# Status on Public Alerts

LIGO-Virgo Low-latency Analysis Group
April 25, 2019

# Current status of low-latency analysis system

- Configured for public alerts, including automated preliminary notices
  a. ER14 did not provide as much opportunity for testing as desired.
  b. Enabled public alerts at start of O3 anyway
    - Event rate consistent with expectations: S190408an, S190412m, S190421ar, S190425z.
  c. Problems which prevent automated notices are being addressed as they come up.
- Compact binary and unmodeled burst pipelines are running
  a. Background estimation appears to be stable.
  b. Robust identification of candidates according to false-alarm-rate criteria.
- Generation of automated preliminary notices
  a. Critical features are in place.
  b. A number of technical problems have been identified and are being fixed (see later)
  c. Automated ingestion and response to external triggers (e.g. GRBs) not yet working.

# S190425z

- S190425z
  - https://gracedb.ligo.org/superevents/S190425z/
  - https://gcn.gsfc.nasa.gov/gcn3/24168.gcn3
- Notes:
  - A special request BNS for this call
  - The signal-to-noise was below threshold in V1 so the candidate was treated as a single-instrument candidate and no automated preliminary notice was sent.
  - On-call experts responded: notices and circulars were issued by hand.
  - Significant candidate with probability of BNS > 0.99
  - Point estimates reported HasNS=1 and HasRemnant=1
  - Localization is dominated by L1 antenna pattern

# S190408an

- S190408an
  - https://gracedb.ligo.org/superevents/S190408an/
  - https://gcn.gsfc.nasa.gov/notices_l/S190408an.lvc
  - https://gcn.gsfc.nasa.gov/other/S190408an.gcn3
- Notes:
  - First end-to-end exercise of full infrastructure
  - An issue with GraceDB and throttling on AWS caused automated processing to fail.
  - On-call experts responded: notices and circulars were issued by hand.
  - Highly significant candidate with probability of BBH > 0.99
  - Machine learning reported HasRemant=0.12 inconsistent with HasNS=0.0
    - Currently reverted to point estimation until machine learning is better trained

# S190412m

- S190412m
  - https://gracedb.ligo.org/superevents/S190412m/
  - https://gcn.gsfc.nasa.gov/notices_l/S190412m.lvc
  - https://gcn.gsfc.nasa.gov/other/S190412m.gcn3
- Notes:
  - The issue with GraceDB and throttling on AWS caused automated processing to fail
    - This time we obtained enough information to diagnose and fix the problem
  - On-call experts responded: notices and circulars were issued by hand.
  - Highly significant candidate with probability of BBH > 0.99
  - Machine learning reported HasRemant=0.12 inconsistent with HasNS=0.0
    - Currently reverted to point estimation until machine learning is better trained

# S190421ar

- S190421ar
  - https://gracedb.ligo.org/superevents/S190421ar/
  - https://gcn.gsfc.nasa.gov/notices_l/S190421ar.lvc
  - https://gcn.gsfc.nasa.gov/other/S190421ar.gcn3
- Notes:
  - Automated processing did not issue public notice due to an edge-case in handling the preferred event across multiple search pipelines.
    - Fix is being deployed
  - On-call experts responded: notices and circulars were issued by hand.
  - Low-significance candidate with FAR of 1 per 2 years.
  - Reported probability of Terrestrial as 96% overestimated and BBH as 4% underestimated
    - Systematic issue for subset of the search pipelines; being studied.

# S190405ar -- retracted

- S190405ar
  - https://gracedb.ligo.org/superevents/S190405ar/
  - https://gcn.gsfc.nasa.gov/notices_l/S190405ar.lvc
- Notes:
  - A low significance event (well below the criteria for a public alert) for which a Notice was issued in error

# Updated information on alerts

- Parameter estimation is ongoing
- Updated information will be released as soon as LVC review is done
  - Updated skymap will be provided.
  - Updated properties (HasNS and HasRemnant) will be provided.
  - Updated classification (Terrestrial, BBH, NSBH, MassGap, BNS) will be provided if possible; this is more involved and may take longer.
- Time to updated information will decrease with experience

# Summary

- LIGO-Virgo low-latency alert system experienced some glitches during its first month of operations; all are being worked out and we expect permanent fixes and fully automated preliminary GCN Notices to be in place soon
- Until then, close supervision of the end-to-end system is in place and on-call experts will intervene when needed
- LIGO-Virgo Public Alerts User Guide & Support
  - https://emfollow.docs.ligo.org/userguide/
  - Feedback or requests for information to: emfollow-userguide@support.ligo.org
- Mailing list
  - Please sign up to the public openlvem mailing list; anyone can subscribe
  - Instructions at https://wiki.gw-astronomy.org/OpenLVEM
  - We will use it to announce changes of configuration, plans, etc