Attachment: LIGO M960078-00-M

LIGO M960078-00-M

REPORT OF THE PANEL ON THE USE OF THE LASER INTERFEROMETER GRAVITATIONAL-WAVE OBSERVATORY (LIGO)

EXECUTIVE SUMMARY

The LIGO Laboratory, with guidance provided by a strong Program Advisory Committee, should establish the means of incorporating the outside research community into effective collaboration with the scientific staff of the Laboratory. In so doing, it will be necessary to identify two independent entities: the Laboratory proper, which is responsible for construction and commissioning of the LIGO facilities and which provides the normal infrastructure and service functions for the LIGO facility as a whole; and an associated entity, an experimental group, herein identified as "The Collaboration", formed to carry out the yet to be finished R&D for the initial detector and to exploit its early use. The Collaboration should be made up of members of the outside community as well as members of the Laboratory staff. Appropriate rules of governance should be established to make entry into The Collaboration as open as possible, consistent with effectiveness. As the LIGO program matures, other collaborations may evolve for the construction and use of additional interferometers.

The analysis of data, at least in the early stages, would be carried out by The Collaboration with data access only to members of that group. At a later date it may become possible, though not with certainty, to set up a mechanism for the distribution of data products to interested parties who are not part of The Collaboration. To facilitate the possible eventual distribution of data products, programs for handling the data should be developed in a user-friendly
fashion. Of immediate importance is the need to better define the technical scope of this data analysis task and the associated funding requirements.

In order to optimize the probability of early detection of gravitational waves, an aggressive program of R&D should be instituted rapidly for the enhancement of the initial detector and the design of a next generation advanced interferometer as well.

A LIGO Research community has already been established with a membership of approximately 2OO persons interested in participating in LIGO research. Many of these individuals and groups will undoubtedly be interested in joining The· Collaboration. However, since many also currently have no base funding, it will be necessary for the

NSF to provide appropriate funds in order for this to take place. On the basis of minimal information, the Panel estimates that the 10 year budget for LIGO related activities presently proposed by the NSF falls short by $5 to $8 M/yr, plus an additional uncertain amount for numerically intensive user computing and for one or more advanced interferometers. The NSF should commission a working group involving both the LIGO laboratory and a knowledgeable group of outside individuals to make a more reliable ten year funding plan. This plan should provide for a gradual expansion of the involvement of the outside scientific community.

An active Visitors' Program should be developed at an early date. Toward that end, the Laboratory should also initiate the establishment of an international coordination with other long baseline interferometer laboratories located throughout the world in order to achieve the full potential of a widely distributed coincidence interferometer system. Encouragement should be extended to foreign countries to become directly involved with the LIGO program.

PREAMBLE

The NSF Panel on the USE OF LIGO was convened in Washington at the National Science Foundation on June 24-25, 1996. A list of Panel members and other individuals attending the meeting is appended, along with the charge and a copy of the agenda. Among those present were several NSF officials including Drs. David Berley, Richard Isaacson, Robert Eisenstein, and William Harris. Also present were the Principal Investigator of the LIGO Cooperative Agreement for the construction of the facility, Dr. Barry Barish, and other leaders of the LIGO construction effort. In addition, prospective users of the facility including Dr. Samuel Finn, Chairperson of the LIGO RESEARCH COMMUNITY (LRC) , and representatives of two foreign Gravitational Wave Interferometer groups, GEO and VIRGO, were also present. Dr. Neal Lane, Director of the NSF, met for an hour with the panel for an exchange of views concerning the issues. The Panel report follows.

The LIGO project represents an extraordinary scientific opportunity coupled to an extraordinary technical challenge. Gravitational waves are an essential feature of our understanding of gravity, one of the fundamental forces of nature, and the LIGO project is designed to provide the first direct experimental detection of these waves. It will also use this capability to open a new field of astronomy which will allow us to view the universe in a way never before possible. Confronting this unique opportunity are unique technical challenges, involving measurements carried out to a precision that earlier was hardly imaginable. Thanks to the inspiration, skill, and leadership of many individuals and organizations, the LIGO project is close to the point of bringing this opportunity to technical realization.

