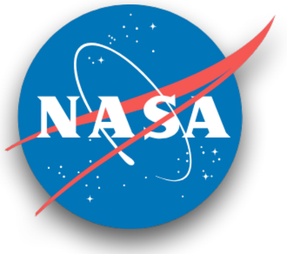
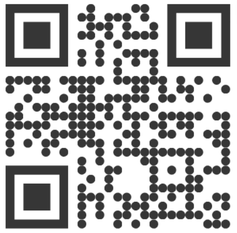
National Aeronautics and
Space Administration



General Coordinates Network

NASA's Next Generation Time-Domain and Multimessenger Alert System

A service of the Astrophysics Science Division at NASA's Goddard Space Flight Center



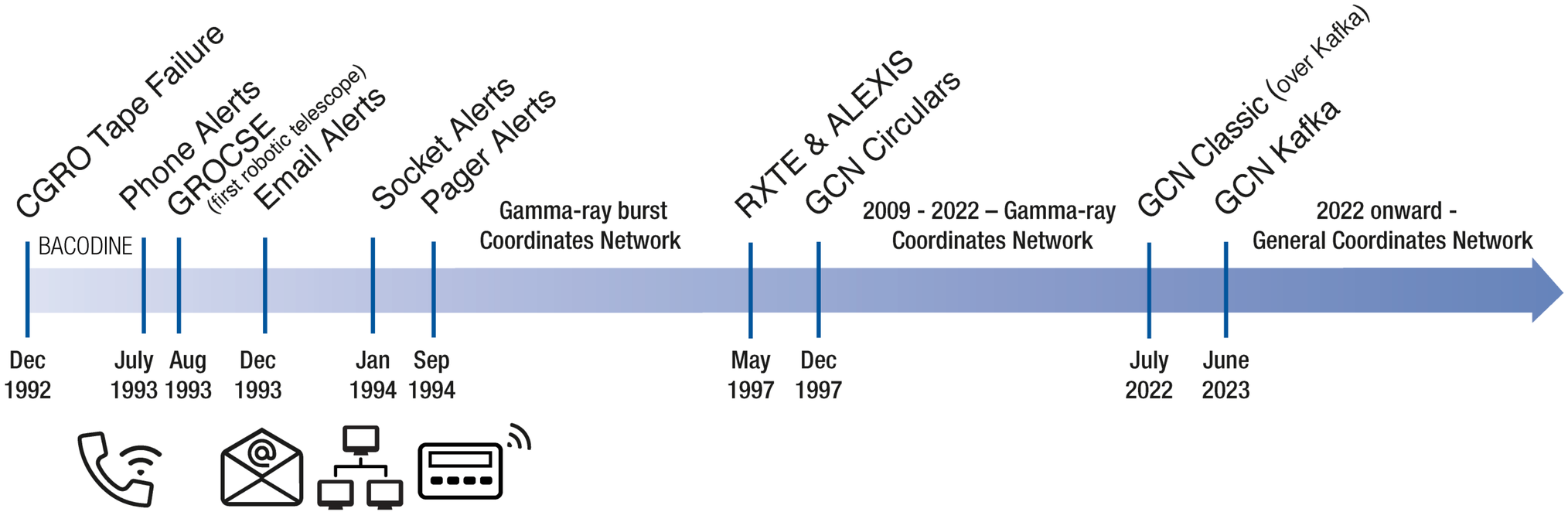
https://gcn.nasa.gov

Courey Elliott
Courey.Elliott@gmail.com
IPN, NASA GCN

30+ Year History

Scott Barthelmy created GCN (known then as the Gamma-ray burst Coordinates Network), to facilitate communication within the community.

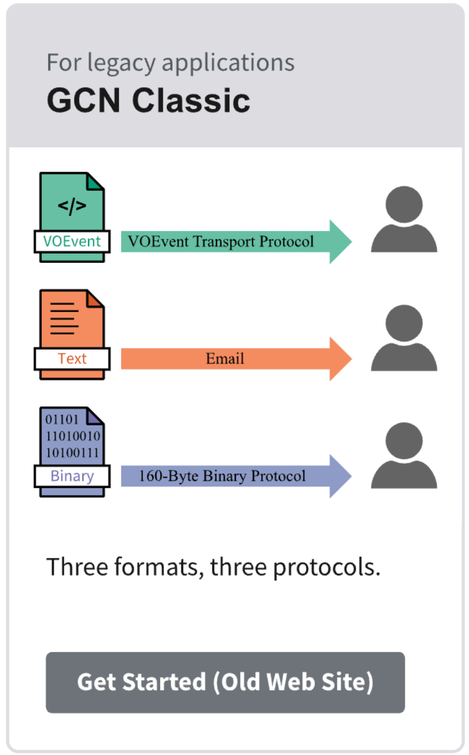
Judy Racusin took over the project around 2021 and committed to modernizing GCN.



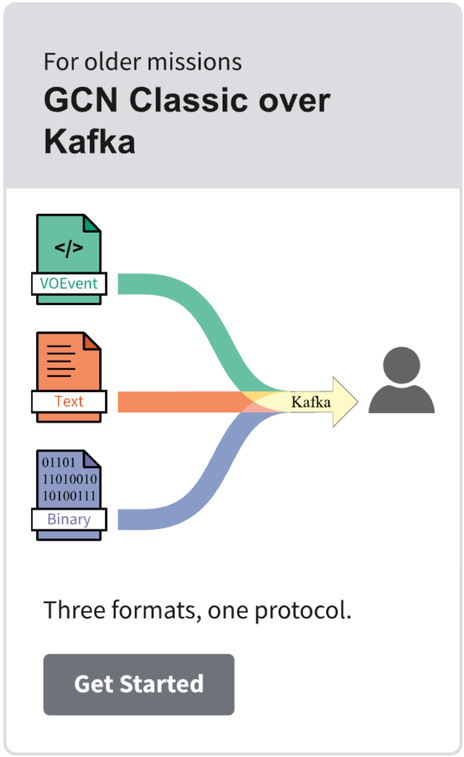
Notices

Notices documentation

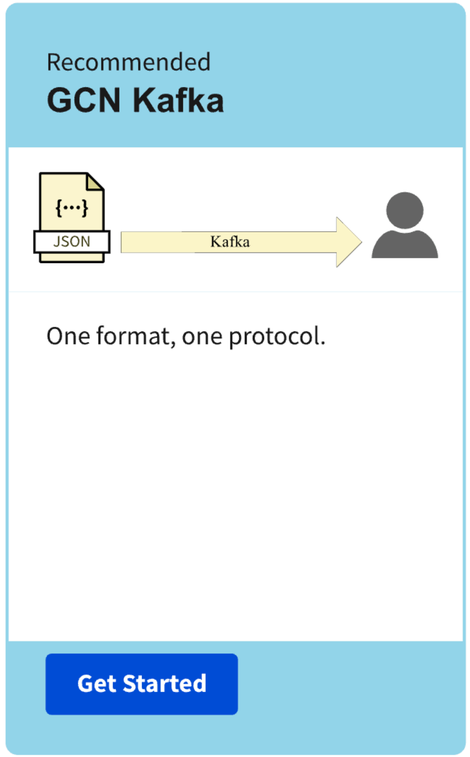
New GCN notices are built on Kafka



GCN Classic provides three formats over 3 different custom protocols



GCN Classic over Kafka provides all three formats in one standard protocol, Apache Kafka



GCN Kafka has begun the process of transitioning to streaming all data in JSON format over Kafka.

What is Kafka?

Kafka is a message system.

We use it to receive notices from missions that we send only to users that are subscribed to that topic.

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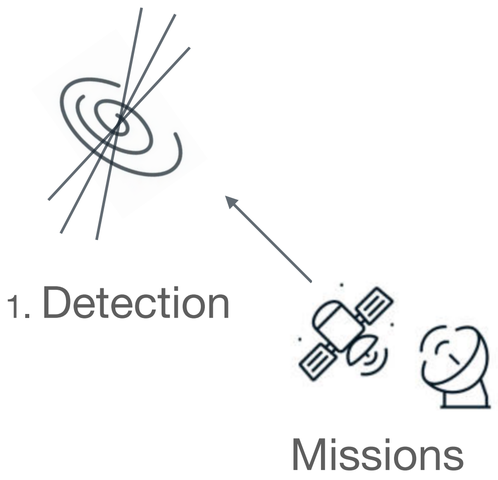

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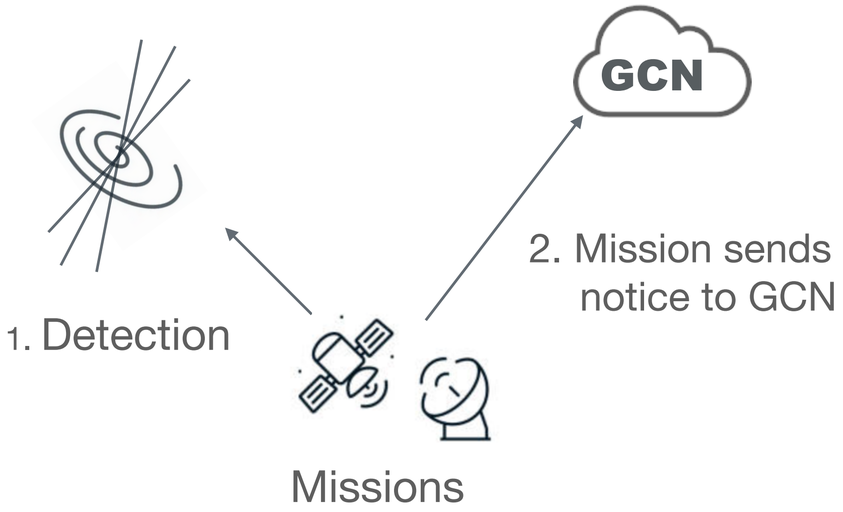

