ER15/04 public alerts so far

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May/25/2023, Open LVKEM Townhall
04 started and we already distributed public alerts!!


**O4 Detection Candidates: 1 (1 Retraction)**

<table>
<thead>
<tr>
<th>Event ID</th>
<th>Possible Source Probability</th>
<th>UTC</th>
<th>GCN</th>
<th>Location</th>
<th>FAR</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>S200525a</td>
<td>BHB (72%), Terrestrial (28%)</td>
<td>May 25, 2023 02:30:17 UTC</td>
<td>GCN Circular Query</td>
<td>Not dans</td>
<td>23.713 per year</td>
<td></td>
</tr>
<tr>
<td>S200526a</td>
<td>BNS (75%), Terrestrial (25%)</td>
<td>May 28, 2023 20:23:41 UTC</td>
<td>GCN Circular Query</td>
<td>Not dans</td>
<td>2.2789 per year</td>
<td>RETRACTED</td>
</tr>
</tbody>
</table>

**ER15 Detection Candidates: 6 (0 Retractions)**

<table>
<thead>
<tr>
<th>Event ID</th>
<th>Possible Source Probability</th>
<th>UTC</th>
<th>GCN</th>
<th>Location</th>
<th>FAR</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>S200524a</td>
<td>BHB (79%), Terrestrial (21%)</td>
<td>May 24, 2023 08:32:06 UTC</td>
<td>GCN Circular Query</td>
<td>Not dans</td>
<td>26.1851 per year</td>
<td></td>
</tr>
<tr>
<td>S200523x</td>
<td>BHB (50%)</td>
<td>May 23, 2023 10:30:23 UTC</td>
<td>GCN Circular Query</td>
<td>Not dans</td>
<td>1 per 3.8038 years</td>
<td></td>
</tr>
<tr>
<td>S200522a</td>
<td>BHB                   (60%)</td>
<td>May 22, 2023 00:22:30 UTC</td>
<td>GCN Circular Query</td>
<td>Not dans</td>
<td>1 per 3.0615 years</td>
<td></td>
</tr>
<tr>
<td>S200513b</td>
<td>Terrestrial (80%), BNS (20%), NSN (14%)</td>
<td>May 11, 2023 05:30:43 UTC</td>
<td>GCN Circular Query</td>
<td>Not dans</td>
<td>76.351 per year</td>
<td></td>
</tr>
<tr>
<td>S200521b</td>
<td>BHB                   (60%)</td>
<td>May 10, 2023 22:40:41 UTC</td>
<td>GCN Circular Query</td>
<td>Not dans</td>
<td>1 per 12.746 years</td>
<td></td>
</tr>
<tr>
<td>S200510a</td>
<td>NSN (90%), Terrestrial (10%), BBH (10%)</td>
<td>May 9, 2023 12:56:58 UTC</td>
<td>GCN Circular Query</td>
<td>Not dans</td>
<td>1 per 89.2763 years</td>
<td></td>
</tr>
</tbody>
</table>
New Threshold for alerts.

Updated Public Alert Threshold for O4*
The false alarm rate threshold for public alerts will be lowered to **2/day** starting in O4. There will therefore be two classes of alerts:

- **Low Significance** (*Subthreshold* in O3) gravitational-wave alerts with false alarm rate greater than **1/month for CBC** and **1/year for Burst**
- **Significant** gravitational-wave alerts with false alarm rate less than **1/month** and **1/year for Burst** that pass automated and manual verification.

*May be tuned slightly during the engineering run.

### Alert summary for O4

- Early warning (pre-merger) alerts will be provided
- Multiple distribution channels for alerts:
  - GCN Notices and Circulars as in O3.
  - Kafka based alerts with embedded skymap via SCiMMA and GCN
ER15: What to expect

- GW analysis pipelines WILL start uploading real event candidates, which MAY result in public alerts.
  - Start date MAY differ for different pipelines (“subject to internal reviews”).
- RRT will NOT provide human response to public alerts in ER15 (except when REALLY interesting candidates are identified, e.g. next GW170817).
- But RRT WILL pick at least one BBH candidate and perform an end-to-end test of manual procedure, including the submission of GCN Initial Circular.
  - Will append “: End-to-End Test” to the usual subject, e.g. “SUBJECT: LIGO/Virgo/KAGRA S1234: Identification of a GW compact binary: End-to-End Test”.
  - This will be a legitimate Circular, but please understand that this is only done for testing RRT procedure.

