

# hetDB

The High-Energy Transients Database

# What am I building to?

- hetDB is a database of transient observations, that makes data from NASA's GCN easy to analyse
- It provides a Python interface to the data it stores

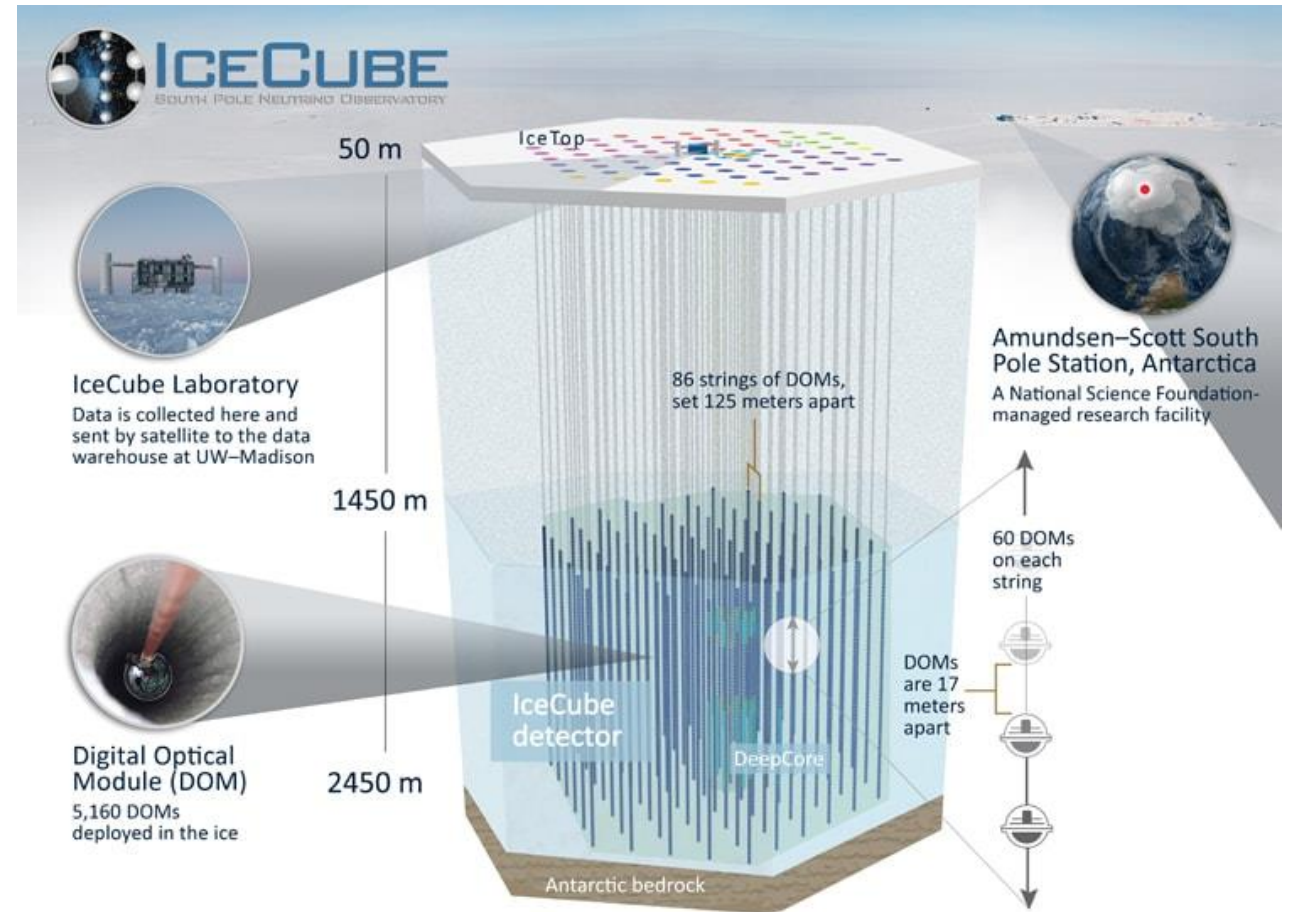
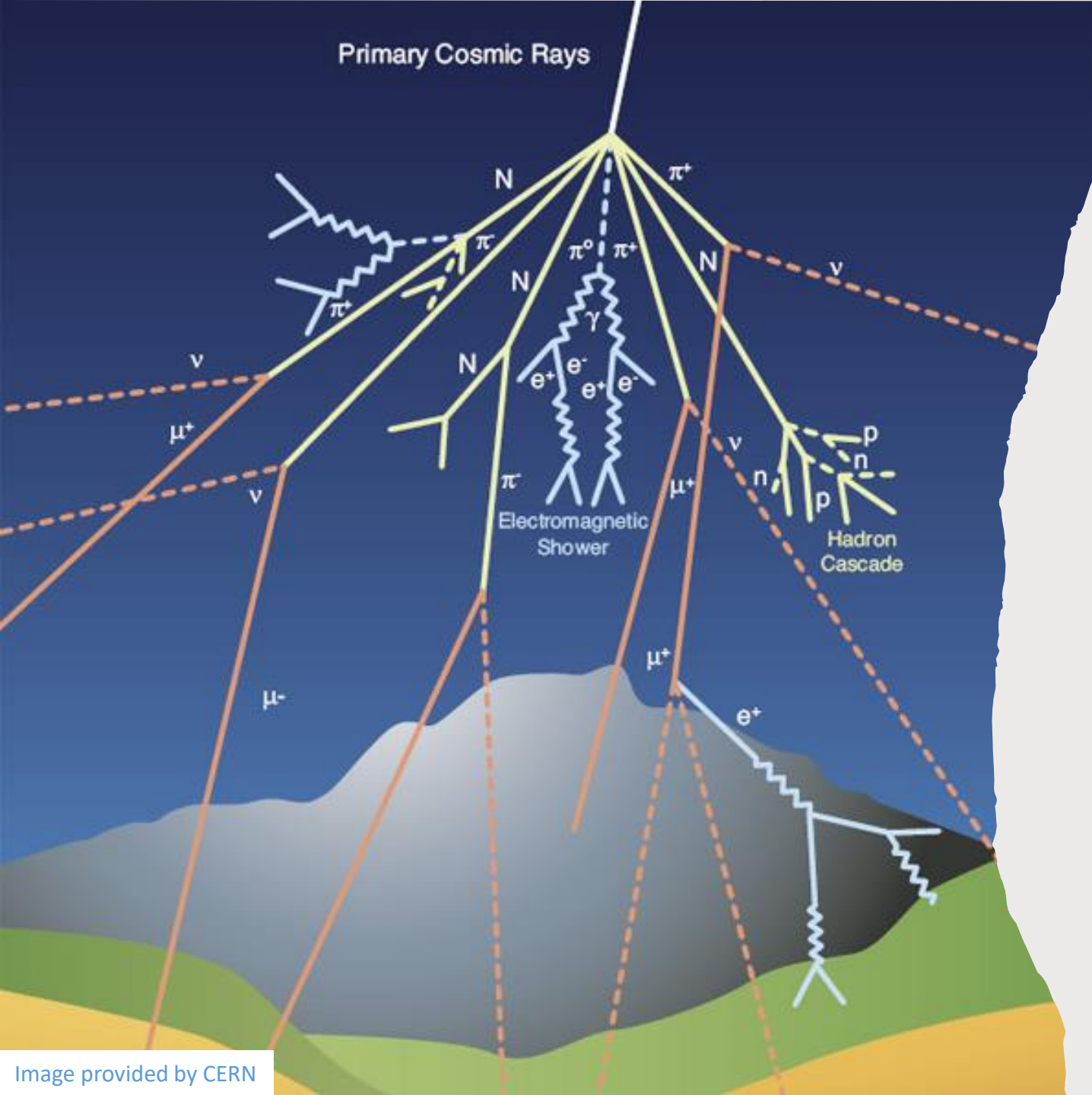


