LIGO, Virgo and public data access

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Data-related procedures

Procedures defined in MOA between KAGRA, LIGO and Virgo

General

All acquired data will be made available to KLV Collaborations, to be used in the framework of Joint Analysis groups. No gravitational wave analysis shall exclude members of either collaboration

Each Collaboration retains the **ownership** of and control over its own data

Entities other than KLV Collaboration

Agreements involving gravitational wave **data sharing and collaborative work with other parties** will be initiated, negotiated and carried out jointly with LIGO and VIRGO, in a spirit of teamwork

No discussion of results or pre-prints shall take place with scientists who are not members of the Collaborations or with members of the media, until the leaderships of the Collaborations have approved the release of the information; this holds for all papers, whether LVC papers or short author list (with a fraction of LVC members and possibly non-LVC authors), and all talks, interviews, and other public dissemination of results.

EM Community

Two 2-day Town meetings (Boston and Amsterdam) were organized before the start of O3

Regular LV-EM meetings (monthly)

Full release of strain data from observation run O3

Procedures defined in MOA between KAGRA, LIGO and Virgo

Motivation

Both the LSC and the Virgo Collaboration recognize the interest of making their data public, with the objective to enable reproduction of LVC results and further exploitation of the data by the greater scientific public. These data comprise of **documented and calibrated strain time series**, as well as **data products** associated with analysis results and publications

Data are owned by our agencies

The Collaborations follow agreements with funding agencies for release of data and data products; for the LSC, the LIGO Data Management Plan (LIGO-M1000066), an agreement between the LIGO Laboratory and the National Science Foundation, is the defining document.

Cadence

The Collaborations will determine a cadence for **release of the full strain h(t) data set from a section of an observation run**. The objective will be to establish a cadence which permits the data to be rapidly released and the core science, as defined by the Programs of the Collaborations and the **LVC publication plan**, to be published, before the release of the full data set

O3 has two run segments of 6 months each

O3a for data taken between April 1, 2019 and September 30, 2019 with release data April 2021
O3b for data taken between November 1, 2019 and April 30 2020 with release data October 2021

Transients: strain data release from a run segment

Procedures defined in MOA between KAGRA, LIGO and Virgo

Observation run O3

The LVC will release, simultaneous with publications analyzing these data, **strain data for a period of 4096 s around the times of transient events**. These data will feature the **full bandwidth** that is used within the Collaborations

Transient catalog

The LVC aim to disseminate the transient catalogs **within order of 6 months of the completion of each run segment**. Adjustments can be made by mutual agreement of the Spokespersons for internal or external considerations

New discoveries

The LVC aim to address new discoveries significant enough to warrant a stand-alone publication on a **time scale of order 3 months**

Disclaimer

Adjustments can be made by mutual agreement of the Spokespersons for internal or external considerations. The objective will be to enable publication as fast as possible while maintaining quality and confidence in the results, and a manageable workload for collaboration members. Flexibility for each case is needed