No human response except for
- REALLY interesting
- BBH picked for End to End test of manual procedure
All of these things happened in ER15 + O4


<table>
<thead>
<tr>
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<th>Possible Source (Probability)</th>
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<th>GCN</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>20030134a</td>
<td>BBH (77%), Terrestrial (27%)</td>
<td>May 12, 2023 12:15 UTC</td>
<td>Low Significance</td>
<td></td>
</tr>
<tr>
<td>20030134b</td>
<td>BBH (56%), Terrestrial (44%)</td>
<td>May 24, 2023 12:30 UTC</td>
<td>Low Significance</td>
<td></td>
</tr>
<tr>
<td>20030132a</td>
<td>BBH (29%), Terrestrial (71%)</td>
<td>May 24, 2023 12:30 UTC</td>
<td>Low Significance</td>
<td></td>
</tr>
<tr>
<td>20030132b</td>
<td>BBH (29%), Terrestrial (71%)</td>
<td>May 24, 2023 12:30 UTC</td>
<td>Low Significance</td>
<td></td>
</tr>
<tr>
<td>20030131a</td>
<td>Terrestrial (80%), BBH (20%), NOBM (10%)</td>
<td>May 24, 2023 12:30 UTC</td>
<td>Low Significance</td>
<td></td>
</tr>
<tr>
<td>20030130a</td>
<td>BBH (29%), Terrestrial (71%)</td>
<td>May 24, 2023 12:30 UTC</td>
<td>RRT E2E Test</td>
<td></td>
</tr>
<tr>
<td>2003012b</td>
<td>NSR1 (20%), Terrestrial (80%), BBH (10%)</td>
<td>May 18, 2023 12:45 UTC</td>
<td>Really interesting</td>
<td></td>
</tr>
</tbody>
</table>

Early Warning (Retracted)
Low Significance (= no human response)
No human response
No human response
No human response
No human response
Low Significance (= no human response)
GCN Circular 33813

S230518h (likely NSBH) : 2 circulars from LVK; 18 follow-up obs so far.

The LIGO Scientific Collaboration, the Virgo Collaboration, and the KAGRA Collaboration report:

We identified the compact binary merger candidate S230518h during real-time processing of data from LIGO Hanford Observatory (H1) and LIGO Livingston Observatory (L1) at 2023-05-18 12:59:08.167 UTC (GPS time: 1366449666.167). The candidate was found by the PyCBC Live [1], GstAL [2], and MBTADOnline [5] analysis pipelines.

The LIGO detectors are currently operating in an "engineering run" mode prior to the start of the O4 observing run. The data being collected at the time of this candidate is believed to be of good quality based on preliminary checks, but requires further investigation. A decision was made to alert the community promptly, with this caveat, due to the potential significance of this candidate.

S230518h is an event of interest because its false alarm rate, as estimated by the online analysis, is 3.2e-10 Hz, or about one in 98 years. The event's properties can be found at this URL: https://gracedb.ligo.org/superevents/S230518h

The classification of the GW signal, in order of descending probability, is NSBH (86%), Terrestrial (10%), BBH (4%), and BNS (<1%).

Assuming the candidate is astrophysical in origin, the probability that the lighter compact object is consistent with a neutron star mass (HasNS) is >99%. [1] Using the masses and spins inferred from the signal, the probability of matter outside the final compact object (HasRemnant) is < 1%. Both HasNS and HasRemnant consider the support of several neutron star equations of state. The probability that any one of the binary components lies between 3 to 5 solar mass (HasMassgap) is < 1%.

One sky map is available at this time and can be retrieved from the GraceDB event page:
* bayestar.multiorient.fits, an initial localization generated by BAYESTAR [4], distributed via GCN Notice about 39 minutes after the candidate event time.

For the bayestar.multiorient.fits sky map, the 90% credible region is about 102 deg2. Marginalized over the whole sky, the posterior of the posterior luminosity distance estimate is 2.1% +/- 79 Mpc (a posteriori mean +/- standard deviation).

For further information about analysis methodology and the contents of this alert, refer to the LIGO/Virgo/KAGRA Public Alerts User Guide: https://enfolow.docs.ligo.org/userguide/.


https://gcn.nasa.gov/circulars/33813
5 Significant (1 retracted), 3 Low Significance so far.

RRT provided human response to 3 Significant candidates (one NSBH, one BBH for E2E test and one Early Warning which was retracted).

RRT procedure seems to have worked well.

Some didn’t receive GCN Early Warning Notice, only Retraction. This is under investigation.

There were other minor issues but those are not critical. Some were already addressed, some will be addressed in the near future.

All in all, this is a good start. I expect that minor hiccups will be found and dealt with as we go for a few weeks.