Image provided by the IceCube Collaboration



# Why do we care?

- Cosmic rays are very high energy charged particles:  $\sim 10^{21}$  eV
- Neutrinos are not charged, so remain undeflected as they travel
- By identifying the emitter of HE neutrinos, we can identify the source of HE cosmic rays
- Hypothesis: the source of GRBs is also the source of cosmic rays
  - Spatial coincidence!

# Gamma-ray Coordinates Network

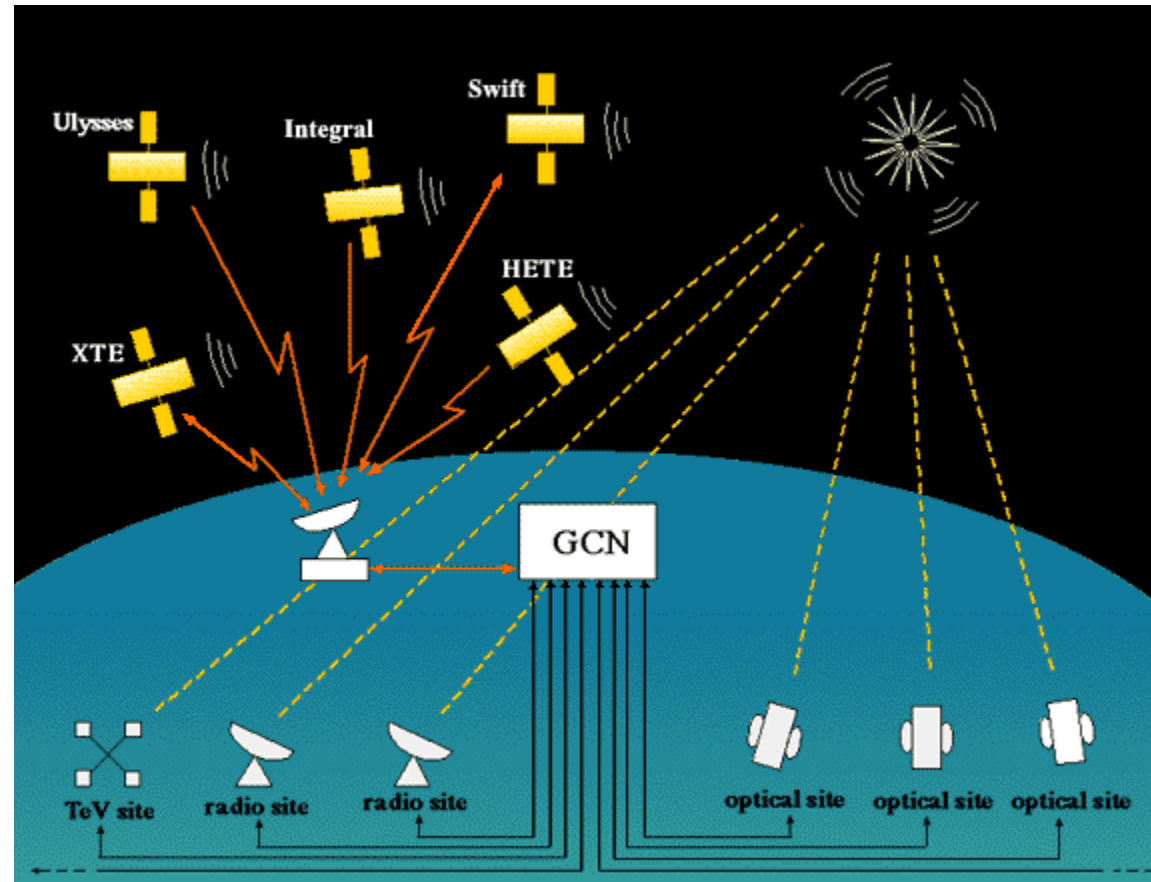


Image provided by NASA

```
////////////////////////////////////  
TITLE:          GCN/AMON NOTICE  
NOTICE_DATE:    Mon 08 Aug 22 08:00:42 UT  
NOTICE_TYPE:    ICECUBE Astrotrack Bronze  
STREAM:        25  
RUN_NUM:       136918  
EVENT_NUM:     45252263  
SRC_RA:        132.3328d {+08h 49m 20s} (J2000),  
              132.5365d {+08h 50m 09s} (current),  
              131.8824d {+08h 47m 32s} (1950)  
SRC_DEC:       -42.7168d {-42d 43' 00"} (J2000),  
              -42.8017d {-42d 48' 05"} (current),  
              -42.5301d {-42d 31' 47"} (1950)  
SRC_ERROR:     39.13 [arcmin radius, stat-only, 90% containment]  
SRC_ERROR50:   14.09 [arcmin radius, stat-only, 50% containment]  
DISCOVERY_DATE: 19799 TJD; 220 DOY; 22/08/08 (yy/mm/dd)  
DISCOVERY_TIME: 28797 SOD {07:59:57.26} UT  
REVISION:      0  
ENERGY:        5.4853e+01 [TeV]  
SIGNALNESS:    3.8646e-01 [dn]
```