The charge to this panel involves formulating recommendations concerning the

LIGO project's future development and its relationship with the scientific community. In order to do so, it is necessary to provide a framework describing relevant aspects of the near-, medium-, the project, together with some of its more challenging problems.

The essential first priority for LIGO is to achieve a definitive initial detection of gravitational waves (GW) with a high level of scientific confidence in the results. Achieving this goal with a novel scientific instrument of high complexity is a major challenge. This achievement will validate the system and inaugurate the field of GW-astronomy.

In near term be focused on completing construction of the and commissioning the first detector. This phase use the initial detector to gain some understanding of the signals observed and to begin to learn about the properties of the world's first large-scale gravitational wave laser interferometer. Despite the impressive technical achievement that this first detector will represent, it may still not have the sensitivity required to demonstrate unambiguously the detection of astrophysical sources of GW. Furthermore, even. if GW are detected by this first system, achieving a higher signal-to-noise ratio will be of immediate importance in order to further confirm the reality of the detection and to extract additional information from these signals.

This situation dictates that accompanying and following the successful commissioning of the initial LIGO interferometer, the LIGO project must be focused on an aggressive R&D effort to achieve an improvement of 10 to 100 times greater strain amplitude sensitivity than that planned for the initial system. This effort will include a combination of incremental enhancements to the first interferometer and the development of innovative advanced interferometer designs. A significant data analysis R&D effort closely coupled to instrumental tests will also be required to take full advantage of the hard-won sensitivity of the instrument.

Achieving the required sensitivity for reproducible, definitive GW detection defines the medium-term project focus. This effort may take as long as 10 years after the first system is commissioned. As part of this effort, it is imperative that extended national and international collaborations be developed in order to bring the best possible people, ideas, and technologies to the GW detection effort. These collaborations must be integrated with centralized R&D coordination and LIGO project management to achieve sensitivity improvement and first detection goals in the most timely manner possible. The collaborations developed during this period will form the basis for the GW community that will carry LIGO into its longer term future. This long-term future will begin with the unambiguous detection of the first sources, an event which will mark the transition of GW detection into an observational science.

LIGO is in the unusual position of attempting the first direct confirmation of a previously undetectable physical phenomenon, based on observation of events which are experimentally not controllable, using a unique instrument of extreme complexity and

with possible subtle interacting instrumental effects. This situation, together with the desire to avoid concentration of resources at a single institution and to benefit from the contributions of the external scientific community, implies that the LIGO relationship to the community in the near-, and medium-term future must be that of a distributed R&D collaboration with centralized coordination and management. This is in contrast to the "user facility/user community" relationship as understood from some established fields of observational or experimental science where a certain level of independence between the user and the facility is implied. Such independence cannot begin to occur for LIGO until a complete understanding of the instrumental behavior can be exhaustively demonstrated in the course of conclusive detection of GW sources. Though it is in no way assured that in the long term the latter kind of relationship can be realized, it is essential that the project be developed in such a way as to create the technical tools required if a “user facility” arrangement of this sort were to become a possibility.

PROCEDURES, POLICIES, AND ROLES

In order to provide the required support for the establishment of a strong, continuing research program to exploit the unique LIGO facilities, it is desirable for the LIGO Laboratory and the NSF to continue to maintain a free and open channel of communication and a strong, cooperative relationship.

We recommend that the Laboratory, in consultation with the NSF, establish a strong Program Advisory Committee (PAC) such that a single set of review procedures, conducted by the Laboratory but with NSF participation, will suffice for the scientific and technical evaluation of most, if not all, proposals immediately relevant to the LIGO facility. These procedures should serve as the basis of Laboratory decisions regarding the allocation of facility resources and to complement the review process regarding funding.

