Gravitational Wave International Committee

17 July, 1999 Meeting Minutes

Attendees:

ACIGA: McClelland, Sandeman;
ALLEGRO: Hamilton;
AURIGA: Cerdonio;
EXPLORER/NAUTILUS: Coccia, Pizzela;
GEO 600: Danzmann, Hough;
LIGO: Barish, Sanders;
LISA: Bender, Folkner;
NIOBE: Blair;
TAMA 300: Kawamura, Kuroda;
VIRGO: Enard, Giazotto;
Secretary: Finn

Invited Visitors:

F. Ricci, S. Meshkov, R. Weiss.

Project Comments: GEO 600 (Hough)

The GEO 600 Project has recently begun planning their future with a ten-year horizon. Those plans involve further development of GEO as an advanced-technology test-bed and heavily emphasize collaborative involvement with other detector efforts in Europe and worldwide. Three research directions were described:

1. Develop advanced detection technologies in the Hannover interferometer, with particular emphasis on cryogenic mirrors and suspensions and crystalline mass technologies;
2. Participate in the design and development of a pan-Europe gravitational wave detector project;
3. Play an active role in the LIGO Science Collaboration, with a particular emphasis on participation in the design and construction of the LIGO II interferometer.

GEO was particular pleased to report that the PPARC Astronomy Panel favorably recommended gravitational wave detection research and endorsed GEO participation in LIGO II detector design and development.

Project Comments: LIGO (Barish)

LIGO construction was completed this year, with the exception of the LIGO Livingston beam-tube bake-out and the purchase of computing systems for the observatory sites as well as the laboratory. The beginning of the Livingston bake-out is imminent, and its completion will mark the end of LIGO as a construction project. (Computing

infrastructure purchases are planned to take place “just-in-time” to capitalize on the rapid increases with time in computer capability per dollar cost.)
As construction ends LIGO is undergoing a transformation from a construction project organization to a research laboratory organization. This transformation is reflected in the new name LIGO Laboratory and the changing demographics of Laboratory employees (fewer engineers and administrative staff, more research scientists).
Detector installation is underway at both sites, as the beginning of installation overlaps the end of construction. The principal focus of installation and commissioning activities is a working system of three interferometers at the promised sensitivity by the end of 2001.
As the construction winds-down and the detector installation and commissioning begins, a strong emphasis is being placed on the development of the LIGO Data Analysis System (LDAS), which is meant to provide a coherent set of tools and infrastructure for carrying out LIGO data analysis.
In parallel with the installation and commissioning of the LIGO I detectors, the LIGO Laboratory is pursuing a vigorous research and development program aimed at technologies for use in LIGO II. Technologies currently under study include resonant sideband extraction, advanced suspensions, and crystalline test masses. The LIGO Laboratory R&D program is supplemented by work taking place at LIGO Science Collaboration member institutions.
The LIGO Science Collaboration is developing the LIGO II detector concept. A conceptual design proposal for the LIGO II detector system will be submitted to the National Science Foundation in fall 1999. Extensive review of the conceptual design will begin at that time.
LIGO civil construction will be ended in a two-day dedication ceremony, which will take place on 11–12 November 1999. GWIC members are encouraged to come.

Project Comments: VIRGO (Giazotto)

VIRGO and GEO are meeting with the goal of establishing an extensive collaboration covering

1. instrument assembly and detector commissioning;
2. the free exchange and flow of personnel between the projects;
3. a joint research and development program directed at monolithic suspensions;
4. a proposed pan-European detector system, tentatively referred to as the European Gravitational-wave Observatory.

A letter of intent to present the goals and conceptual plan for the European Gravitational-wave Observatory is in preparation. It is likely that the plan for this detector will include cryogenic mirrors and suspensions.
The last impediments to VIRGO civil construction have been removed and construction is now fully underway. Commissioning is currently scheduled to begin in mid-2001, with completion in the second half of 2002.
VIRGO’s data analysis plans are described in the DAD, a nine-chapter book that covers the techniques and algorithms to be used to reduce the data and analyze sources. Implementation of the data analysis system is underway.
VIRGO and its sponsoring agencies INFN and CNRS are looking toward the transition of VIRGO from a construction project to a research laboratory, a structure in which

scientists not contributing directly to VIRGO construction or operation goals will be able to contribute more effectively.