# GCN Notices

- Custom format
- Made for emails
- Machine- & Human-readable

# GCN Circulars

- Paragraphs of text
- Made for emails
- Human-readable,  
machine-unreadable

TITLE: GCN CIRCULAR

NUMBER: 32357

SUBJECT: IceCube-220624A: Classification of AT2022nit as a type Ia supernova and AT2021bei as an AGN

DATE: 22/07/09 11:15:01 GMT

FROM: Simeon Reusch at DESY <simeon.reusch@desy.de>

Robert Stein (Caltech), Jannis Necker, Simeon Reusch (DESY), Shreya Anand, Kaustav Das (Caltech), Jesper Sollerman (Stockholm Uni), Viraj Karambelkar, Mansi Kasliwal (Caltech) and Anna Franckowiak (DESY/Ruhr University Bochum) report:

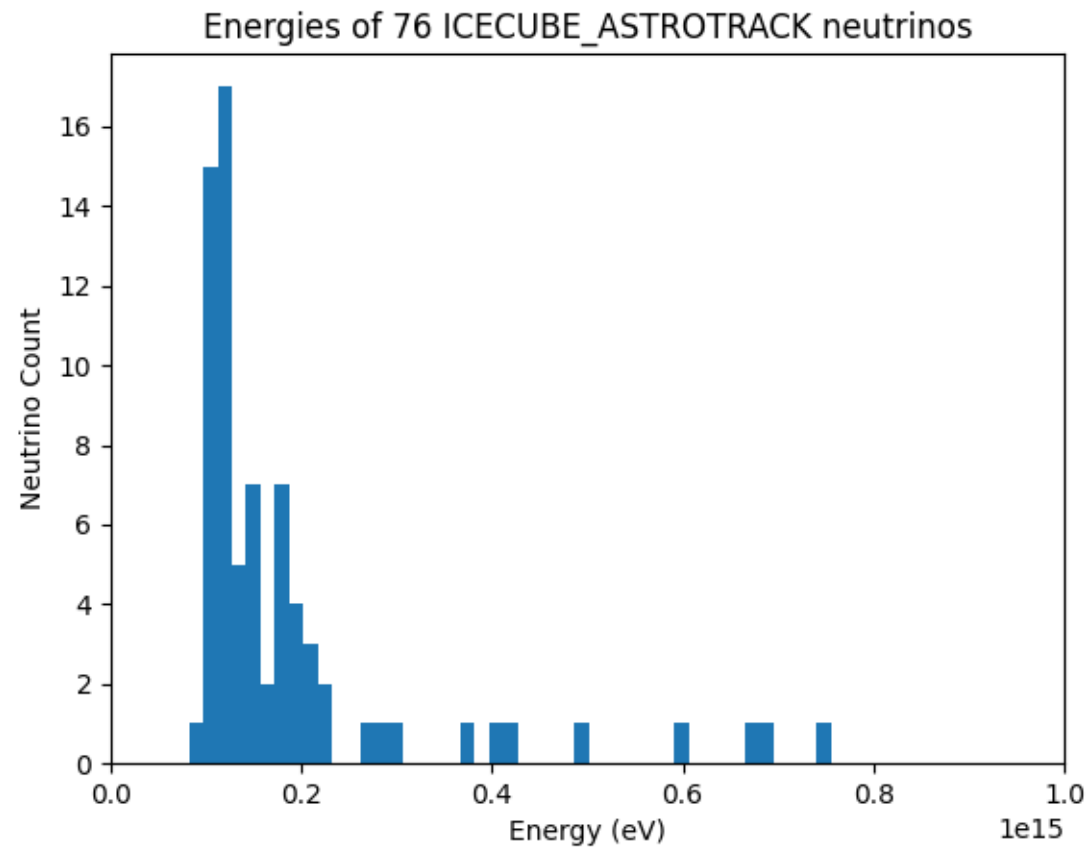
We observed neutrino IC220624A (Santander et al., GCN 32260) with the Zwicky Transient Facility (Reusch et al., GCN 32270) as part of our ZTF neutrino follow-up program (Stein et al. 2022). Though no candidates were identified with our initial ToO observation, we continued our regular monitoring of the localisation with additional ToO and serendipitous observations.