At the present time, the LIGO Laboratory and the LIGO scientific collaboration are managed as a single project. As scientific participation evolves into a broader collaboration, the LIGO Laboratory and its associated scientific collaboration will evolve into two distinct entities. The first of these, the Laboratory facility itself, directed by the Principal Investigator (PI) and supported by the staff, will provide a broad and sophisticated infrastructure that makes it possible for complex instruments to be designed, built and operated.

The second of these, the initial LIGO research collaboration will be devoted to the ongoing development of the first interferometer, currently under construction. That experiment involves a highly sophisticated detector that will benefit, in design, development and operation, from contributions of a community of collaborators broader than those within the Laboratory itself. This collaboration, consisting of LIGO Laboratory scientists and outside participants, will build, commission and exploit the initial detector. It should evolve toward an organization with its own internal management

structure such that all members of the collaboration have a voice in its governance, along with certain obligations as well as privileges. In the early stages of the program, it is to be expected that the Laboratory staff will provide the leadership in the program. As the collaboration grows and matures, the outside collaborators can be expected to play an ever increasing role in a largely independent organization.

At this point in the discussion it seems useful to say a word about terminology. The LIGO construction program is directed by the PI of the Cooperative Agreement with the NSF. Since laboratories are customarily directed by a "Director" we would suggest that the title of this person be taken as "Director and Principal Investigator", usually addressed as "Director". However, for the purposes of the remainder of this report we will continue to use the designation PI. As a second point, our Panel has found it confusing for the single name, LIGO, to be used in connection with two quite distinct entities, the Laboratory, and the initial experimental collaboration. We recommend that such a distinction be made and that the collaboration, when it is formed, choose an appropriate independent name. For purposes of further discussion here, we will identify this group “The Collaboration”. Such collaborations usually designate their leader as "Spokesperson". In the initial days of construction and commissioning, the Spokesperson should probably be chosen by the Laboratory PI from among the Laboratory staff. Over the course of time, it would be expected that the Spokesperson would be chosen by election of the membership. As the development of the LIGO community matures, additional collaborations will likely be formed which will choose their own identifying names and Spokespersons.

The PAC appointed by the PI can help with the transition of establishing The Collaboration, as well as in giving general advice on the development of the Laboratory and the experimental program. The PI may seek the advice of the PAC regarding the timing, the details of the transition, and the level of involvement necessary to become part of The Collaboration. Our panel believes that one of the most important components of the governance of The Collaboration will be an open and clear procedure for the involvement of new individuals or groups.

An aggressive program for the enhancement of the initial detector should be instituted as soon as possible. Decisions regarding the Laboratory's research and development (R&D) and implementation of the upgrades should be made by the LIGO PI, usually with advice from the PAC. Groups implementing upgrades are likely to become members of The Collaboration as appropriately determined by the Collaboration. On the other hand, R&D for upgrades should be open to groups both inside and outside The Collaboration.

To prepare for the long-term future, the PI has a responsibility to stimulate a program of R&D for advanced interferometers. All proposals submitted by members of the scientific community for advanced R&D should be open for consideration. Future

interferometers could be, and almost certainly will be, proposed by entirely new collaborations. These proposals would be submitted to the PI and reviewed by the PAC. Proposals approved by the PI, with advice from the PAC, would then be considered by the NSF for funding. The PAC review would be part of the NSF review process.

Many of the groups that will join the LIGO program do not presently have base funding for this scientific research. While the project will be able to fund the construction deliverables that these groups undertake, the NSF must make provisions to fund the ongoing research operations of these groups in LIGO-related research. Two separate actions are thus necessary for participation in a collaboration--acceptance by The Collaboration according to its governance procedures and funding by the NSF (or other funding agency).

The full potential of LIGO will not be realized until LIGO and other large interferometers at several sites throughout the world are functioning in a coordinated manner. For research on enhanced initial interferometers and advanced new detectors, the panel recommends that LIGO initiate the formation of an international group to coordinate research in these advanced projects among the several major laboratories, worldwide, which are now designing or building long base-line interferometers. Such actions may both accelerate achievement of the goals and, in some cases, reduce the duplication of effort and resources. Efforts should also be made to see if there are other countries which would be willing to join and contribute resources to the effort to build advanced interferometers at LIGO.