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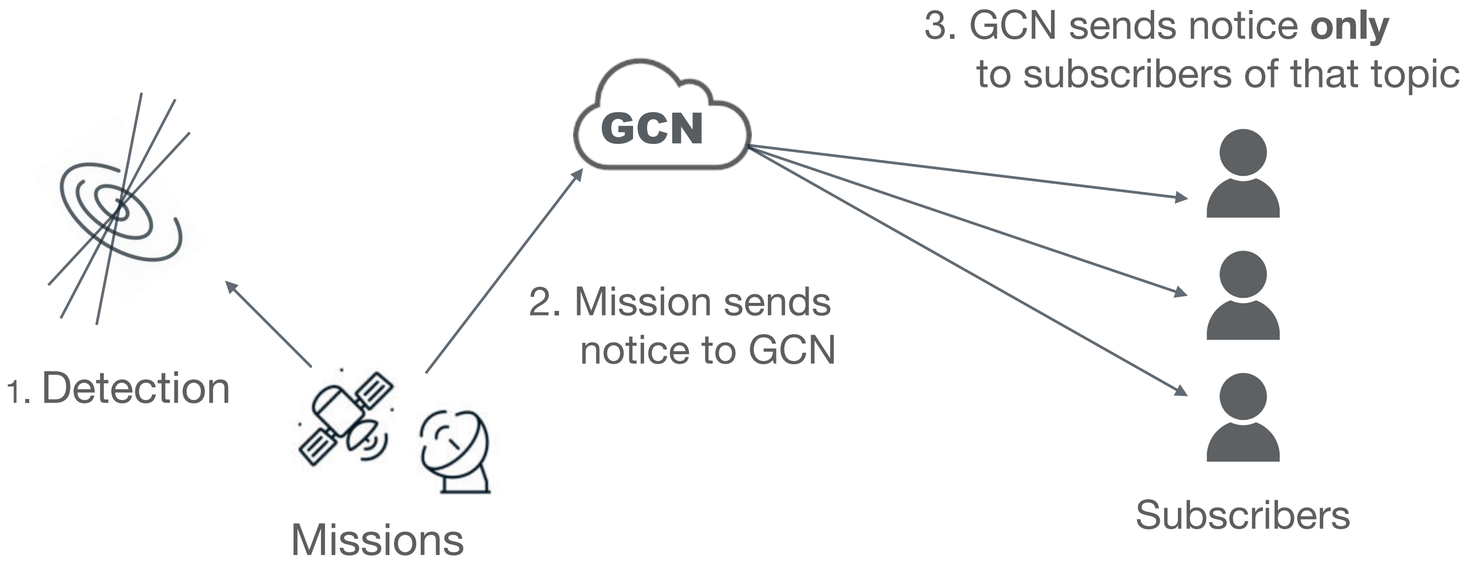

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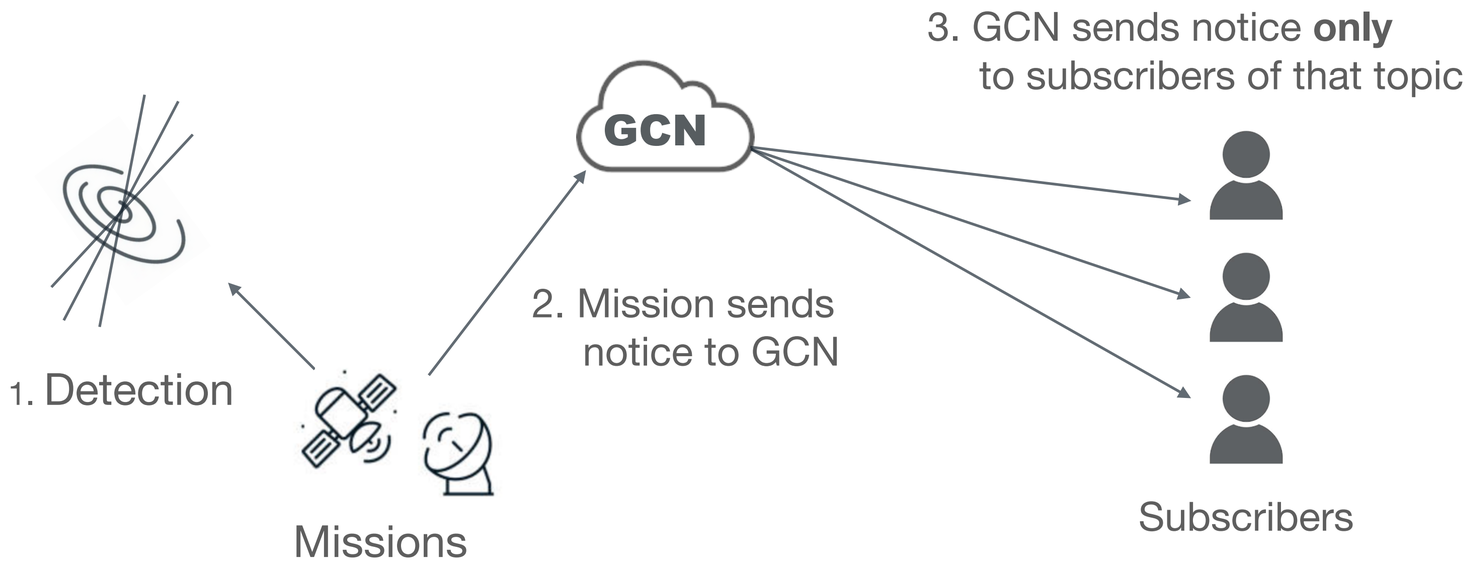


You choose what topics you want to subscribe to. You will only receive notices for the topics you are subscribed to. Each mission has different topics.

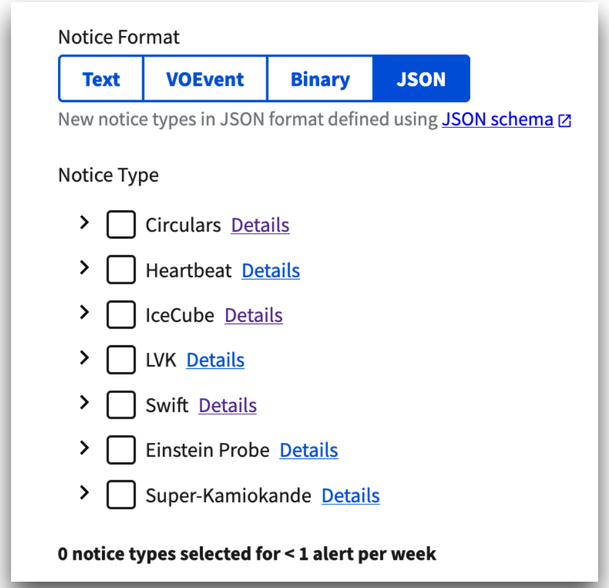
Notices

Example of a json formatted circular notice:


```
{
  "$schema": "https://gcn.nasa.gov/schema/main/gcn/circulars.schema.json",
  "eventId": "GRB 230410A",
  "submitter": "Fermi GBM Team at MSFC/Fermi-GBM <do_not_reply@GIOC.nsstc.nasa.gov>",
  "submittedHow": "email-legacy",
  "subject": "GRB 230410A: Fermi GBM Final Real-time Localization",
  "circularId": 33603,
  "format": "text/plain",
  "body": "The Fermi GBM team reports the detection of a likely LONG GRB\\n\\nAt 11:26:00 UT on
           10 Apr 2023, the Fermi Gamma-ray Burst Monitor (GBM) triggered and located GRB
           230410A (trigger 702818765.135562 / 230410476).\\n\\nThe on-ground calculated
           location, using the Fermi GBM trigger data, is RA = 352.3, Dec = 22.9 (J2000 degrees,
           equivalent to J2000 23h 29m, 22d 53'), with a statistical uncertainty of 2.1 degrees.
           \\n\\nThe angle from the Fermi LAT boresight is 72.0 degrees.\\n\\nThe skymap can be
           found here:\\nhttps://heasarc.gsfc.nasa.gov/FTP/fermi/data/gbm/triggers/2023/
           bn230410476/quicklook/glg_skymap_all_bn230410476.png\\n\\nThe HEALPix FITS file,
           including the estimated localization systematic, can be found here:\\nhttps://
           heasarc.gsfc.nasa.gov/FTP/fermi/data/gbm/triggers/2023/bn230410476/quicklook/
           glg_healpix_all_bn230410476.fit\\n\\nThe GBM light curve can be found here:\
           \nhttps://heasarc.gsfc.nasa.gov/FTP/fermi/data/gbm/triggers/2023/bn230410476/
           quicklook/glg_lc_medres34_bn230410476.gif",
  "createdOn": 1718212589034
}
```


You choose what topics and formats you use.

Example of the topic selection screen on the GCN website:

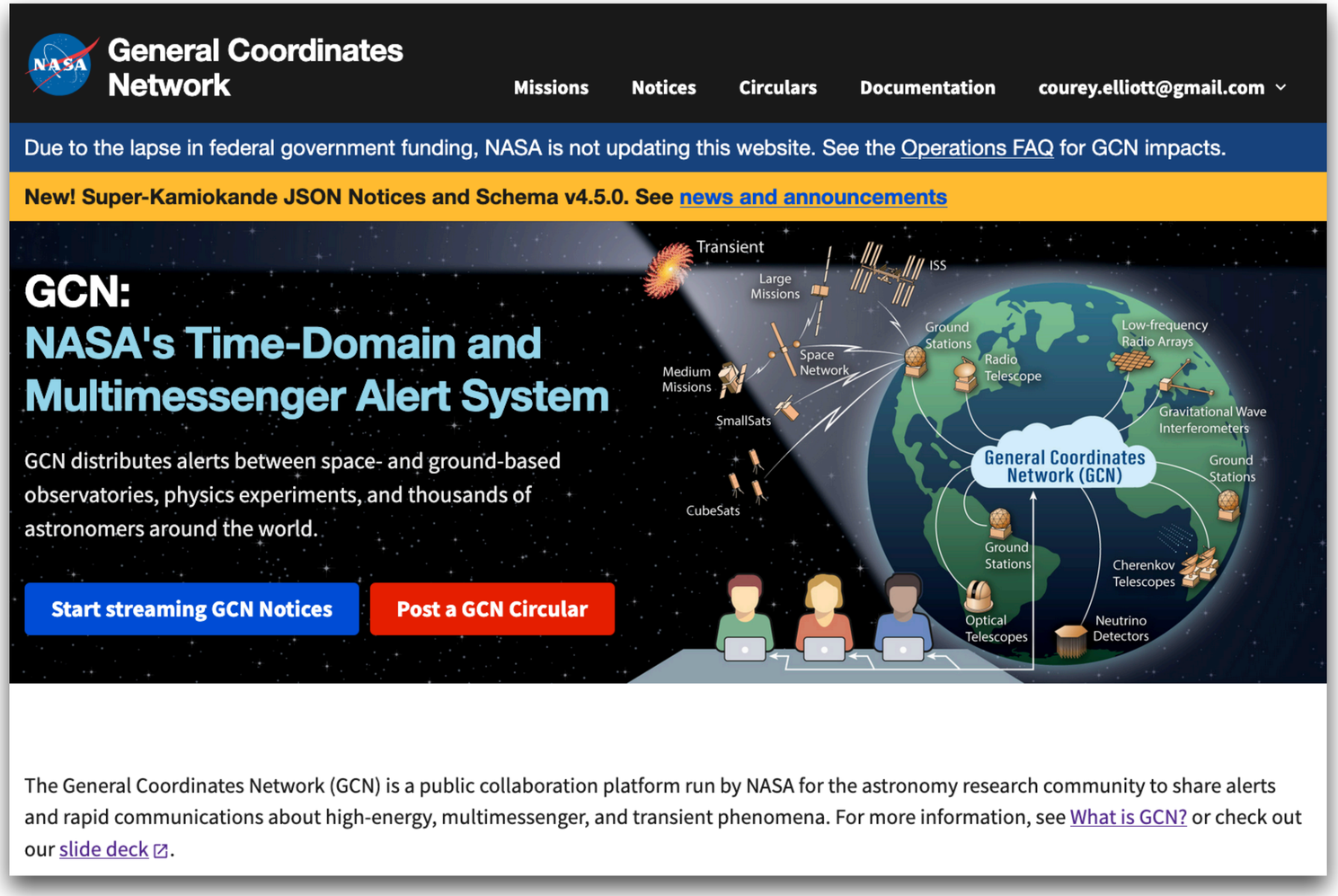


Example of a text formatted Fermi GBM notice:

```
TITLE:            GCN/FERMI NOTICE
NOTICE_DATE:      Wed 22 Oct 25 22:34:21 UT
NOTICE_TYPE:      Fermi-GBM Alert
RECORD_NUM:       1
TRIGGER_NUM:      782865260
GRB_DATE:         20970 TJD;   295 DOY;   25/10/22
GRB_TIME:         81255.26 SOD {22:34:15.26} UT
TRIGGER_SIGNIF:   4.5 [sigma]
TRIGGER_DUR:      0.512 [sec]
E_RANGE:          3-4 [chan]   47-291 [keV]
ALGORITHM:        10
DETECTORS:        0,0,0, 0,0,0, 0,1,0, 1,0,0, 0,0,
LC_URL:           http://heasarc.gsfc.nasa.gov/FTP/fermi/data/gbm/triggers/2025/bn251022940/quicklook/glg_lc_medres34_bn251022940.gif
COMMENTS:         Fermi-GBM Trigger Alert.
COMMENTS:         This trigger occurred at longitude,latitude = 51.35,5.67 [deg].
COMMENTS:         The LC_URL file will not be created until ~15 min after the trigger.
```

Notices Documentation

GCN Website

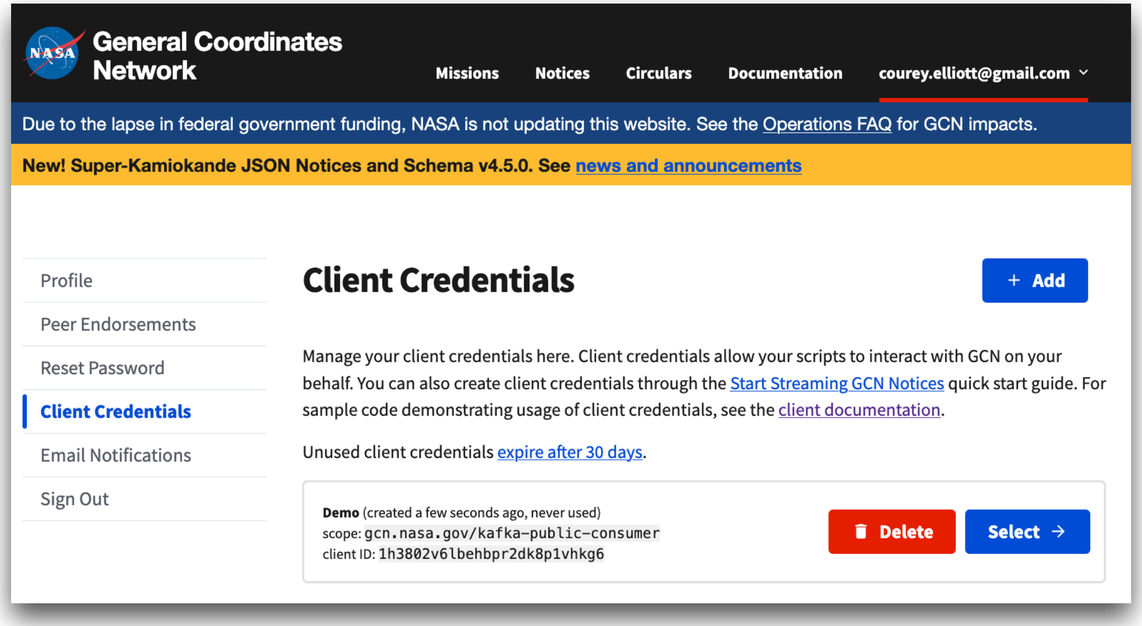


There are a lot of new features on the website with many more in development

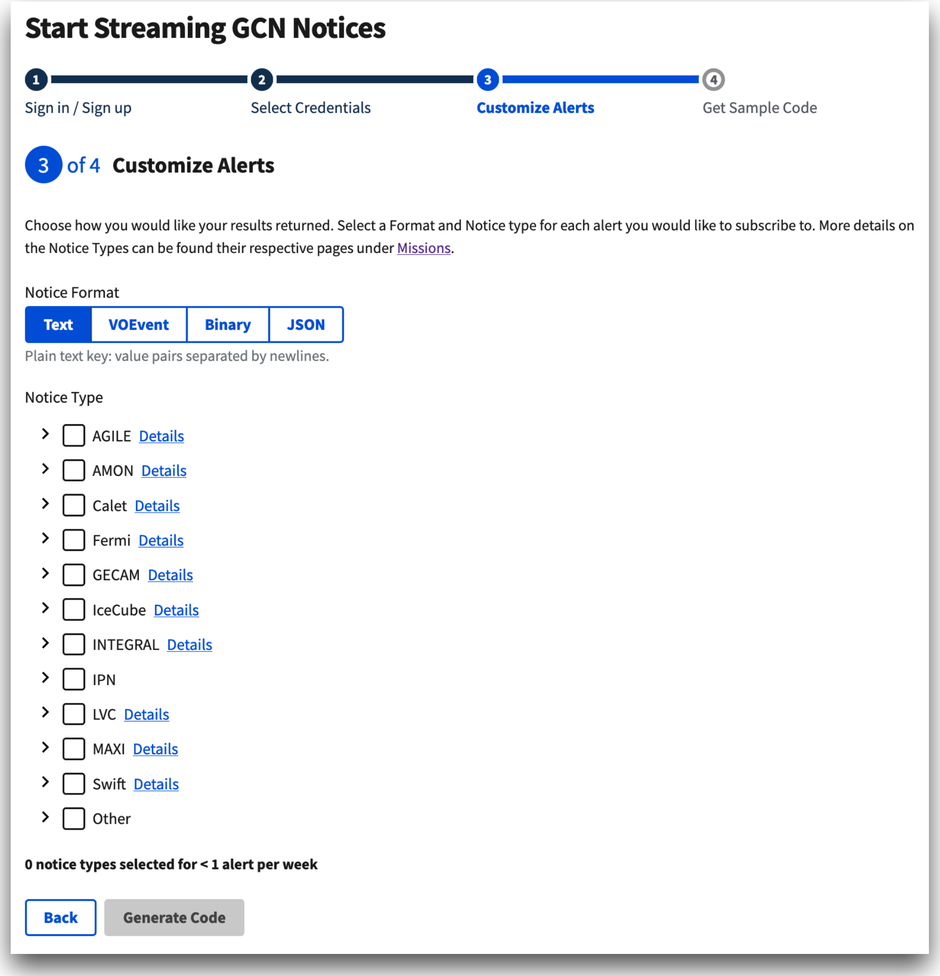
https://gcn.nasa.gov

Client Credentials

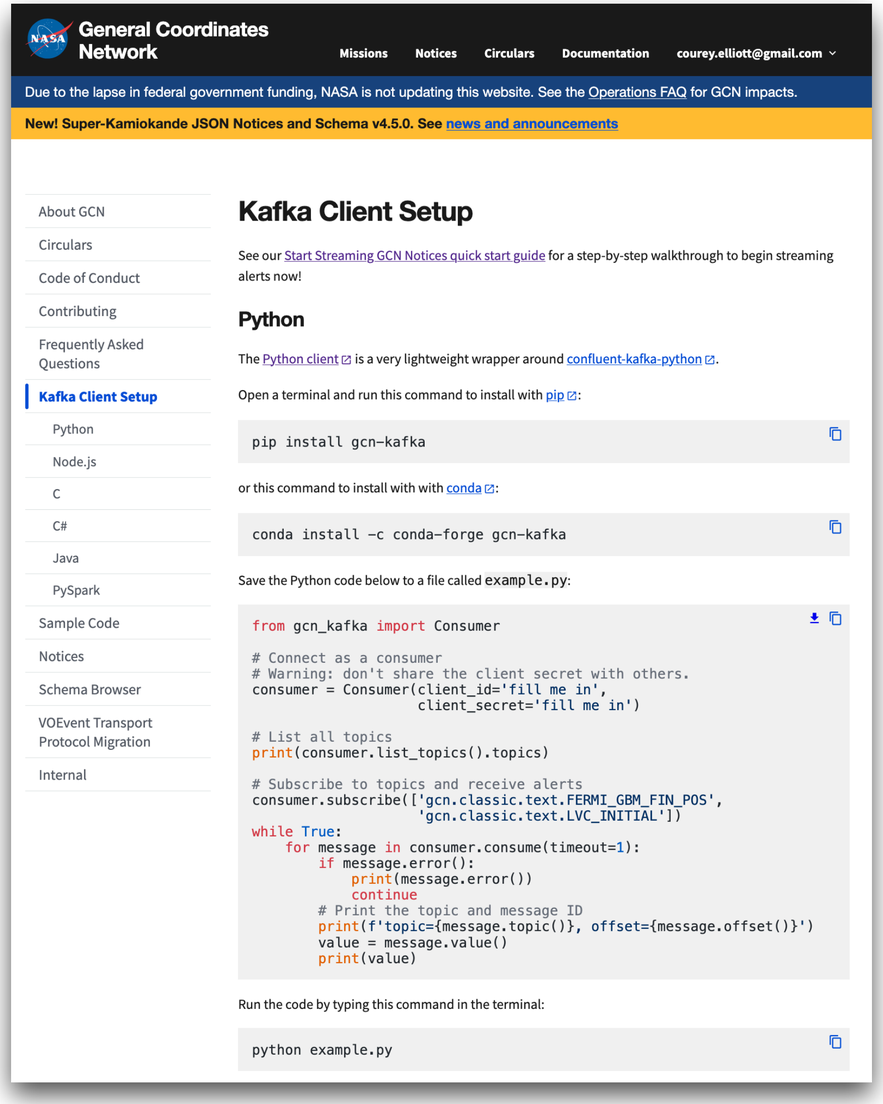
Client credentials allow you to connect to Kafka



There is sample code for many programming languages in the documentation



Consuming Notices



General Coordinates Network

Missions Notices Circulars Documentation courey.elliott@gmail.com

Due to the lapse in federal government funding, NASA is not updating this website. See the Operations FAQ for GCN impacts.