As part of these additional observations, we identified the transient ZTF22aaparxg/AT2022nit as a possible optical counterpart. We undertook spectroscopic observations of AT2022nit with the Low Resolution Imaging Spectrometer (LRIS, Oke et al. 95) at the Keck I Observatory.

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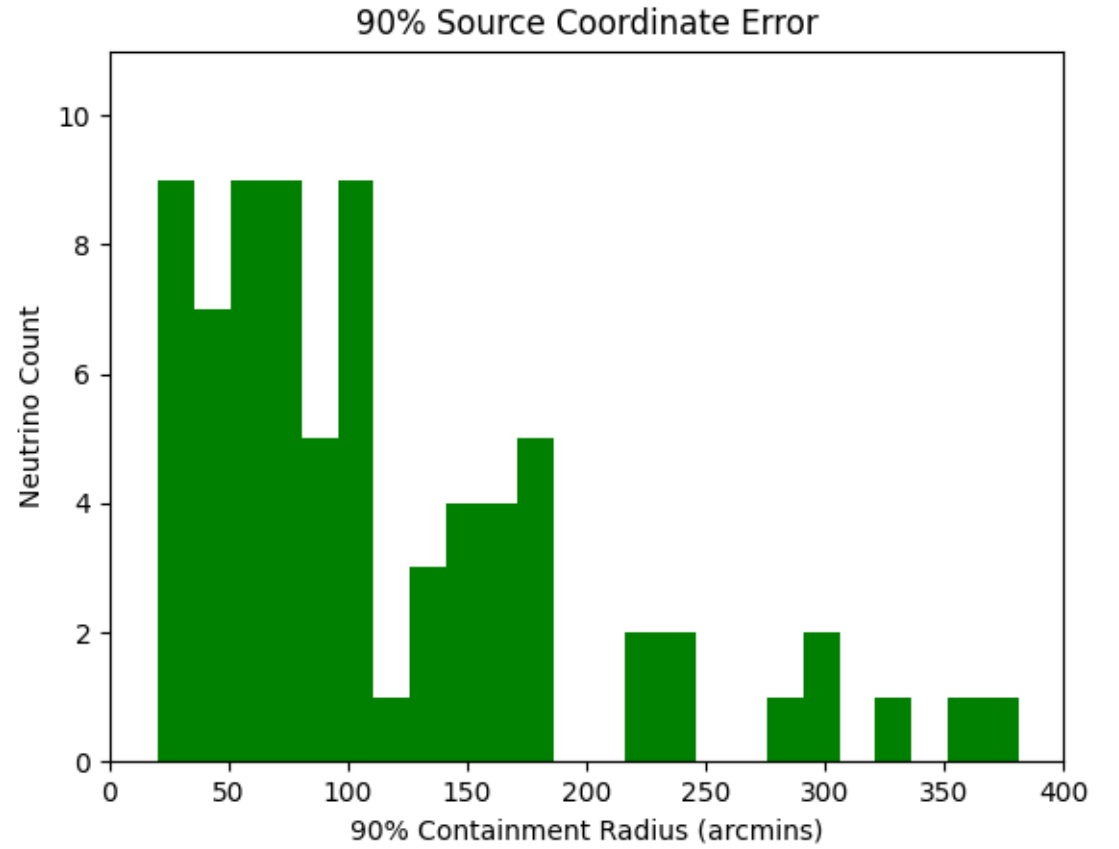
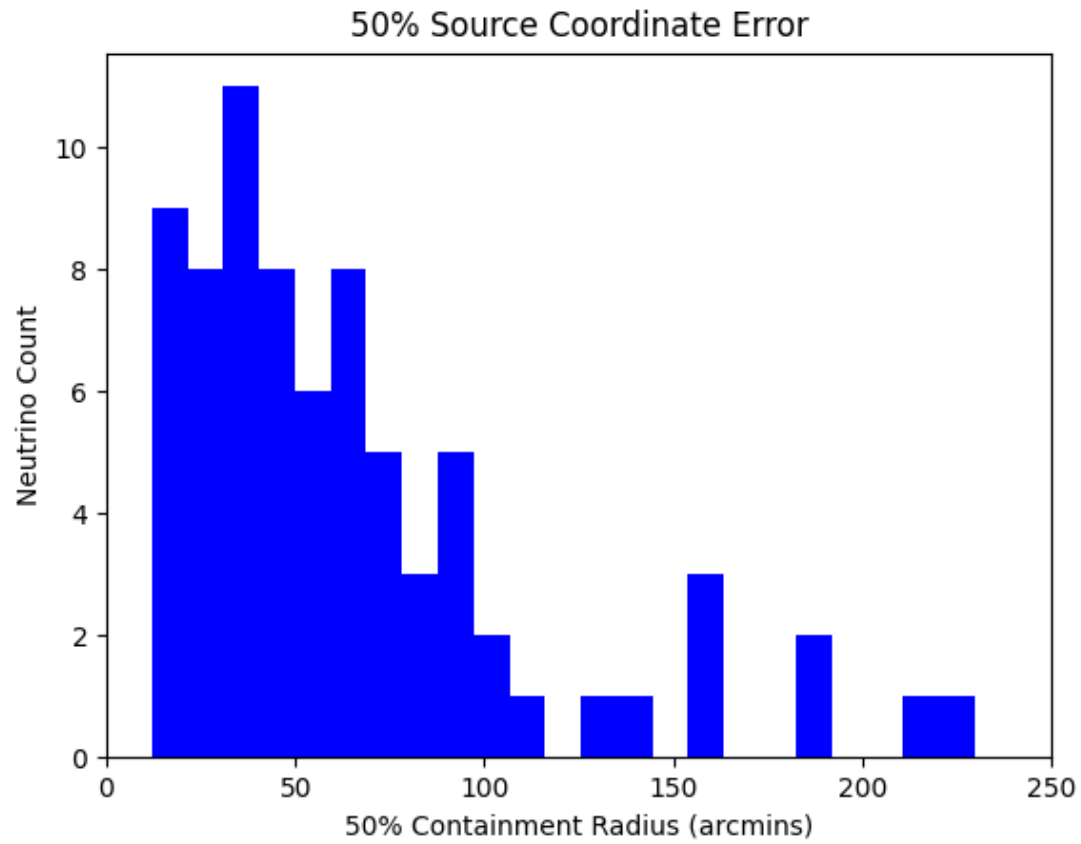
- SQL database of data from GCN alerts
- Stores all information contained in GCN notices + circulars
- Determines particle messenger, observatory, event
- Focused on parsing recent IceCube notices
  - ...but can easily be adjusted to work with others

