIGO and GEO data, in particular S2 and S3 data.

The aim is to use the *Hough Incoherent Algorithm* to set up an upper limits for every 1 Hz band for isolated pulsars using a frequentist approach. The search will cover a wide sky area (or even the full sky), a large frequency band, and it will also include 1 spin-down parameter.

Present driver code (stand alone code) is already in place, but it might need to be modified in relation with new SFT data format that is under revision. The output of the 'driver' code will be carefully investigated and compared with the expected theoretical number-count distribution. Further strategies need to be developed to veto some frequency bands, because of the presence of spectral line artifacts, or very high 'number-counts'. Notching known instrumental lines will be considered. Placement of the different patches to cover the full sky will also be implemented

Because of performance, a new code to set up the frequentist upper limit using Monte-Carlo signal injection will be developed. This code will use new functions that will be developed in collaboration with AEI that will substitute the current 'makefakedata' code under LALapps. This new optimized code will compute the confidence  $C(h_0)$  for several values of the amplitude  $h_0$  at once. We consider the possibility to obtain the upper limit by interpolation.

10. During the period February 15, 2004 to August 15, 2004, the LIGO Laboratory will provide, as requested and necessary, LIGO data of relevance to the research topics in Item No. 9.
11. The research effort pursuant to this Attachment A will be coordinated by Alicia M. Sintes Olives and Albert Lazzarini on behalf of UIBRG and the LIGO Laboratory, respectively.
12. 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. 9, as indicated below.
  - a) Accommodations for UIBRG investigators while on LIGO research assignment at Caltech, and /or LIGO sites.
  - b) Provide funding for visits at Caltech, and/or LIGO sites, as agreed on a case-by-case basis.

Approved:

2004.07.27  
Barry C. Barish 14:45:45 -  
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Barry Barish  
LIGO Laboratory Director

Alicia M. Sintes

29.07.2004

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Alicia M. Sintes Olives  
Principal Investigator  
Relativity Group  
Balearic Islands University



Digitally signed by Albert  
Lazzarini  
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16 July 2004

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Albert Lazzarini  
LIGO Laboratory Data and  
Computing Group Leader