It is urgent that an effective Visitors' Program be established as soon as possible. It will have the result of drawing effective assistance of committed individuals into the program.

DATA HANDLING

LIGO is a national facility and, as such, the management has a desire and an appropriate level of obligation to make the data available to those who can make effective scientific use of them. In making suggestions about how data might be made available, we distinguish between two possible phases in the project.

The first phase spans the development of the facility through the convincing detection of GW. This discovery would be of such monumental importance that the community could ill afford the report of a false signal. During this phase, correct processing and interpretation of the data will require a deep understanding of the technical issues relating to the performance of the detectors. In this phase, we suggest that community involvement in data handling would best be achieved by drawing into The Collaboration a group of people who would work directly with the in-house LIGO team in developing data analysis systems, algorithms, simulations, etc. The participants could

be chosen by soliciting applications from the community with selection being made by the PI in consultation with the PAC. Applications would be evaluated on the merit of what the proposer would contribute to the project. Data in this phase would be given only to The Collaboration and publications would require approval of The Collaboration and perhaps, in some cases, of the PI. Formation of The Collaboration should occur soon in order to bring community expertise to bear on the problem of data processing and analysis. This is an area that may be particularly well suited to community involvement because of the broad base of experience that is already available and because project plans have not yet been finalized. Multiple approaches to handling the same data sets may be an advantage.

When GW events have been detected and the detectors are well understood, the possibility of developing distributable data products should be considered. For example, there will be interest in developing independent approaches to searching for various types of GW events. Early work on developing the data processing system should be carried out in such a way as to facilitate the distribution of data products, if it is decided to do so, rather than to preclude them.

LIGO USER COMMUNITY

An unusual aspect of LIGO is that there is not yet a well developed community of active interferometer researchers that it will serve. Rather, the community is being built simultaneously with the LIGO facility and detector. This means that an estimate of the size of the community is necessarily an imprecise exercise. Still, there are a variety of ways to judge the scale of the scientific community that will soon be in place.

During the fall of 1995, the LIGO Research Community (LRC) formed through an international e-mail solicitation. It now has about 200 members. The distribution is roughly evenly divided between experimentalists and theorists, and between U.S. and foreign scientists. The organization's purpose is to serve as a two-way channel of communication between the LIGO Project and those interested in its use, as well as to act as an advocacy body for gravitational wave research in general. The members of the LRC elected an Executive Committee of seven scientists, chaired by Dr. L. Samuel Finn of Northwestern University. There have been two general membership meetings of the LRC. These meetings were held at the Aspen Center for Physics in January and at the APS meeting in May, 1996. Seventy-five members attended one or both meetings.

The NSF currently funds eight groups outside the Caltech/MIT core groups to conduct LIGO-related research. Of these, four perform experimental research and four are interested in theoretical topics related to possible gravitational wave sources and/or data analysis techniques. About half a dozen additional proposals are in various stages of

preparation. In addition, several other universities are considering creating new faculty lines in this field. Several strong groups in other countries are looking forward to collaborating with the LIGO Project.

The topics on which continued research and development is necessary span the range of the technologies on which GW detection rests. Research is necessary in seismic isolation, reduction of thermal noise, construction of high power lasers, higher quality mirrors and optical components, novel interferometer configurations, and engineering of the interferometer control systems. In addition, a major investment needs to be made in constructing a data processing system and in developing search algorithms for the variety of signals that may exist in LIGO's data. The above topics will be addressed by research within the LIGO project itself, but many would likely benefit by contributions from one or more outside groups.