New! Super-Kamiokande JSON Notices and Schema v4.5.0. See news and announcements

- About GCN
- Circulars
- Code of Conduct
- Contributing
- Frequently Asked Questions
- **Kafka Client Setup**
  - Python
  - Node.js
  - C
  - C#
  - Java
  - PySpark
- Sample Code
- Notices
- Schema Browser
- VOEvent Transport Protocol Migration
- Internal

Kafka Client Setup

See our Start Streaming GCN Notices quick start guide for a step-by-step walkthrough to begin streaming alerts now!

Python

The Python client is a very lightweight wrapper around confluent-kafka-python.

Open a terminal and run this command to install with pip:

```
pip install gcn-kafka
```

or this command to install with with conda:

```
conda install -c conda-forge gcn-kafka
```

Save the Python code below to a file called `example.py`:

```
from gcn_kafka import Consumer

# Connect as a consumer
# Warning: don't share the client secret with others.
consumer = Consumer(client_id='fill me in',
                    client_secret='fill me in')

# List all topics
print(consumer.list_topics().topics)

# Subscribe to topics and receive alerts
consumer.subscribe(['gcn.classic.text.FERMI_GBM_FIN_POS',
                    'gcn.classic.text.LVC_INITIAL'])
while True:
    for message in consumer.consume(timeout=1):
        if message.error():
            print(message.error())
            continue
        # Print the topic and message ID
        print(f'topic={message.topic()}, offset={message.offset()}')
        value = message.value()
        print(value)
```

Run the code by typing this command in the terminal:

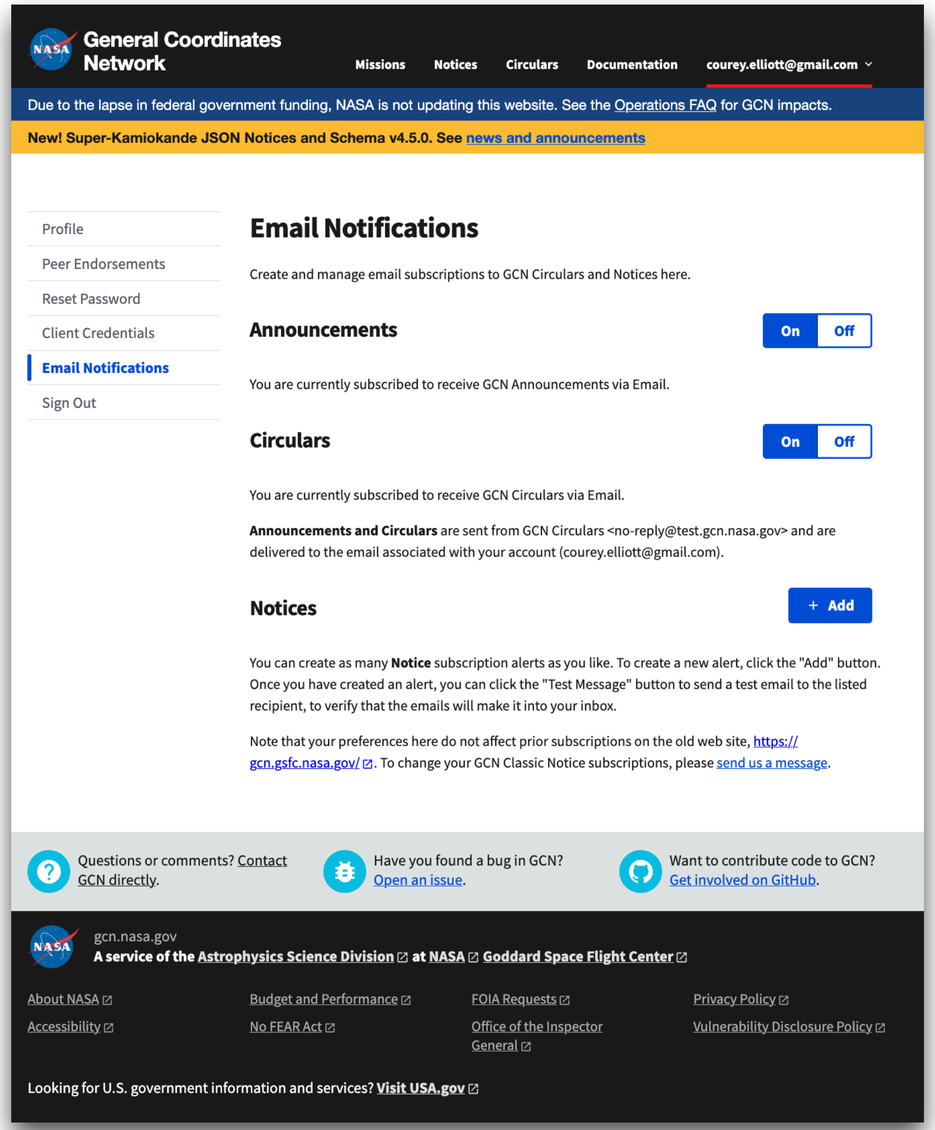
```
python example.py
```

Documentation with code samples! You can cut and past the code from the example and replace the client id and secret with your own, and you can start consuming.

You can subscribe to all different formats and as many topics as you would like. You adjust them on the line that says “consumer.subscribe”

When you run your script, you will start consuming and will continue consuming as long as the script is running

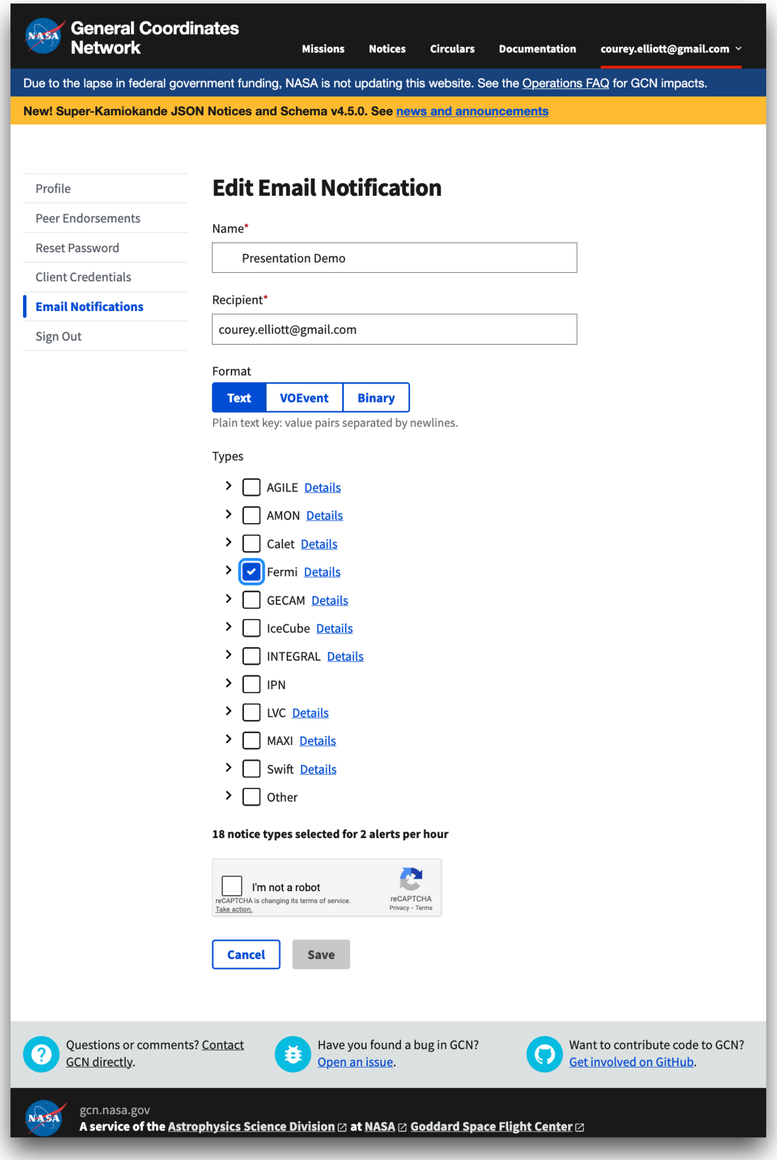
Manage your own email notifications

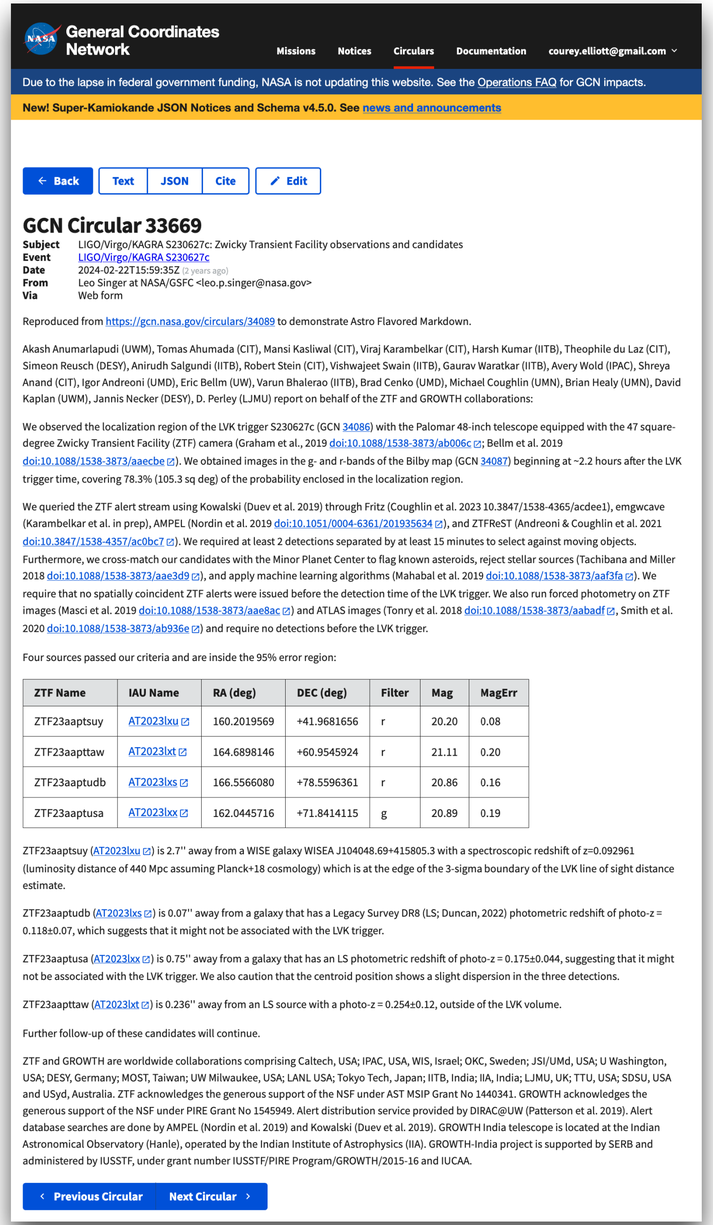


Toggle email announcements and Circulars by email

Subscribe to Notice Alerts via email

Choose what notice topics you want to be alerted to





General Coordinates Network

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New! Super-Kamiokande JSON Notices and Schema v4.5.0. See news and announcements

Back | Text | JSON | Cite | Edit

GCN Circular 33669

Subject LIGO/Virgo/KAGRA S230627c: Zwicky Transient Facility observations and candidates
Event LIGO/Virgo/KAGRA S230627c
Date 2024-02-22T15:59:35Z (2 years ago)
From Leo Singer at NASA/GSFC <leo.p.singer@nasa.gov>
Via Web form

Reproduced from https://gcn.nasa.gov/circulars/34089 to demonstrate Astro Flavored Markdown.