Project Comments: TAMA 300 (Kawamura/Kuroda)

TAMA has been successfully locked as a Fabrey-Perot recombined Michelson interferometer with a 10 W laser and a 10 m mode cleaner, but without power recycling.
The managing board of TAMA has been expanded to include Kuroda and Tsubono, together with Fujimoto. At the same time the detector group has been unified under the direction of Kawamura.
The TAMA 300 program formally finishes at the end of the first quarter 2000. Two avenues of continuation are being explored: an extension of the original TAMA program or a new research and development program.
The second TAMA workshop will be held in Tokyo 19–22 October 1999.
Finally, a part of TAMA is proposing to join the LIGO Science Collaboration. The proposed research program is in resonant sideband extraction.

Project Comments: ALLEGRO (Hamilton)

The ALLEGRO detector is currently running at a peak spectral sensitivity of approximately $2x10^{-21}/Hz^{1/2}$. A new 3-year funding cycle is just now beginning. The research program for this funding cycle focuses on increasing the detector bandwidth and improving the detector spectral sensitivity.
ALLEGRO is collaborating, through the IGEC, with the European and Australian bar detector groups on data analysis. Some results of that collaboration were reported at the Amaldi meeting and other results will be forthcoming. Additionally, ALLEGRO is planning to capitalize on its close proximity to the LIGO Livingston Observatory with a running stochastic background search in the detectors sensitive band.
National Science Foundation support for the ALLEGRO program remains strong. The Foundation is interested in supporting the participation of the ALLEGRO spherical detector research and development, but only as part of an international collaboration. Funding for research and development of detector technologies, such as improved SQUIDs, must now be funded through sub-contract from LSU and not directly through a National Science Foundation award. This change in funding profile is complicating the development of these technologies.

Project Comments: AURIGA (Cerdonio)

The AURIGA detector is running at a peak spectral sensitivity of several times $10^{-22}/Hz^{1/2}$.
A common problem with integrating new or improved components into the detectors is that these technologies are generally developed and tested under ideal, as opposed to normal, operating conditions. A cryogenic test facility, with mounting jigs identical to those found on the actual detectors, has been fully funded. This facility will allow new transducers, including SQUIDs and other detector technologies, to be tested under operating conditions with a rapid cool/warm duty cycle and without disturbing the operating detector.
In addition to new, low-noise SQUIDs, the AURIGA Project is exploring optical transducer technologies.

AURGIA is also pleased to report its great satisfaction with the cooperative data analysis coordinated by the IGEC between the Australian, European and United States bar detector programs.

Project Comments: EXPLORER/NAUTILUS (Coccia)

NAUTILUS is running with a peak spectral sensitivity of several times $10^{-22}/Hz^{1/2}$. The detector noise is principally electronic.
The SQUID transducer is operating at a noise level of between 100 and 200 $h/2\pi$. A laboratory SQUID has shown a noise performance of 5.5 $h/2\pi$. The current problem with achieving this performance in the detector is integration. Should this problem be overcome, this new SQUID would expand the bandwidth at peak spectral sensitivity to 50 Hz.
The current research program is focusing on a new capacitive transducer and a double DC SQUID amplifier. In addition, a small program is continuing to explore the characteristics of a spherical detector of the TIGA design.
Professor Guido Pizzella has resigned as spokesperson of the EXPLORER/NAUTILUS collaboration, passing the reins to Professor Eugenio Coccia, who will represent the collaboration on GWIC.

Project Comments: NIOBE (Blair)

NIOBE is presently in the middle of a funding period and in the final stages of installing improved microwave transducers. These improvements should lower the transducer noise from the several thousands to the several hundreds of $h/2\pi$.
NIOBE is also a full participant in the international collaborative data analysis network IGEC. In addition to this collaboration with the other bar detector groups, NIOBE has developed strong international ties to with researchers in India, who are involved particularly with the analysis of NIOBE data for periodic sources of gravitational radiation. NIOBE is currently exploring additional avenues of international collaboration on the continued development and improvement of the NIOBE detector.

