

Welcome

To the 3nd Dawn Workshop

What's Next for Gravitational Wave Astronomy?

Albert Lazzarini LIGO Laboratory, Caltech Syracuse, NY 6-7 July 2017

Since we last met in 2016...

A third solid detection, GW170104, was announced!
 We are going to be in the open data era by the time of the O3 run

O2 is currently running
 Through end of August

Virgo has become operational!
 Participating in 2nd half of O2

Planning for O3 has begun

From last year's workshop LSC Summary of Recommendations

Recommendation: A+ upgrade - high priority, near-term goal; A+ concept endorsed; LIGO Laboratory & partners should embark upon the upgrade program as soon as feasible.

- ✓ LIGO Laboratory is preparing a proposal for an A+ upgrade to be submitted to NSF this fall.
- Discussions are ongoing with the UK to explore modalities of participation with in-kind contributions, using the successful aLIGO model for an international partnership.
- <u>Recommendation</u>: A+ upgrade should also be implemented on LIGO-India before it begins science operations.
 - L-I is taking A+ impacts on the facility design into account, e.g., ensuring that a filter cavity can be accommodated with minimal impact in the future.
 - ✓ L-I has acknowledged that by the time it comes on line the US A+ detectors will have better performance than the baseline aLIGO design the US is providing.
 - There is the intent to introduce the same upgrades at the time of installation. There are plans to augment the L-I budget baseline for these modifications.

From last year's workshop(2) LSC Summary of Recommendations

<u>**Recommendation:**</u> Continued focus on improving coating thermal noise is essential for all future gravitational-wave detector concepts -- an adequately funded, focused, and well-coordinated R&D effort on producing coatings with lower thermal noise is urgently needed

- Since the last workshop a multi-institutional consortium was established and a proposal submitted to NSF for a coatings research center. The proposal received strong recommendations for funding but at present the NSF has insufficient resources.
- Coatings research has been identified by Physics Directorate as a key element on the NSF's initiative seeking additional mid-scale funding for its 10 Big Ideas — one of which is Windows on the Universe: Multi-Messenger Astrophysics
 - A close collaboration has been established by various LSC groups and a number of experienced coatings groups across the globe: MIT-LL, Colorado State, Berkeley, Montreal, Glasgow, LMA.
 - A campaign of parameterized exploration of coating approaches has started, with LIGO Laboratory providing high-throughput coating characterizations that inform the fabrication processes & parameters.

From last year's workshop(3) LSC Summary of Recommendations

- Recommendation: Produce a set of (3-4) metrics that go beyond Volume-Time, that better characterize the full discovery potential of the next generation detector network.
 - ✓ There is now a study effort (ref. next slide) to develop the science case for the 3G detectors.
 - Breadth of their discovery potential will be characterized according to different astrophysics and physics goals, and science reach.

Gummary of Recommendations

- Recommendation: A strong commitment by the international GW community to begin the process of global planning and establishing community-wide buy-in of the requirements and approach to meeting them with a 3rd generation network of detectors.
 - ✓ GWIC has established a sub-committee (co-chaired by D. Reitze and M. Punturo) that has been charged with coming up with a global planning approach
 - The LSC (led by LIGO-MIT) will submit a proposal for a study to NSF this fall.
 - ✓ The study will be coordinated with other international 3G efforts (i.e., ET) and the GWIC 3G study.
 - ✓ The deliverable will be somewhere between the LIGO Blue Book and the ET conceptual design study in depth, with a greater international aspect than either of them.

From last year's workshop(6) LSC

Summary of Recommendations

- Recommendation: Coordinated R&D for short/medium timescales, with cooperation between funding agencies (through GWAC) and the science teams (through GWIC).
 - ✓ GWIC chair Sheila Rowan gave the first presentation to GWAC members in October 2016 outlining the 3G planning process.
 - Example of GWAC cooperation: NSF is working with the STFC to coordinate review of the A+ proposal.
 - ✓ GWAC has requested regular updates as GWIC's work progresses.
 - Recommendation: GWAC should encourage or request GWIC to coordinate an international R&D effort in the critical technologies for next generation ground-based GW detectors.
 - The plan is for the 3G study effort (see above) to be coordinated internationally.
 - The science case starts with the assumption that "the network is the detector" and that no single effort can succeed alone.
 - The R&D will be coordinated, but this does not preclude different final designs; external constraints may drive choices and lead to different local realizations. However the intent is to coordinate and share R&D on common elements

From last year's workshop(4) LSC Summary of Recommendations

- Recommendation: Enable rapid communication to EM partners of all information available, including sky maps, significance, distance and event ID
 - Since the last workshop O2 has started and to date 8 triggers have been shared (3 later retracted) with electromagnetic partners under the terms of the MOUs LIGO and Virgo have with individual groups.
 - ✓ Latency in issuing triggers as low as ~30 minutes.
 - Looking forward to the next observing run, O3, (LIGO) triggers will be publicly released per the terms outlined in the LIGO Data Management Plan

Recommendation: continue to pursue MOUs for focused science targets/papers even in the era of open triggers.

This year's workshop



- We will have succeeded this year if the workshop endorses...
 - Ongoing effort on a compelling science case that can be presented to the funding agencies
 - Strong commitment for the community to proceed on developing a concept(s) for a 3G network
 Commitment to coordinate at an international level
 An approach to organizing the necessary enabling R&D

☐ GOAL: develop a report that

Informs the funding agencies on community plans

Serve as a basis for a community roadmap