Akash Anumarlapudi (UWM), Tomas Ahumada (CIT), Mansi Kasliwal (CIT), Viraj Karambelkar (CIT), Harsh Kumar (IITB), Theophile du Laz (CIT), Simeon Reusch (DESY), Anirudh Salgundi (IITB), Robert Stein (CIT), Vishwajeet Swain (IITB), Gaurav Waratkar (IITB), Avery Wold (IPAC), Shreya Anand (CIT), Igor Andreoni (UMD), Eric Bellm (UW), Varun Bhalerao (IITB), Brad Cenko (UMD), Michael Coughlin (UMN), Brian Healy (UMN), David Kaplan (UWM), Jannis Necker (DESY), D. Perley (LJMU) report on behalf of the ZTF and GROWTH collaborations:

We observed the localization region of the LVK trigger S230627c (GCN 34086) with the Palomar 48-inch telescope equipped with the 47 square-degree Zwicky Transient Facility (ZTF) camera (Graham et al., 2019 doi:10.1088/1538-3873/ab006c; Bellm et al. 2019 doi:10.1088/1538-3873/aaecbe). We obtained images in the g- and r-bands of the Bilby map (GCN 34087) beginning at ~2.2 hours after the LVK trigger time, covering 78.3% (105.3 sq deg) of the probability enclosed in the localization region.

We queried the ZTF alert stream using Kowalski (Duev et al. 2019) through Fritz (Coughlin et al. 2023 10.3847/1538-4365/acdee1), emgwcave (Karambelkar et al. in prep), AMPEL (Nordin et al. 2019 doi:10.1051/0004-6361/201935634), and ZTFReST (Andreoni & Coughlin et al. 2021 doi:10.3847/1538-4357/ac0bc7). We required at least 2 detections separated by at least 15 minutes to select against moving objects. Furthermore, we cross-match our candidates with the Minor Planet Center to flag known asteroids, reject stellar sources (Tachibana and Miller 2018 doi:10.1088/1538-3873/aae3d9), and apply machine learning algorithms (Mahabal et al. 2019 doi:10.1088/1538-3873/aaf3fa). We require that no spatially coincident ZTF alerts were issued before the detection time of the LVK trigger. We also run forced photometry on ZTF images (Masci et al. 2019 doi:10.1088/1538-3873/aae8ac) and ATLAS images (Tonry et al. 2018 doi:10.1088/1538-3873/aabadf, Smith et al. 2020 doi:10.1088/1538-3873/ab936e) and require no detections before the LVK trigger.

Four sources passed our criteria and are inside the 95% error region:

ZTF Name	IAU Name	RA (deg)	DEC (deg)	Filter	Mag	MagErr
ZTF23aaptsuy	AT2023lxu	160.2019569	+41.9681656	r	20.20	0.08
ZTF23aapttaw	AT2023lxt	164.6898146	+60.9545924	r	21.11	0.20
ZTF23aaptudb	AT2023lxs	166.5566080	+78.5596361	r	20.86	0.16
ZTF23aaptusa	AT2023lxx	162.0445716	+71.8414115	g	20.89	0.19

ZTF23aaptsuy (AT2023lxu) is 2.7'' away from a WISE galaxy WISEA J104048.69+415805.3 with a spectroscopic redshift of z=0.092961 (luminosity distance of 440 Mpc assuming Planck+18 cosmology) which is at the edge of the 3-sigma boundary of the LVK line of sight distance estimate.

ZTF23aaptudb (AT2023lxs) is 0.07'' away from a galaxy that has a Legacy Survey DR8 (LS; Duncan, 2022) photometric redshift of photo-z = 0.118±0.07, which suggests that it might not be associated with the LVK trigger.

ZTF23aaptusa (AT2023lxx) is 0.75'' away from a galaxy that has an LS photometric redshift of photo-z = 0.175±0.044, suggesting that it might not be associated with the LVK trigger. We also caution that the centroid position shows a slight dispersion in the three detections.

ZTF23aapttaw (AT2023lxt) is 0.236'' away from an LS source with a photo-z = 0.254±0.12, outside of the LVK volume.

Further follow-up of these candidates will continue.

ZTF and GROWTH are worldwide collaborations comprising Caltech, USA; IPAC, USA, WIS, Israel; OKC, Sweden; JSI/UMd, USA; U Washington, USA; DESY, Germany; MOST, Taiwan; UW Milwaukee, USA; LANL USA; Tokyo Tech, Japan; IITB, India; IIA, India; LJMU, UK; TTU, USA; SDSU, USA and USyd, Australia. ZTF acknowledges the generous support of the NSF under AST MSIP Grant No 1440341. GROWTH acknowledges the generous support of the NSF under PIRE Grant No 1545949. Alert distribution service provided by DIRAC@UW (Patterson et al. 2019). Alert database searches are done by AMPEL (Nordin et al. 2019) and Kowalski (Duev et al. 2019). GROWTH India telescope is located at the Indian Astronomical Observatory (Hanle), operated by the Indian Institute of Astrophysics (IIA). GROWTH-India project is supported by SERB and administered by IUSSTF, under grant number IUSSTF/PIRE Program/GROWTH/2015-16 and IUCAA.

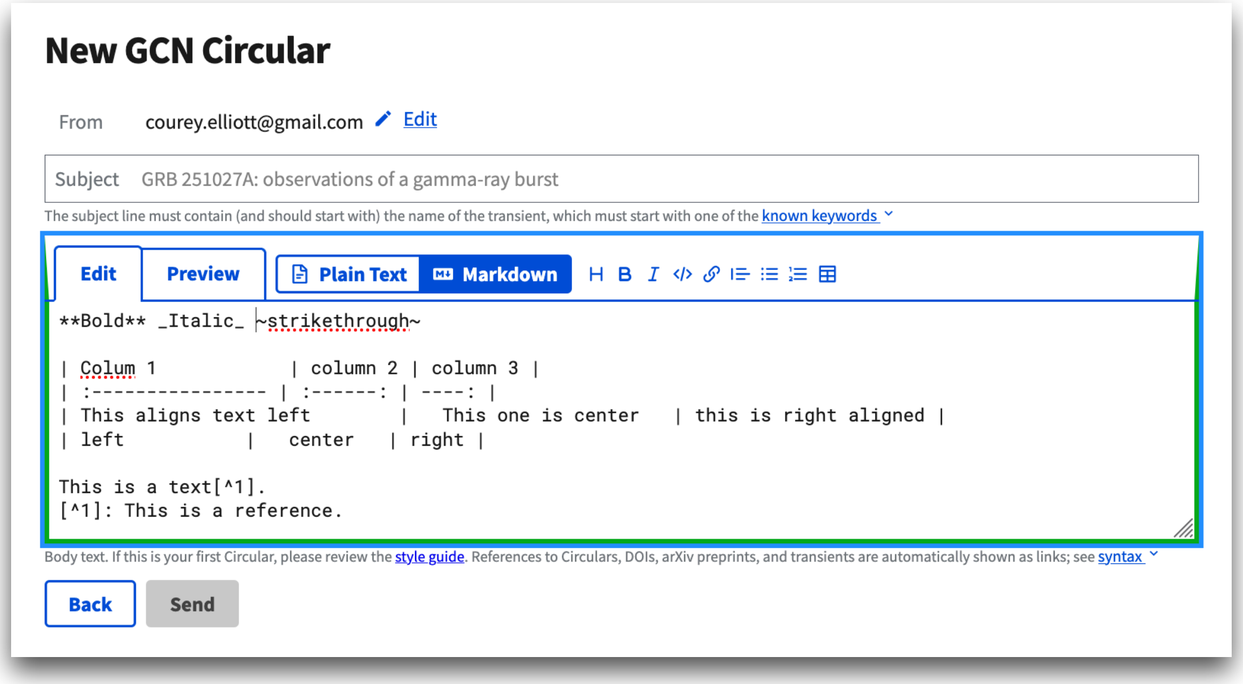
Previous Circular | Next Circular

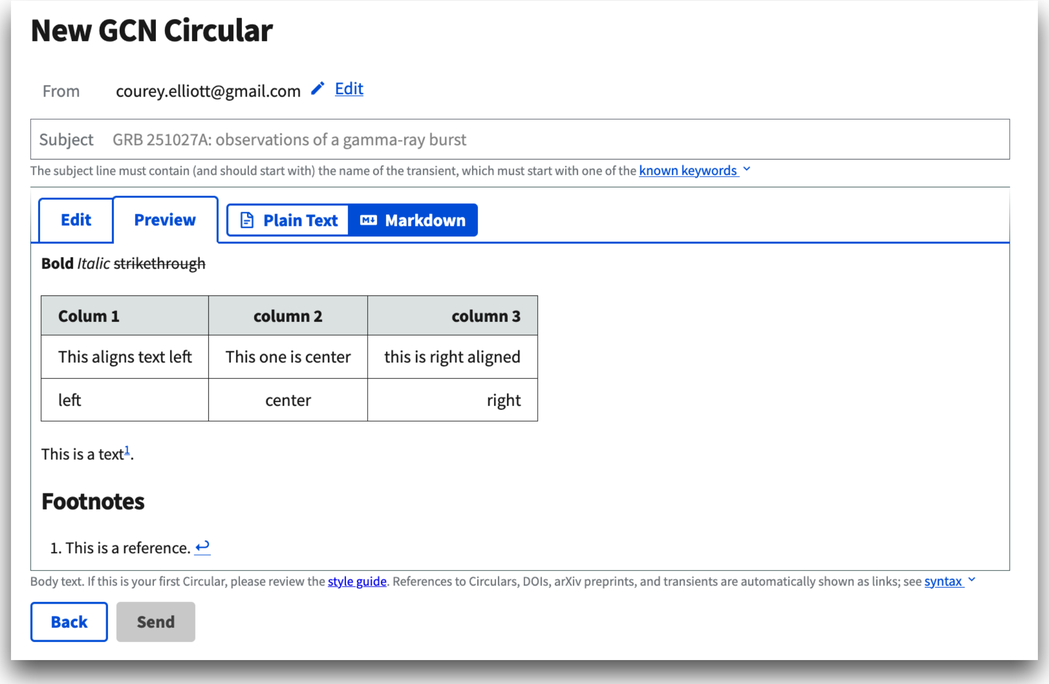
Circulars

- Circulars are the most well known offering from GCN
- Facilitate sharing of research
- Text bodies written by researchers, intended for humans
- Citable
- Users can elect to receive Circulars via email
- Users can subscribe to the Circulars Kafka topic to receive a JSON formatted notice of the Circular upon publication.