The community will be populated in part by "graduates" of the original LIGO groups, and perhaps also from other parts of the pre-existing gravitational physics community. Recently there has been an influx of talented people from experimental high energy physics and atomic/molecular/optical physics, as well as a few in materials science and control engineering. In the near future, experts in signal processing should also be drawn into the field if LIGO is to have the optimum chance of success. The large base of talent in relativistic astrophysics and numerical relativity should be drawn in to help recognize and interpret signals that LIGO may detect. LIGO is an excellent example of a multidisciplinary scientific effort.

LIGO FUNDING

The Panel finds it cannot make a reliable estimate of the funding required for the development and support of a vigorous and effective GW research community at LIGO. This is due to several factors: inadequate time to consider this issue; uncertainty in the size of the community; and little understanding of the magnitude of the computing requirements for the community.

Dr. Berley has presented the NSF "LIGO INITIAL FUTURE ESTIMATES" of the budget required. These data are shown in the tabulation below. All figures are given in FY1997 dollars. One item given in this budget, the R&D for LIGO and collaborators, was independently estimated by Dr. Barish, PI; his budget number was slightly larger than the NSF figure. The figure for operations does not include the personnel and financial resources required to assist the external scientists in their research activities while working within the Laboratory. In addition we have found that the NSF estimate has omitted certain other items which we are sure will be required. These are:

(1) Support for the base operating funds for the scientific effort for the collaborating groups, as distinct from the already budgeted R&D funds supplied to the

collaboration members from the LIGO budget for upgrades and detector development. Assuming that new support will be needed for at least 35 individuals, one can estimate the sum of support required for the base programs at the home institution to be $3 to 5 M/yr.

(2) Support for the complete computing system required by the outside collaborating groups to interact with the data stream from the LIGO facility. In a private communication, Dr. Barish estimates a requirement of $3-5M for the initial capital equipment and an additional $lM/yr for its operation. Thus over the lO-year period we obtain an approximate average incremental need of $1.5M/yr.

(3) Possibly exceptionally large computing power requirements for the collaborating groups. This need is very difficult to estimate for two reasons: lack of real knowledge about the data analysis requirements; and lack of knowledge concerning available options for access to large computing facilities. Consequently, we have made no allocation for this purpose. Determination, in first approximation, of the technical and funding requirements for these data analysis computational needs should be an immediate priority for LIGO.

(4) Capital funds for the establishment of one or more additional interferometers by an independent collaboration. The integrated capital costs for such equipment can be expected to fall in the range of $25-50M. It has already been proposed by one group that such construction would actually start in about the year 2002. This seems premature in view of the fact that there may be much to be learned from working with the initial complement of interferometers and their enhancements before starting construction on an advanced detector. It seems that such an effort should be delayed a few years beyond 2002. Nevertheless, it is to be expected that a formal proposal will be made for a construction "start" before the end of the 10-year period. However, we have made no allocation for this purpose.

We tabulate below the anticipated expenses based on the assumptions above. All figures are expressed in FY1997 dollars.

NSF "LIGO INITIAL FUTURE ESTIMATES"	$M/yr
Operations	20
Equipment	6
Other Related (R&D for LIGO and Collaborators)	5
Total	31

Necessary Additions:	
Other Related (R&D for LIGO and Collaborators)	1
Support of Collaborator base research programs	3-5

Computing net for Collaborators 1.5
Total -5-8

Combined Total $36-39

It is the view of the Panel that the estimates projected by the NSF, in the "LIGO INITIAL FUTURE ESTIMATES", are inadequate to cover the needs and uncertainties discussed above. We recommend that the NSF commission a small working group to prepare more reliable budget figures. The composition of the group should involve appropriate individuals both from within and outside the Laboratory.

COMMENT AND RECOMMENDATIONS

Demonstrating conclusive detection of gravitational waves LIGO will require a deep understanding of the technical details of the system. This in turn requires that LIGO's relationship with its scientific community, will be that of a in at least distributed the R&D near-and medium-term future, collaboration with centralized coordination and management. This is in contrast to the "user facility/user community" relationship which is possible in other fields where a significant level of independence between the user and details of the instrumentation can be achieved.