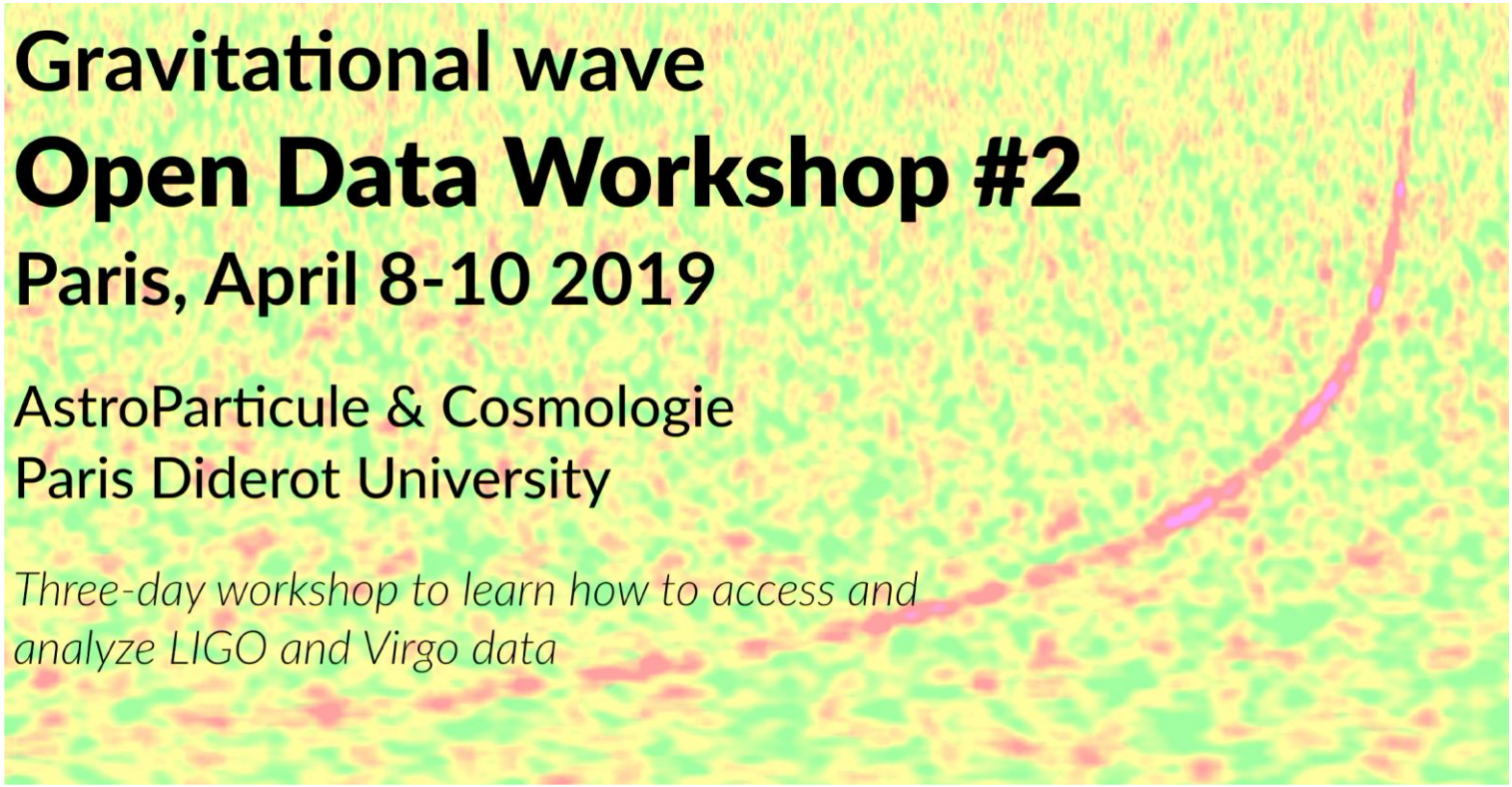
The LVC aim to have all observational papers released at the latest by the time the data become public

Hosting of LVC public data releases

The Gravitational Wave Open Science Center (https://gw-openscience.org) hosts LVC data releases

All LIGO Virgo data obtained in O1 and O2 have been released to the public (under the Creative Commons CC-BY license)

GW Open Data Workshops provide hands-on training to learn how to access and analyze LIGO and Virgo data