Circulars Create, Edit, and Correction Requests

Circulars can be created, edited, and corrections requested on the website



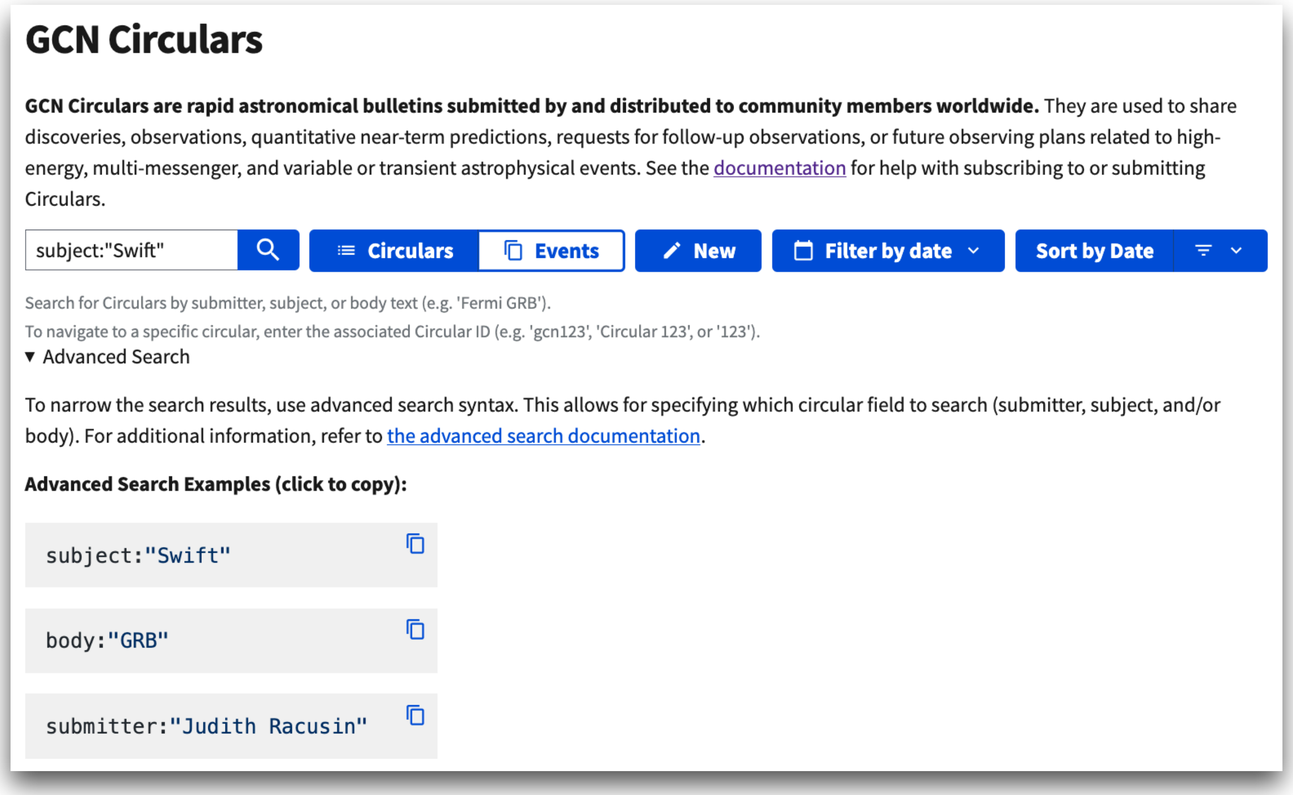


Circular Corrections Documentation

The markdown editor allows you to format your circular and preview what it will look like before submitting

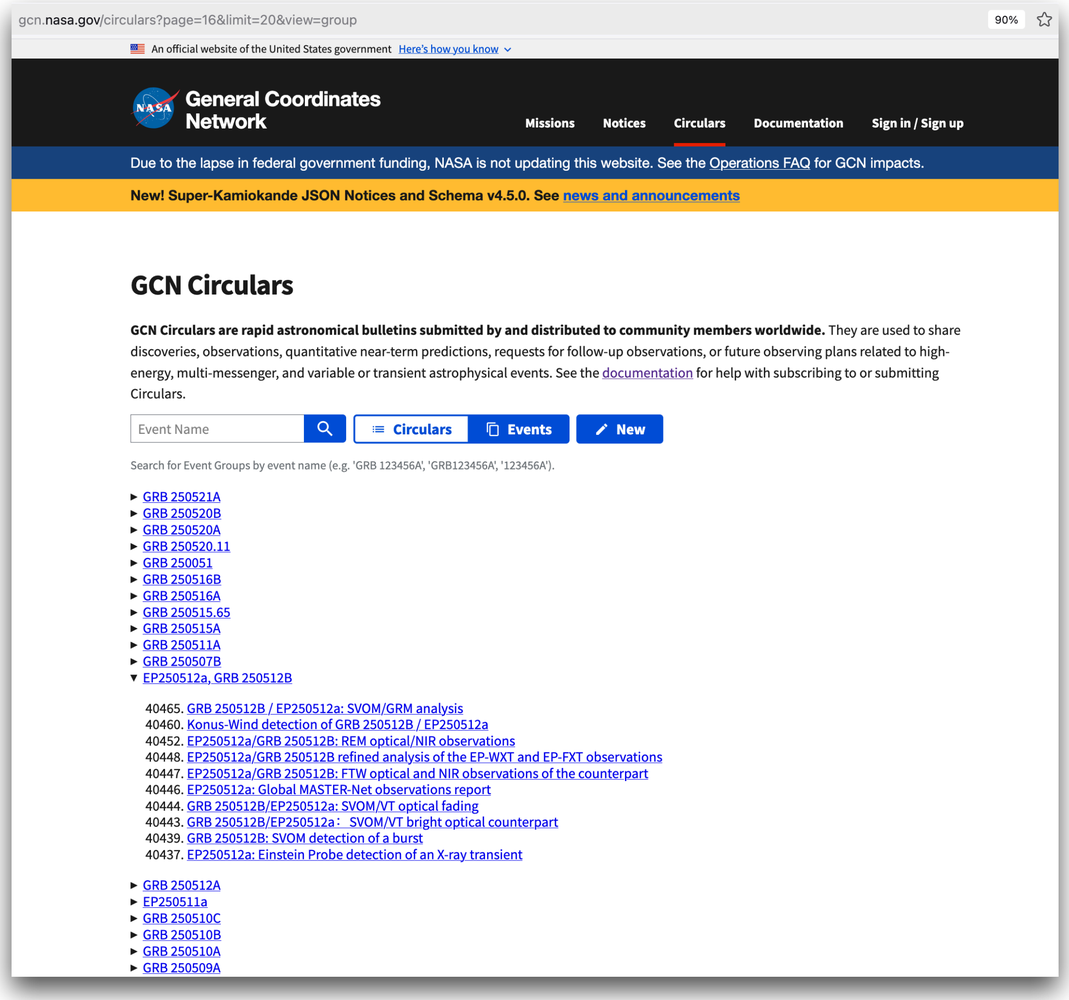
Markdown Documentation

Improved Search on Circulars Archive



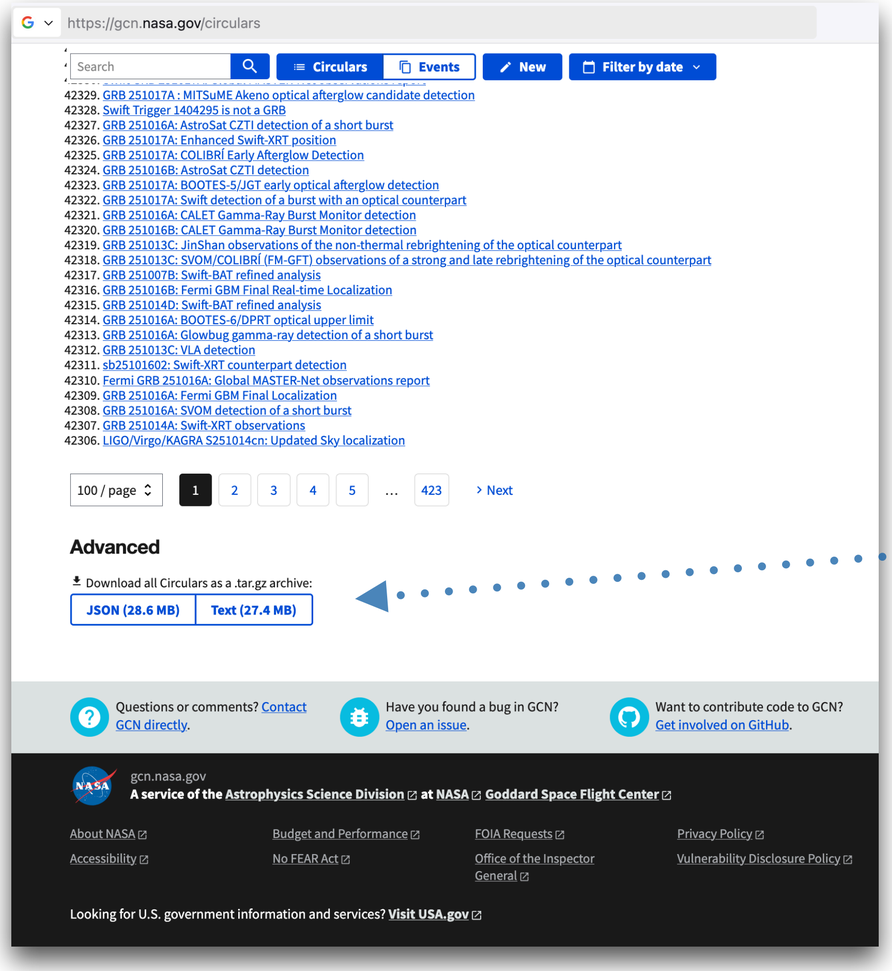
- Filter by date
- Lucene search syntax enabled
- More accurate results
- Search by Event name In Event view

New Event View

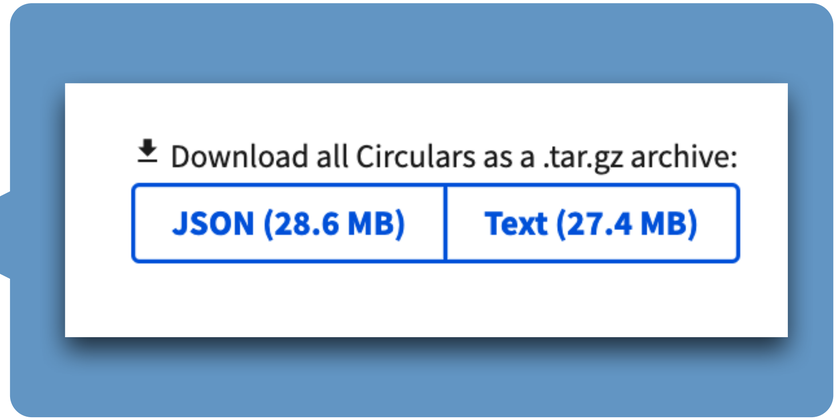


- View Circulars aggregated by Event
- Each Event has a dropdown arrow that displays all the circulars related to the Event(s)
- Moderators are able to link related events so all circulars for all related events will be included.