In light of the above observations, the Panel feels that it would be derelict in its duty if it did not somewhere explicitly express a general word of caution. The LIGO project is a highly visible, extremely difficult research undertaking with an extraordinary potentlal for important scientific payoffs. Whereas universal sharing of data products by all who wish to be involved is an attractive concept, severe damage could result to the project, to the responsible Caltech-MIT group, to the NSF, and to the broad scientific community if data were misinterpreted and premature or erroneous conclusions were reached, leaked or even published. Such misinterpretation of data is infinitely more likely on the part of people who have not been intimately involved in the design and operation of the experiment and its equipment than by the group that has been responsible for all phases of the project.

Experience to date with large experimental collaborations has established a need for a kind of organized control of such matters. Those who have always thrived in an atmosphere of complete academic freedom are unaccustomed to this control. Such necessary controls, unpleasant though they may be, may make relatively light demands and have been successfully established in formally organized groups of close collaborators. Such controls cannot be effectively imposed on miscellaneous independent participants in data analysis.

In formulating policies and practices in matters of this kind, the credibility, and with it the continuing viability of the LIGO project. must always receive overriding

priority.

We make the following recommendations:

1. The Program Advisory Committee (PAC), as already planned by the Principal Investigator, should be put in place as soon as possible to advise on the development of the Laboratory and the experimental program. Of special importance would be the advice of the PAC on procedures for implementing the formation of The Collaboration, the acceptance of other collaborations, the selection of R&D projects, and the assignment of priorities.

2. In order to optimize the conditions for the successful detection of gravitational waves, an aggressive program of R&D should be put in place at an early date for both the enhancement of the initial detector and the design of an advanced interferometer. This program should involve many members of the community outside of the LIGO project.

3. LIGO should evolve from the current single project management into two entities: a LIGO Laboratory and a formally organized initial experimental collaboration, herein called "The Collaboration". It is to be expected that at some later date other collaborations from the community will be formed which will propose to build and install one or more additional interferometers in the LIGO Laboratory.

4. The Collaboration should devise its own plan for internal governance, including clear procedures for the involvement of new members and reasonable criteria for their acceptance.

5. As early as possible, The Collaboration should draw in those who can develop data analysis systems, algorithms, simulations, etc. These people should work intimatelY with other members of The Collaboration to ensure that the codes are systematic, general and
efficient. An early task in this area is to make a more detailed assessment of the required personnel, computational resources and budget.

6. Insofar as competent prospective user groups do not currently have funds available for LIGO-related research, it will be necessary for the NSF to supply new funds for the base support of such research. For that reason, and because of uncertainties arising from the possible need for additional computing support and support for advanced interferometers, we believe that the LIGO-related budget anticipated for the 10-year future should be increased over the NSF "LIGO INITIAL FUTURE ESTIMATES" by $5 to $8M/yr on the average, from a total of $31M to a total of $36-39M/year (1997 dollars). However, to obtain more secure budget figures, we recommend that the NSF commission a working group, consisting of appropriate members of the LIGO Laboratory

and knowledgeable outside individuals, to make a long-range (10-year) comprehensive plan for the funding the entire program.

7. An urgent priority for the Laboratory is the continuation and expansion of the already planned Visitors' Program.

8. The Laboratory should initiate the formation of an international coordinating group involving the several gravitational wave laboratories being established throughout the world. This group could exchange information and could coordinate utilization of research facilities and research activities, as well as attempt to minimize redundant efforts.

9. The Laboratory should make known to foreign scientists its openness to receive contributions to the overall LIGO effort, both in R&D and of components or systems, in return for participation in the Collaboration and an appropriate level of involvement in the governance of the Laboratory.

10. The NSF should encourage participation in the LIGO program by other federal agencies and private institutions.

11. The appropriate individuals should be consulted about the desirability of changing the title of the administrative head of the LIGO project, which is now "Principal Investigator", to "Director and Principal Investigator". The title "Spokesperson" could be assigned to the leaders of experiments or collaborations.