Special Report: GRAIL and Mini-GRAIL (Frossati)

GWIC heard a special report from Professor Frossati on the status of the GRAIL Project. The original GRAIL Project was for the development of a 3 m diameter, 100 metric ton CuAl spherical detector operating at millikelvin temperatures. Its plans called for a resonant frequency of approximately 700 Hz and a bandwidth at peak sensitivity of approximately 100 Hz. As a spherical detector GRAIL would be equally sensitive to radiation incident from any direction while simultaneously allowing the incident direction to be determined through the interrogation of the sphere's quadrupole normal modes. Despite strong, positive scientific reviews the original GRAIL Project was turned down by the Dutch science-funding agency. A recent proposal for a scaled-down spherical detector (Mini-GRAIL, with a diameter between 0.5 and 1.5 m and a resonant frequency between 1.5 and 4.2 KHz), made in collaboration with the EXPLORER/NAUTILUS group was also, despite positive scientific reviews, recently turned down. In both cases, the strong positive scientific reviews were offset by the perceived risks of not achieving the sensitivity necessary to positively detect gravitational waves.

Project Report: ACIGA (Sandeman/McClelland)

The ACIGA Consortium for the research and development toward an Australian interferometric gravitational wave detector was formed in 1994. It was funded for three years beginning in 1995 as a coordinated program across three universities. At the time for the renewal proposal in 1997 it was clear that the overall ACIGA research and development program was larger than could be accommodated within the Australian Research Council (ARC) ' Large Grants' Physics Panel. This lead to the component sub-programs of the 1997 renewal proposal being sent out for separate review in 1997. Correspondingly, reviewers saw only specific components of the proposal and only some of the programs received continued funding. Despite this, the achievement also in 1997 of infrastructure grants from the ARC, the universities involved and the Western Australian government has enabled ACIGA to maintain its momentum to the present time.

To overcome the 'Large Grants' difficulties and with a new round of ARC Special Research Centre (SRC) programs beginning January 2000, ACIGA was asked to submit a SRC proposal early this year. These Centres offer the possibility of a nine year funded program at a yearly level consistent with ACIGA research and development requirements. (This is similar to the situation in, for example, the United States, where funding for LIGO construction comes not from the Mathematical and Physical Sciences Directorate of the National Science Foundation, but through a special Major Research Equipment program administered through the Directors office.)

Unfortunately the ACIGA SRC proposal was rejected before being sent for external peer review, on the grounds that the goals set down (equivalent to LIGO II specifications) for, high power laser stability, interferometer configurations and suspension isolation were not achievable. The ARC internal reviewers were apparently unaware that these goals were similar to those presently set by the LSC and that the present ACIGA research achievements were consistent with meeting those goals. ACIGA has lost an internal ARC appeal despite considerable support from GWIC members (for which the ACIGA management is extremely grateful). It is currently appealing the funding decision at the ministerial level.

Recognizing the contributions, commitment and strategic importance of the ACIGA Consortium to the international effort to detect gravitational waves, GWIC has addressed the following statement of concern to The Hon. Dr. D. Kemp, Minister for Education, Training and Youth Affairs, and Senator The Hon. N. Minchin, Minister for Industry, Science and Resources:

> The Gravitational Wave International Committee wishes to express its concern regarding the funding for the proposed Australian Research Centre for Gravitational-wave Astronomy.
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> The proposers of this Centre have a long and very strong tradition of research in gravitational wave detection technology. They have made important contributions to the design of the next generation of advanced interferometric detectors, which are now being proposed in the United States and in Europe. The continued

support of the Centre's proposers is important to the success of worldwide efforts to detect gravitational waves and learn from them.

The Gravitational Wave International Committee emphasizes the strategic importance of a full-scale Southern Hemisphere detector as part of the global detector array needed to establish gravitational wave astronomy. A substantial research and development program in gravitational wave detection in Australia now will ensure its future role as the site for the Southern Hemisphere detector.

Professor John Sandeman, a founding member of GWIC, has resigned as director of the ACIGA Consortium, passing on the reins to Professor David McClelland, who will continue to represent ACIGA on GWIC.

Project Report: LISA (Bender)

Considerable progress has been made toward a joint ESA/NASA mission. A LISA technology-planning meeting was held at JPL on 5-6 November 1998 to organize the writing of a LISA Technology Plan. The Technology Plan (which can be downloaded from http://lisa.jpl.nasa.gov/documents.html) was presented to a peer review panel February 16-17, 1999. The review went well and the results from the panel were favorable. The comments from the review panel are appended to the end of this message. Some minor changes to the Technology Plan document will be made before issuing it as a JPL Document. Depending on NASA funding, and discussions between NASA and ESA, the Plan will probably need to be updated in 6-12 months.