Archive Download



Download the entire Circular Archive in either JSON or text format. The archive is gzipped so the download is small.

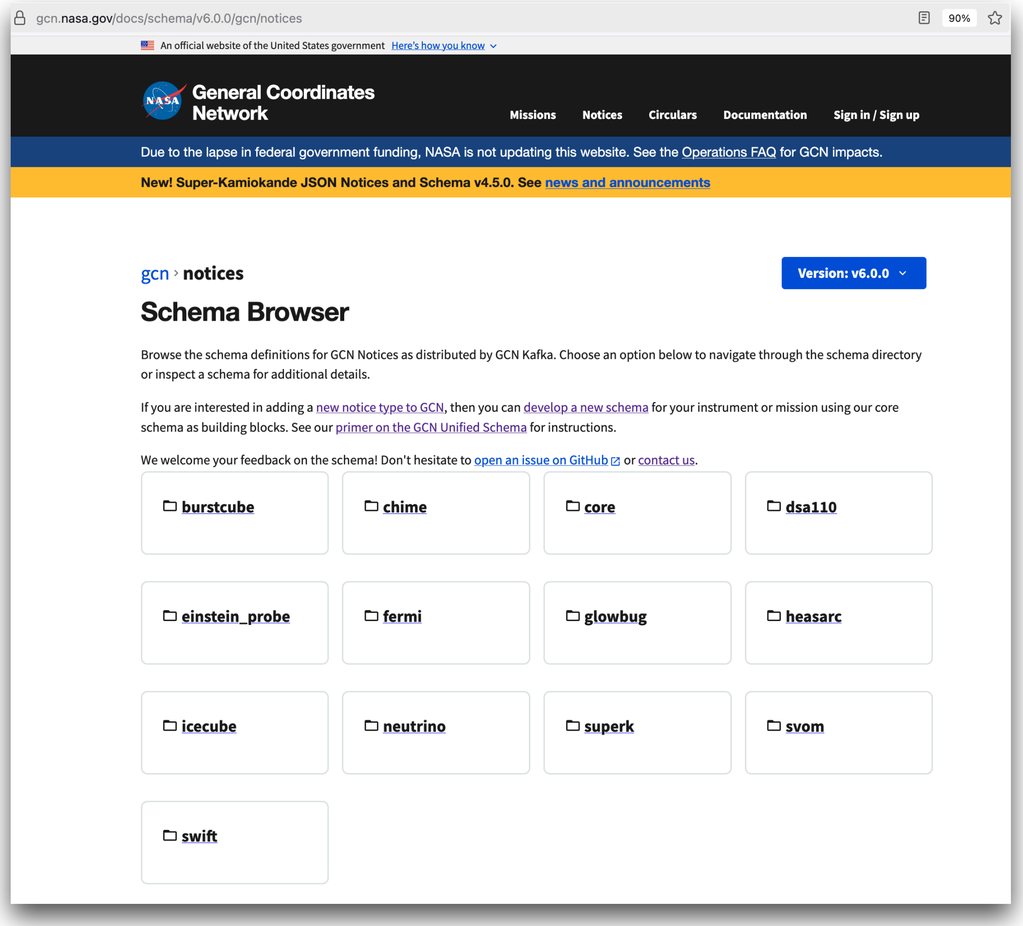


Scroll to the bottom of the Circulars page to find the download buttons.

JSON Schema

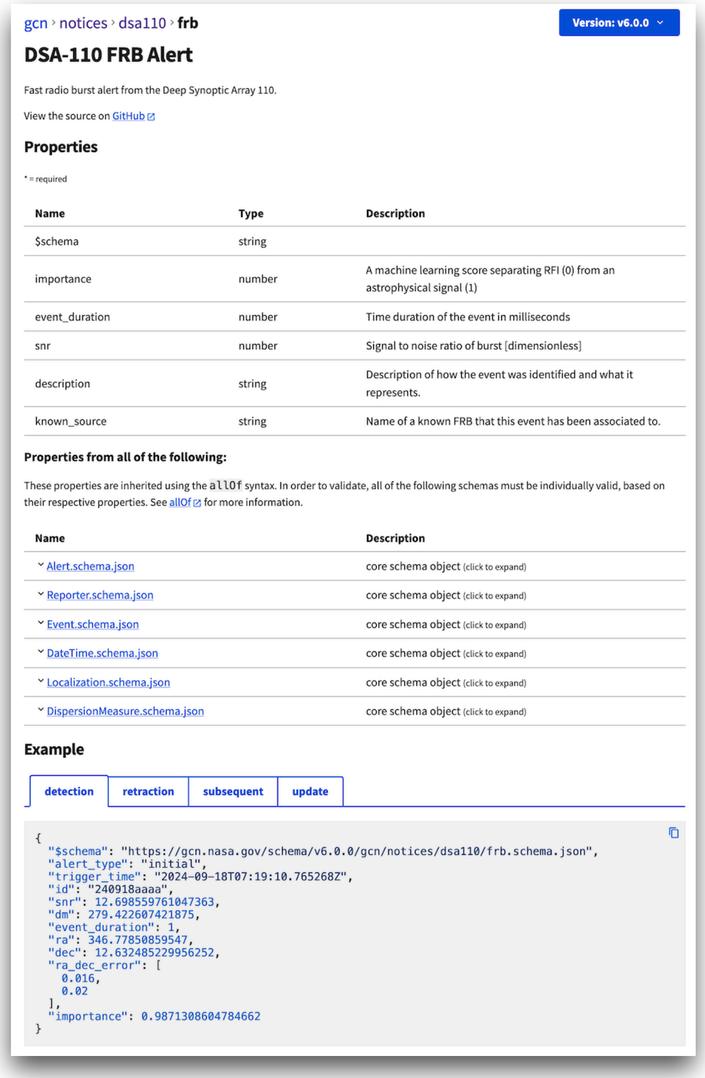
Schema and examples can be found on GitHub:

Schema Browser



- Schemas tailored to each mission's needs, all represented in JSON format
- JSON is human and machine readable
- Creates consistency of format across all topics using the new schema.

Schema Browser



gcn › notices › dsa110 › **frb** Version: v6.0.0

DSA-110 FRB Alert

Fast radio burst alert from the Deep Synoptic Array 110.

View the source on GitHub

Properties

* = required

Name	Type	Description
$schema	string	
importance	number	A machine learning score separating RFI (0) from an astrophysical signal (1)
event_duration	number	Time duration of the event in milliseconds
snr	number	Signal to noise ratio of burst [dimensionless]
description	string	Description of how the event was identified and what it represents.
known_source	string	Name of a known FRB that this event has been associated to.

Properties from all of the following:

These properties are inherited using the `allOf` syntax. In order to validate, all of the following schemas must be individually valid, based on their respective properties. See allOf for more information.

Name	Description
Alert.schema.json	core schema object (click to expand)
Reporter.schema.json	core schema object (click to expand)
Event.schema.json	core schema object (click to expand)
DateTime.schema.json	core schema object (click to expand)
Localization.schema.json	core schema object (click to expand)
DispersionMeasure.schema.json	core schema object (click to expand)

