

ANNUAL REPORT 2018-2019
IAU COMMISSION D1 Gravitational-Wave Astrophysics

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ORGANIZING COMMITTEE	M. A. Hendry, Richard Manchester, Eleonora Troja, David Shoemaker, Marta Volonteri

1. Commission D1 description and goals

The IAU Commission D1 Gravitational-Wave Astrophysics was instituted in August 2015 with the goals of:

- integrating gravitational-wave (GW) observations into the mainstream astronomy;
- expanding the knowledge and science impact of GW astrophysics to the IAU community;
- fostering communication among diverse communities by providing a forum to bring together GW physicists and astronomers, observers and theorists, to share their expertise and to plan GW and electromagnetic observations, joint analysis and interpretation.

The Commission D1 represents GW searches over 12 orders of magnitude in frequency: going from the nanohertz of the Pulsar Timing Array (PTA) to low frequencies between 20 μ Hz to 0.2 Hz of the LISA space-based detector, and the high frequencies from 10 Hz to kHz of ground-based detectors, such as the Advanced LIGO, Advanced Virgo, and KAGRA interferometers. The Commission D1 currently includes 197 members.

The IAU Commission D1 is complementary to the Gravitational Wave International Committee, GWIC (Working Group 11 of the International Union of Pure and Applied Physics, a fellow organization of IAU under the International Council of Scientific Unions), which was instituted in 1997 to facilitate international collaboration and cooperation in the construction, operation and use of the major GW detection facilities world-wide (<https://gwic.ligo.org/>). The emphasis on both astrophysics and instrumental projects makes effective communication and cross-representation among the IAU Commission D1 and GWIC extremely valuable. M. Branchesi is member of the GWIC as representative of the IAU Commission D1, and D. Shoemaker is the Executive Secretary of the GWIC serving on the Commission D1 organizing committee.

2. Commission D1 activities

The organizing committee identified the following main lines of activities:

- to support meetings/workshops related to GW astrophysics discoveries and prospects;
- to stimulate initiatives to discuss about the development of common infrastructure and software, standard data format, and naming conventions for transients including GW and counterparts, about planning of global networks of GW, EM and neutrino

observatories, about developing joint science cases to drive projects for new facilities and their operation;

- to support education and development of young researchers in the new emerging field of GW and multi-messenger astronomy;
- to promote initiatives for increasing the participation of all gender and under-represented groups in the field of GW astronomy;
- to enhance IAU senior and junior membership of scientists involved and/or interested in GW astrophysics;
- to increase the participation of GW related theses in the IAU PhD Prize to recognize Excellence in Astrophysics;
- to improve the Commission D1 web-page and populate it with content

Conferences

- The Commission D1 organizing committee supported and participated in the proposal and organization of the IAU Symposium 363, “Neutron Star Astrophysics at the Crossroads: Magnetars and the Multimessenger Revolution”, which was expected to be held at the Gran Sasso Science Institute, L’Aquila, Italy, June 22nd-26th, 2020 (<https://astromeeeting.gssi.it/>). Due to the COVID-19 outbreak it was decided to postpone the symposium to 2021. The symposium seeks to provide an interdisciplinary forum, bringing together astrophysicists, computational and nuclear physicists, and GW researchers to discuss new findings in neutron-star astrophysics, and lay down the open questions to be solved in the first decade of GW observations. It will present the status, perspectives and challenges for the multi-messenger astronomy, and it will explore the many facets of neutron stars, from theory to their most extreme observational manifestations, such as magnetar giant flares, gamma-ray bursts, kilonovae and supernovae. It will include discussions about next-generation facilities for multi-messenger astronomy and their associated science cases;

- We endorsed the proposal to hold an IAU Focus Meeting entitled “Physics of relativistic jets on all scales” (SOC chairs: Monica Orienti, INAF/IRA and Bong Won Sohn KASI, Korea Republic) during the IAU General Assembly 2021, Busan, Korea Republic;

- During the IAU General Assembly, held in Vienna, August 20-31, 2018 a significant part was reserved to GW astrophysics. An invited discourse “The new exploration of the Universe through GW observations” was given by M. Branchesi on August 22; a panel discussion was organized during the “IAU Focus Meeting FM13: Global Coordination of International Astrophysics and Heliophysics Activities from Space and Ground” on August 23 about “Gravitational Waves and Transient Science”. During the IAU Division D meeting, three talks were given to describe the main results of the LIGO and Virgo observations and the multi-messenger observations of GW170817 on August 24. An exhibit on GW astronomy was jointly organised by the Education and Public Outreach (EPO) groups of the LIGO Scientific collaboration, the Virgo collaboration, LISA and PTA communities.

Participation in the GWIC meeting

M. Branchesi as the representative of the IAU Commission D1 participates in the annual GWIC meeting. The last one was held in Valencia, July 6, 2019. During the one-day meeting there were reports from the representatives of the current GW experiments, LIGO, Virgo, KAGRA, GEO 600, OzGrav, the European Pulsar Timing Array (EPTA), PPTA, NANOGrav, the upcoming instrument IndIGO, and reports from the representatives of the LISA, the Einstein Telescope and Cosmic Explorer communities, and the representatives of the Theory Community, IUPAP Affiliate Commission AC2 (Internation-

tional Commission on General Relativity and Gravitation), and IAU Commission D1. Large space was devoted to the discussion about the work of the GWIC subcommittees, in charge to examine the path for developing a network of third generation of ground-based GW observatories, and to develop the science case for them to drive their designs and operations. It was underlined the importance of providing a reliable roadmap for each project and observing plan to the astrophysical community.

Marica Branchesi
President of the Commission D1