NASA is currently going through a strategic planning exercise. As part of this exercise, on 23 February 1999 Bill Folkner and Sterl Phinney made a presentation on LISA to the Structure and Evolution of the Universe Subcommittee, which was well received. A similar presentation was made on 25 March 1999 to the Panel on Particle, Nuclear, and Gravitational-Wave Astrophysics of the National Research Council's Astronomy and Astrophysics Survey Committee (http://www.nas.edu/bpa/projects/astrosurvey/particle/). This second presentation also included additional material on LISA science goals as well as on the OMEGA mission concept. (Following the meeting, JPL decided to merge efforts from OMEGA into the LISA study to form a unified mission concept.)

Among the three mission concepts being considered for the ST5 project opportunity in NASA's New Millennium is a Disturbance Reduction System, which would include drag-free operation and tests of inertial sensors: both technologies that are important to LISA. Plans are for one of the three competing concepts to be selected in late July 1999.

In a letter sent to ESA's Dr. Roger Bonnet by NASA's Dr. Alan Bunner, ESA was invited to participate in the ST5/DRS mission concept. Dr. Bonnet has replied that this will be considered, and suggested that the possibility be discussed at the NASA/ESA bilateral meeting to be held in mid-June 1999. Pending some level of commitment by ESA, the ST5 study team is focusing on a US-only mission for the purposes of preparing the ST5 concept paper. This is necessitated by the tight time schedule.

On the ESA side, a seven month ESA Industrial Phase A study was initiated in June 1999.

Beginning with the next GWIC meeting, Dr. William Folkner, the head of the LISA Pre-Project office at JPL, will represent LISA on GWIC.

Collaborative Data Analysis (Weiss)

Following a status report on the IGEC, Rai Weiss (LSC Spokesperson) initiated a discussion of collaborative data analysis, pointing out the benefits of correlating the output of multiple gravitational wave and astronomical or particle (i.e., neutrino) detectors. The scientific benefits include improved detection confidence, ability to locate sources on the sky, ability to measure radiation polarization, and multiple baselines for stochastic signal measurements. Other benefits include increased diagnostic capability (i.e., the ability to distinguish between gravitational waves and instrumental or environmental artifacts) and operational flexibility (the ability to continue to participate in a gravitational wave watch while making detector improvements).

As part of this discussion, GWIC considered a proposal by Adalberto Giazotto to appoint a technical group, from the different gravitational wave detector projects, to study and report back to GWIC on algorithms, mechanics, and organization of a collaborative data analysis effort. This proposal was enthusiastically endorsed by GWIC and Giazotto was asked to prepare a charge and assemble the committee on consultation with the project directors.

Research and Development Technical Exchanges; Strategic Planning (Giazotto)

Giazotto noted that, while there have been a number of successful examples of technical cooperation or information exchange between the several gravitational wave detection projects, there has been no regular and formal venue for detailed discussion of R&D efforts underway in all the projects. Such meetings would stimulate greater R&D collaboration and promote the kind of advanced work necessary for future detectors. Following an extended discussion and acting upon an earlier recommendation by ACIGA, GWIC decided this proposal should be expanded to include the preparation by GWIC of a strategic plan for the worldwide development of gravitational wave detectors. It was agreed that the annual Aspen meeting on gravitational wave detection presents an excellent opportunity to begin the technical work involved required as the foundation for a strategic, and asked the organizers to work with Giazotto to develop an appropriate meeting format.

PaNAGIC Proposal (Barish)

The Particle and Nuclear Astrophysics and Gravitation International Committee is a sub-committee of IUPAP charged to promote the growth of a common culture in the intersection of the fields of Particle Physics, Nuclear Physics, Astrophysics and Gravitational Physics. At its first meeting, it proposed that GWIC become a “liaison committee” for gravitational wave physics, thus bringing GWIC under the umbrella of IUPAP.

After discussing the proposal, the role of the different IUPAP commissions (especially AC.2: General Relativity and Gravitation), and the proposed relationship between IUPAP and GWIC, GWIC agreed to the proposal by the PaNAGIC.