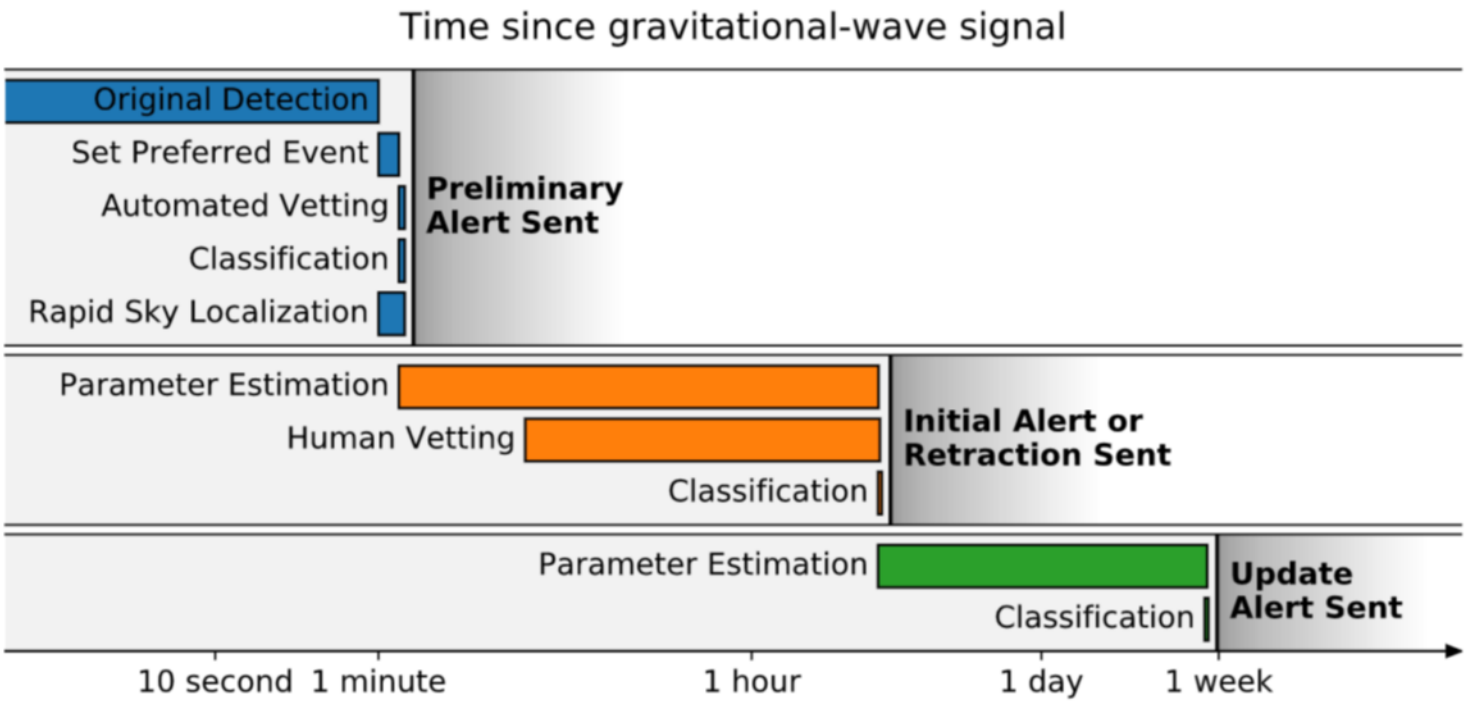


O3 public alert for GW event candidates

Low-latency GW data analysis pipelines to promptly identify GW candidates and send GW alerts

Alert timeline

- Calibrations, reconstruction, state vector (1 Hz), veto streams (50 Hz), online pipelines, triggers
- GraceDB, orchestrator, GW candidates, DQR
- Global data quality, vetting, checks, studies



https://emfollow.docs.ligo.org/userguide

Release of Open Public Alerts

Procedures defined in MOA between KAGRA, LIGO and Virgo

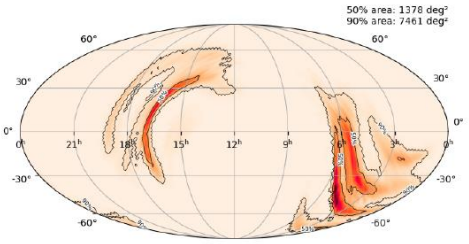
LIGO and Virgo Collaborations release Open Public Alerts, with low latency, for all interesting signal triggers, and follow-up information sufficient for non-GW observers to find hosts

S190425z

FAR < 1/100 yrs

7461 deg2 in 90% c.r.
Distance 156±41 Mpc
L, V

BNS	>99%
Terrestrial	<1%
NSBH	0%
MassGap	0%
BBH	0%



GCN 24168, 24228

Latest — as of 27 January 2020 14:32:30 UTC

Test and MDC events and superevents are not included in the search results by default; see the query help for information on how to search for events and superevents in those categories.

Query:

Search for: Superevent

Search

UID	Labels	t_start	t_0	t_end	FA
S200116ah	EM_READY PE_READY ADVNO EM_Selected SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK GCN_PRELIM_SENT	1263211019.170712	1263211020.170712	1263211021.170712	2.02
S200115j	EM_READY PE_READY ADVOK EM_Selected SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK GCN_PRELIM_SENT	1263097406.735840	1263097407.752869	1263097408.769043	2.09
S200114f	EM_READY ADVOK EM_Selected SKYMAP_READY DQOK GCN_PRELIM_SENT		1263002916.239300	1263002916.252885	1.22
S200112r	EM_READY PE_READY ADVOK EM_Selected SKYMAP_READY EMBRIGHT_READY PASTRO_READ		1262879936.093931	1262879937.093931	1.28
S200108v	EM_READY PE_READY ADVNO EM_Selected SKYMAP_READY EMBRIGHT_READY PASTRO_READ		1262512856.558755	1262512857.558755	2.66
S200106av	EM_READY ADVNO EM_Selected SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK G		1262370881.578613	1262370882.623047	3.12
S200106au	EM_READY ADVNO EM_Selected SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK G		1262370887.292480	1262370888.456543	3.66
S200105ae	EM_READY PE_READY ADVOK SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK GCN		1262276684.057208	1262276685.059117	7.67
S191225aq	EM_READY ADVNO EM_Selected SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK G		1261346253.870117	1261346254.870117	1.26
S191222n	EM_READY PE_READY ADVOK EM_Selected SKYMAP_READY EMBRIGHT_READY PASTRO_READ		1261020955.119478	1261020956.119478	6.45
S191220af	EM_READY PE_READY ADVNO EM_Selected SKYMAP_READY EMBRIGHT_READY PASTRO_READ		1260879872.690032	1260879873.690394	3.96
S191216ap	EM_READY PE_READY ADVOK EM_Selected SKYMAP_READY EMBRIGHT_READY PASTRO_READ		1260567236.472999	1260567237.487849	1.13
S191215w	EM_READY PE_READY ADVOK EM_Selected SKYMAP_READY EMBRIGHT_READY PASTRO_READ		1260484270.333152	1260484271.365682	1.00
S191213ai	EM_READY ADVNO EM_Selected SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK G		1260287963.899585	1260287964.899585	2.00
S191213g	EM_READY PE_READY ADVOK EM_Selected SKYMAP_READY EMBRIGHT_READY PASTRO_READ		1260246866.142224	1260246867.145035	3.54
S191212q	EM_READY ADVNO EM_Selected SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK G		1260174466.641861	1260174467.641861	3.36
S191205ah	EM_READY ADVOK EM_Selected SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK G		1259617946.568738	1259617947.568738	1.24
S191204r	EM_READY ADVOK EM_Selected SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK G		1259514944.091822	1259514945.124422	3.06
S191129u	EM_READY PE_READY ADVOK EM_Selected SKYMAP_READY EMBRIGHT_READY PASTRO_READ		1259070047.197372	1259070048.244883	2.65
S191124be	ADVNO EM_Selected SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK GCN_PRELIM		1258624776.099619	1258624777.099619	1.67
S191120at	ADVNO EM_Selected SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK GCN_PRELIM		1258315735.323325	1258315736.367101	6.10
S191120aj	ADVNO EM_Selected SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK GCN_PRELIM		1258302232.438461	1258302233.438461	2.86
S191117j	ADVNO EM_Selected SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK GCN_PRELIM		1258006120.454868	1258006121.454868	1.11
S191110af	ADVNO EM_Selected SKYMAP_READY DQOK GCN_PRELIM_SENT		1257462422.183200	1257462422.287284	2.49
S191110x	PE_READY ADVNO EM_Selected SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK G		1257444540.210120	1257444541.210120	2.93
S191109d	EM_READY PE_READY ADVOK EM_Selected SKYMAP_READY EMBRIGHT_READY PASTRO_READ		1257296855.220703	1257296856.278186	1.53
S191105e	EM_READY PE_READY ADVOK EM_Selected SKYMAP_READY EMBRIGHT_READY PASTRO_READ		1256999739.933105	1256999740.933105	2.28

Bottlenecks

Optimizing scientific output of LVC, recognition of (young) scientists, open science approach

Gravitational Wave Analysis White Paper

Define the **scope** of efforts of LIGO Virgo Collaboration, and shall be approved by each Collaboration's governing bodies. **Scope is limited** by LVC resources

Publication Plan

LIGO and Virgo Collaborations agreed on an **LVC Publication Plan** before the start of O3. The Publication Plan lists the collaboration papers that the LVC commits to publishing as LVC Papers. Periodic revisions are made and dates set for public release. The Collaborations discuss the Publication Plan during joint meetings and approve it or propose **amendments**

LVC versus broad scientific community

Release of all strain data allows the broad community to independently assess discoveries, possibly unveil new events and realise the full scientific potential of the data. However, it should be noted that the LVC focuses on more than transients

Short author list publications

Analyses on the public data may be undertaken by individuals and smaller groups with authorship as desired. LVC publication rules must be followed also when **co-authoring with non-LVC persons** on subjects within the scope of the Programs laid out by the LVC; LVC members must inform non-LVC colleagues of these rules in a timely way