William R. Frazer
Edwin. L. Goldwasser
Russell A Hulse
Boyce D. McDaniel, Chair _____ 7/26/96
Piermaria Oddone (for the Panel)
Peter R. Saulson
Sidney C. Wolff

List of those attending the June 24-25, 1996, meeting of the

PANEL ON THE USE OF THE
LASER INTERFEROMETER GRAVITATIONAL-WAVE OBSERVATORY (LIGO)

PANEL MEMBERS

Dr. William Frazer, UC Berkeley & Berkeley National Laboratory
Dr. Edwin L. Goldwasser, University of Illinois
Dr. Russell A. Hulse, Princeton Plasma Physics Laboratory
Dr. Boyce D. McDaniel, Cornell University, Chair
Dr. Piermaria Oddone, Lawrence Berkeley National Laboratory
Dr. Peter R. Saulson, Syracuse University
Dr. Sidney C. Wolff, National Optical Astronomy Observatories

OTHERS PRESENT

Dr. Alain Brillet, CNRS-LAL, Orsay, France
Dr. Karsten Danzmann, Hannover, Germany
Dr. Lee Samuel Finn, Northwestern University
Dr. A. Lazzarini, Caltech
Dr. Barry Barish, Caltech
Dr. Ron Drever, Caltech
Dr. Robert Byer, Stanford Univ.
Dr. Wm. Hamilton, Louisiana State
Dr. Bernard Whiting, Univ. of Floria
Dr. Gena Mitselmakher, Univ. of Florida
Dr. David Tanner, Univ. of Florida
Dr. Robin Stebbins, Univ. of Colorado
Dr. Rai Weiss, MIT
Dr. Arthur Komar, New York
Mrs. Carol Langguth, NSF
Mr. Aaron Israel, NSF
Dr. David Berley, NSF
Dr. Richard Isaacson, NSF
Dr. Robert A. Eisenstein, NSF
Dr. William C. Harris,
NSF Dr. Neal Lane, NSF

PANEL ON THE LONG RANGE USE OF LIGO
NATIONAL SCIENCE FOUNDATION
June 24-25, 1996
Agenda

Monday, June 24		
8:30 a.m.	Committee Business	
8:45 a.m.	Welcome	W. Harris
		R. Esienstein
9:00 a.m.	NSF View on the Use of LIGO	D. Berley
9:45 a.m.	Break	
10: 00 a.m.	LIGO Status	B. Barish
	LIGO Science	R. Weiss &
	LIGO R&D	A. Lazzarini
	LIGO as a Facility	
11:15 a.m.	LIGO Research Community	S. Finn
12:00 noon	Lunch	
1:15 p.m.	Foreign Collaborators	
	VIRGO	A. Brillet
	GEO	K. Danzmann
2:15p.m.	U.S. Collbaorators	R. Byer
		G. Mitselmahker
		R. Stebbins
		W. Hamilton
		R. Drever
		P. Saulson
Break		
4:30 p.m.	Executive Session	
6:00 p.m.	Adjourn	
Tuesday, June 25		
8:00 a.m.	Executive Session	
9:00 a.m.	Discussion with Collaborators	
10:00 a.m.	Executive Session	
11:00 a.m.	Meeting with Director	N. Lane
12:00 noon	Lunch	
1:00 p.m.	Formulate Conclusions	
	Report	
4:00 p.m.	Adjourn	

NSF PANEL ON THE USE OF THE LASER INTERFEROMETER GRAVITATIONAL-WAVE OBSERVATORY (LIGO)

CHARGE

The Panel is requested to advise the NSF on the development of a users program for LIGO.

Please address the procedures, NSF policies, and resources required to select, stimulate, and support outstanding investigations at LIGO.

Please advise on the respective roles of the LIGO Project and the NSF in the organization, review and funding of the scientific observations and the detector R&D.

Please endeavor to estimate the size of the users community.

Please advise on the NSF funds that will be required over the next decade for LIGO to be an effective user facility.