

Memorandum of Understanding
between the
University of Wisconsin - Milwaukee Relativity Group(UWMRG)
and the
Laser Interferometer Gravitational Wave Observatory (LIGO) Project
November 1, 1995

The purpose of this Memorandum of Understanding is to establish and define a collaborative relationship between the University of Wisconsin - Milwaukee Relativity Group(UWMRG) and the Laser Interferometer Gravitational Wave Observatory (LIGO) Project. Both parties to this agreement share the joint goals of observing gravitational radiation and of using gravitational radiation as an astrophysical probe. This agreement is intended to further these joint goals.

1. The University of Wisconsin - Milwaukee Relativity Group(UWMRG) consists of Professors Bruce Allen, John Friedman, and Leonard Parker, plus, typically, two postdoctoral fellows and six graduate students. The members of this group who are actively working on LIGO-related issues and who are the primary parties to this agreement are Professor Bruce Allen , plus, typically, one postdoctoral fellow and two graduate students. UWMRG's LIGO-related research, during the remainder of the 1990s, will focus primarily on issues related to signal detection , particularly as it relates to the detection of a stochastic background of relic gravitational radiation , and to the detection of inspiraling binary systems. This work will be funded primarily by research grants from the National Science Foundation(PHY-95-07740) and by University of Wisconsin - Milwaukee cost-sharing funds.
2. The Laser Interferometer Gravitational-Wave Observatory (LIGO) Project is aimed at opening the field of gravitational-wave astrophysics through the direct detection of gravitational waves. LIGO detectors will use laser interferometry to measure the distortions of the space between free masses induced by passing gravitational waves. The design, construction, and operation of LIGO is being carried out by scientists, engineers, and staff at the California Institute of Technology (Caltech) and the Massachusetts Institute of Technology (MIT). Caltech has prime responsibility for the project under the terms of a Cooperative Agreement¹ with the National Science Foundation (NSF). LIGO will become a national facility for gravitational-wave research, providing opportunities for the broader scientific community to participate in detector development, observations and data analysis. LIGO welcomes the participation of outside scientists at any of these levels. LIGO is being constructed in a phased approach beginning with one three-interferometer detector system and evolving to a nine-interferometer configuration to enable simultaneous use by several gravitational-wave obser-

1. Cooperative Agreement No. PHY-9210038 between the National Science Foundation, Washington, D.C. 20550 and the California Institute of Technology, Pasadena, CA 91125, dated May 1992.

vation systems.

3. In entering into this Memorandum of Understanding, the LIGO Project will carry out its responsibilities following the requirements of the Cooperative Agreement¹.
4. The LIGO Project is responsible for obtaining NSF approval of all collaborative Memoranda of Understanding with international partners, or of those involving NSF costs exceeding \$100,000. All Memoranda of Understanding will be provided to NSF for their information.
5. Each party to this agreement continues to be responsible for all support of its staff including travel costs associated with the activities under this agreement. Exceptional support of travel by the other institution may be allowed for travel requested by that institution.
6. This Memorandum of Understanding will remain in force until the parties mutually agree to terminate it. An annual Attachment will define specific activities if any, beyond those spelled out in this document , to be carried out during the following year.
7. UWMRG will study mechanisms by which a stochastic background of gravitational radiation could be produced, and means by which data from the LIGO detector could be used to detect such a background.
8. UWMRG will develop and document a data-analysis pipeline to use for such analysis. It will provide the LIGO project with detailed recommendations about computer hardware and software required to implement this pipeline.
9. UWMRG will develop numerical simulations of the (noisy) data stream that would arise from such a stochastic background, and will use these simulations to test the data analysis pipeline. UWMRG will also test the data analysis pipeline on data from the Caltech 40 meter prototype antenna, and will use this experience to develop vetoing techniques for removing non-gaussian contamination from the data.
10. UWMRG will develop techniques that could be used to determine(or place limits on) the multipole moments that characterize any anisotropy in the stochastic gravity wave background.
11. UWMRG will investigate the possibility of combining LIGO data with similar data from other detectors, and where feasible and profitable, will develop a data analysis pipeline for such analysis.
12. UWMRG will investigate systematic sources of noise , such as correlated electrical interference, that could mimic a stochastic background and will investigate techniques that might be used to remove such contamination from the gravity-wave signals.
13. UWMRG will communicate to the LIGO Project its research results and its interpretation of the implications for LIGO.

14. The LIGO Project will communicate its research results related to data analysis methods. It will make available to UWMRG all LIGO reports and internal memos relevant to the above mentioned issues. It will also endeavour to provide additional computational resources, should those become necessary.
15. UWMRG and LIGO will work together in organizing international collaborative research and exchange of ideas in the areas of stochastic background sources and detection methods.
16. UWMRG and LIGO will work together to define a program of joint analysis of data collected by the LIGO detector. UWMRG and LIGO will also work together to define and propose a program of analysis of data to be collected by an international network of gravitational wave observatories.

Approved:

Barry Barish
LIGO Principal Investigator

Bruce Allen
UWMRG Principal Investigator

Date

Date