Astroparticle Physics Journal (Barish)

The Astroparticle Physics Journal editorial board has decided to expand into the area of gravitational physics. Barish has been asked to become the editor for this new area of

emphasis. Astroparticle Physics provides a venue for publishing important technical developments or details that would not be considered by, e.g., Physical Review or Reviews of Scientific Instrumentation. For example, a recent issue of Astroparticle Journal carried an article on the VIRGO end-to-end model SIESTA.
Publication in Astroparticle Journal is free of page charges and electronic submission in either elsart or revtex style is encouraged.

Large Cryogenic Gravitational-Wave Telescope (Kuroda)

GWIC heard a report by Kuroda on the proposed Large Cryogenic Gravitational Wave Telescope. The LCGT is a five-year project aimed at a cryogenic mirror and suspension interferometric gravitational wave detector with sensitivity great enough to detect inspiraling neutron star binaries at distances of 200 Mpc. The LCGT Project was approved as a future ICRR project in February 1999. The project will be reviewed again later this year. If the decision is ratified then LCGT, which will take over TAMA, will submit a budget in mid 2000 for funding to start in 2002.

Gravitational Wave Data Analysis Workshop (Ricci)

The Fourth Gravitational Wave Data Analysis Workshop will take place in Rome on 2-4 December 1999. Previous meetings have all had attendance of approximately 100+/-20 people; the attendance at this meeting is expected to be similar. A scientific organizing committee, chaired by Fulvio Ricci, has been selected based on recommendations from the gravitational wave detector projects. The workshop organization will follow closely the format of the MIT and Penn State hosted conferences of 1996 and 1998. The scientific organizing committee has agreed to focus the workshop on four topics:

1. Basic tools for data analysis (calibration, data diagnostics and validation);
2. Transient events (sources – modeled and unmodeled –, filters and parameter extraction);
3. Software and hardware environments for GW data analysis (data storage, distribution and computational infrastructure; tools for GW data analysis, including tutorials and benchmarks; software validation procedures);
4. Continuous signals (pulsars and stochastic backgrounds: hierarchical analysis strategies, algorithms, upper limits).

Approximately 1/2 day will be devoted to each discussion topic. In addition, a round-table discussion on multi-detector data analysis is planned. The organizing committee is now discussing session chairs, who will have the responsibility of organizing a few short, focused talks followed by moderated discussion.

1999 Amaldi Meeting (Meshkov/Barish)

GWIC heard a final report on the just completed Amaldi Meeting, which was the first to be organized by GWIC as the new “home” for the gravitational wave detection community. The final attendance was 255, of which 177 were paid. Over 42% of the attendees were from outside the United States. While the format and publisher of the conference proceedings has not yet been decided on, it is expected that the conference will finish in the black, with a final budget of approximately $100,000.
GWIC discussed the several options that have been explored for publishing the conference proceedings: self-publishing, both on the web and on a CD; publishing as a

special issue of an established journal; and publishing with a publisher who will provide an electronic version. It was decided that the important issues were timeliness of publication (i.e., the conference proceedings should be out in under one year), the ability to publish an electronic version on the web simultaneously with any paper edition, and the ability to publish incrementally as contributions become available.

2002 Amaldi Meeting (Barish)

GWIC heard proposal from TAMA and ACIGA to host the next GWDAW. Each proposal included proposed meeting dates, information on the venue, conference facilities, housing, transportation and budget. Both proposals were strong; however, following the discussion the TAMA proposal was withdrawn in favor of the ACIGA proposal, which was then accepted by GWIC. The next Amaldi Meeting will be held 8-14 July 2001 on the campus of the University of Western Australia, in Perth. This is the week preceding GR-15 in Durbin, South Africa.

Expanded GWIC Membership

At the December 1998 Paris meeting, GWIC decided to expand its membership by inviting up to two additional members from the theoretical relativity or observational or theoretical astrophysics community to join the committee in a fixed term appointment. For this purpose GWIC solicited recommendations from the International Society for General Relativity and Gravitation and considered these along with others made by the GWIC members. These recommendations were discussed and the decision made to invite a single representative to join the committee now. The decision on the appointment of a second representative was deferred to a later time.

Next Meeting

The next GWIC meeting will be either immediately before or after the next Marcel Grossman Meeting, which will take place during the summer of 2000 in Rome. Eugenio Coccia will take charge of the local organization for this meeting.