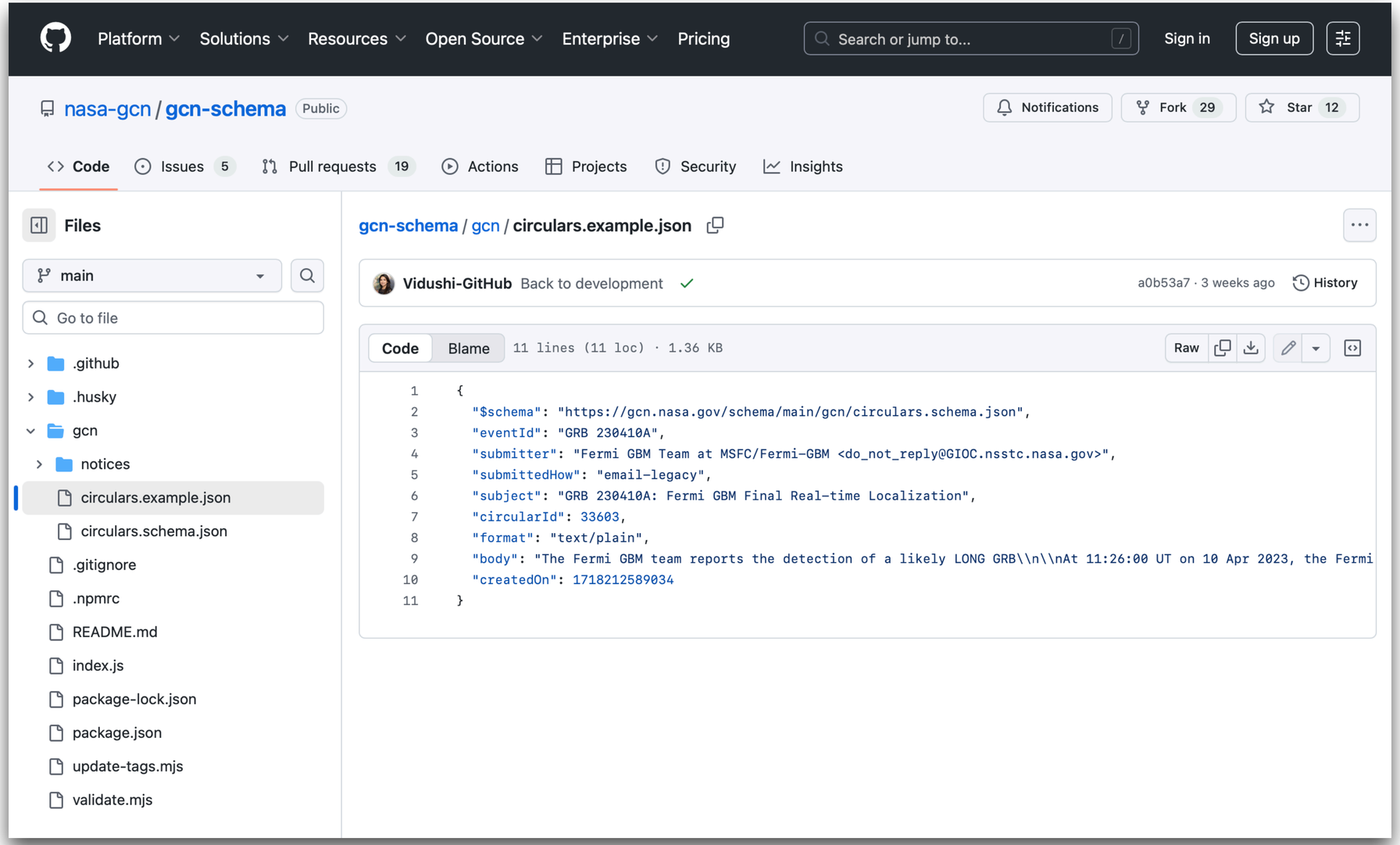
Example

detection | retraction | subsequent | update


```
{
  "$schema": "https://gcn.nasa.gov/schema/v6.0.0/gcn/notices/dsa110/frb.schema.json",
  "alert_type": "initial",
  "trigger_time": "2024-09-18T07:19:10.765268Z",
  "id": "240918aaaa",
  "snr": 12.698559761047363,
  "dm": 279.422607421875,
  "event_duration": 1,
  "ra": 346.77850859547,
  "dec": 12.632485229956252,
  "ra_dec_error": [
    0.016,
    0.02
  ],
  "importance": 0.9871308604784662
}
```

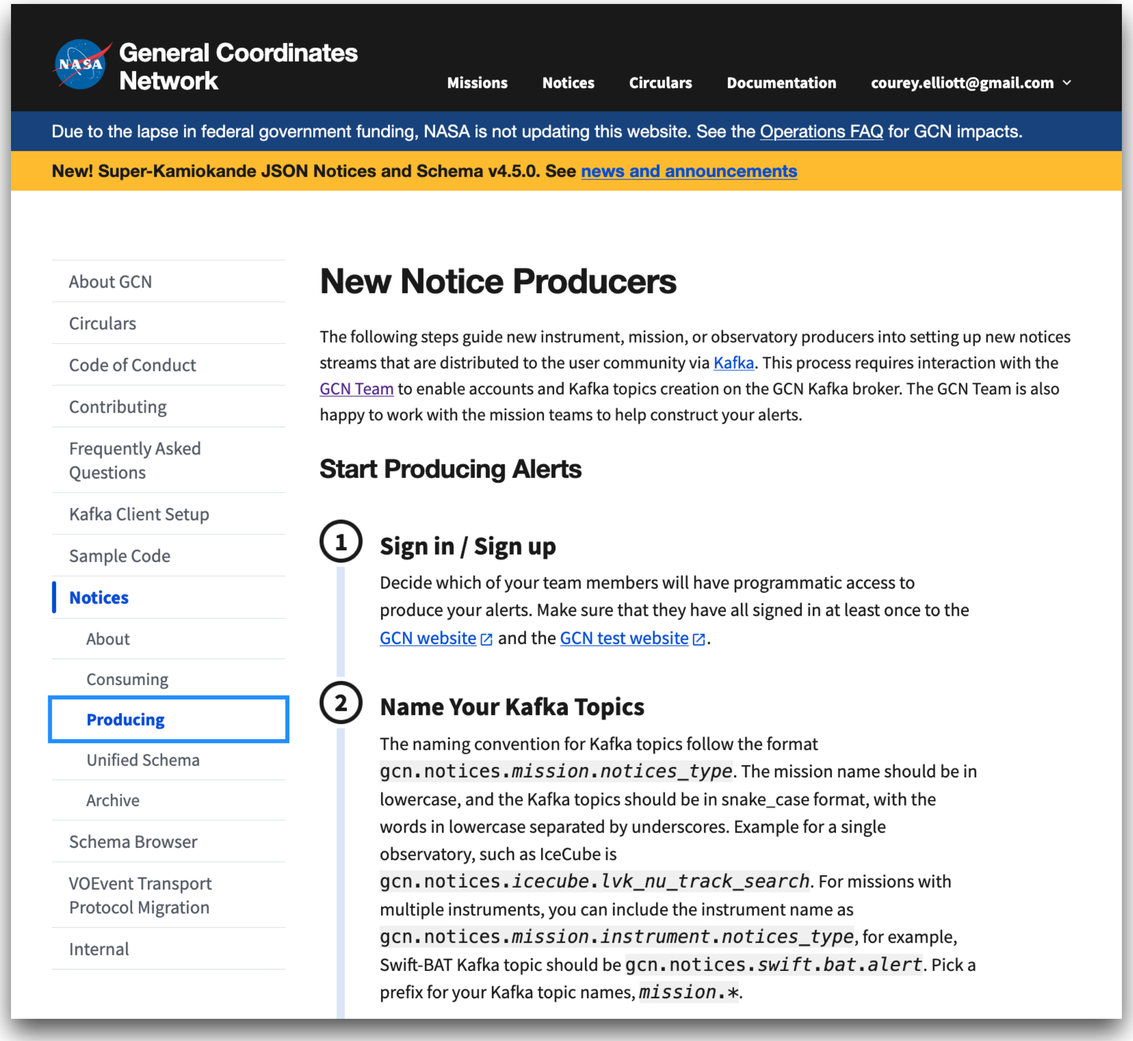

- The Properties section shows all of the mission specific fields. It tells you which are required fields.
- The Properties from all of the following section shows you what other schemas are being used.
- The Example section shows an example of each notice type

Schema Examples



GCN
Schema repo
on GitHub

Onboarding New Producers



1. Documentation and code samples can be found on the GCN website

2. Navigate to Notices in the left hand sub navigation menu.

3. Drop down options will open. Click on Producing.

Onboarding New Producers

Start Producing Alerts

1 Sign in / Sign up

Decide which of your team members will have programmatic access to produce your alerts. Make sure that they have all signed in at least once to the GCN website and the GCN test website.

2 Name Your Kafka Topics

The naming convention for Kafka topics follow the format `gcn.notices.mission.notices_type`. The mission name should be in lowercase, and the Kafka topics should be in snake_case format, with the words in lowercase separated by underscores. Example for a single observatory, such as IceCube is `gcn.notices.icecube.lvk_nu_track_search`. For missions with multiple instruments, you can include the instrument name as `gcn.notices.mission.instrument.notices_type`, for example, Swift-BAT Kafka topic should be `gcn.notices.swift.bat.alert`. Pick a prefix for your Kafka topic names, `mission.*`.

3 Contact the GCN Team

Send the GCN Team your list of team members from Step 1 and your chosen Kafka topic prefix from Step 2. The GCN Team will reply after they have configured producer permissions for your team.

4 Draft Your Schema

As a GCN Notice producer, you can create your own instrument-specific schema. Please contribute your schema to our GitHub repository, placing it in a folder under `gcn/notices/mission` and submit a pull request for the GCN Team to review. For details, please refer to the schema documentation.

Producer Onboarding Documentation

5 Build Producer Code

- Log out and log back in.
- Go through the Start Streaming GCN Notices process.
- On Step 2, choose the scope `gcn.nasa.gov/kafka-mission-producer`.
- Your producer code will look very similar to the client example code in Step 4 of the Start Streaming GCN Notices guide. Your `client_id` and `client_secret` can be found in Step 4 client example code.
- Start from this and adjust the `client_id`, `client_secret`, `topic` and `data` content:

```
from gcn_kafka import Producer
# Connect as a producer.
# Warning: don't share the client secret with others.
producer = Producer(client_id='fill me in', client_se
# Choose the right topic for this notice.  If your mi
# multiple topics, they all start with 'gcn.notices.n
# If there is only one topic, it will be simply as fo
topic = 'gcn.notices.mission'
# JSON data converted to byte string format
data = json.dumps({
    '$schema': 'https://gcn.nasa.gov/schema/vX.Y.Z/gc
    'key': 'value'
}).encode()
producer.produce(topic, data)
producer.flush()
```

6 Create or Update the Mission Page

Create a new mission page by submitting a pull request or by sending text to the GCN Team.

7 Announce New Notice Types

Work with the GCN Team to draft a community announcement, which the GCN Team will circulate.

The steps for onboarding a new producer can be found in our documentation.

We would love to help you at any part of the process should you have any questions. Please don't hesitate to reach out!

We have onboarded many missions. There are examples of their schema in the schema repo and schema browser.

Onboarding New Producers

We are continuing to break into new fields.
We've even recently had preliminary discussions with planetary defense.

Some Producers that are Onboarding Currently:

CHIME, DSA-110	🎉 Welcome FRB community!
HEASARC	Novel use of messaging to alert users to the addition of new data sets and calibration files. There is a separate topic for each mission, so you only follow the ones you are interested in.
Swift & Fermi	The same missions we know and love, with new notice format
IPN	Automated joint localizations using the IPN
KM3NeT	🎉 Neutrino Observations. Welcome!

Onboarding New Producers

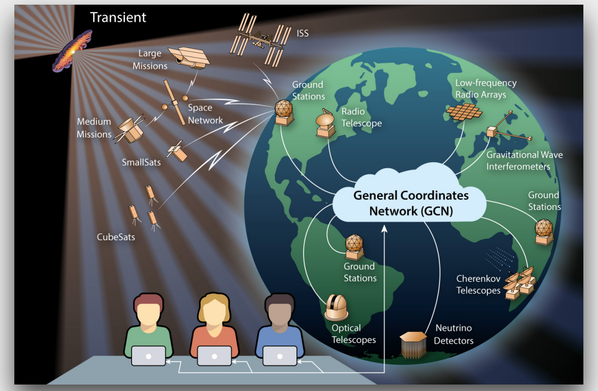
We need the community's help!

We encourage you to reach out if you think this could be a tool your project would benefit from.

We walk each mission through the process to create the specific schema they need.

Please contact us if you may be interested in making a topic for your project or mission

Please don’t hesitate to contact us!



GCN Website

If you find a bug or would to suggest a feature, please create an issue on our GitHub

GitHub Issue

If you have any questions or comments, write us!

GCN Contact form