# hetDB



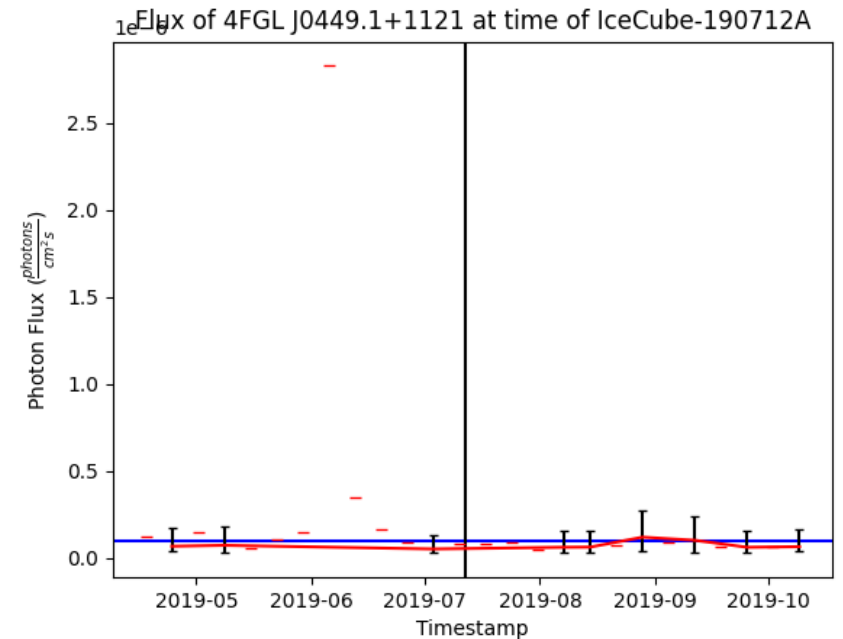
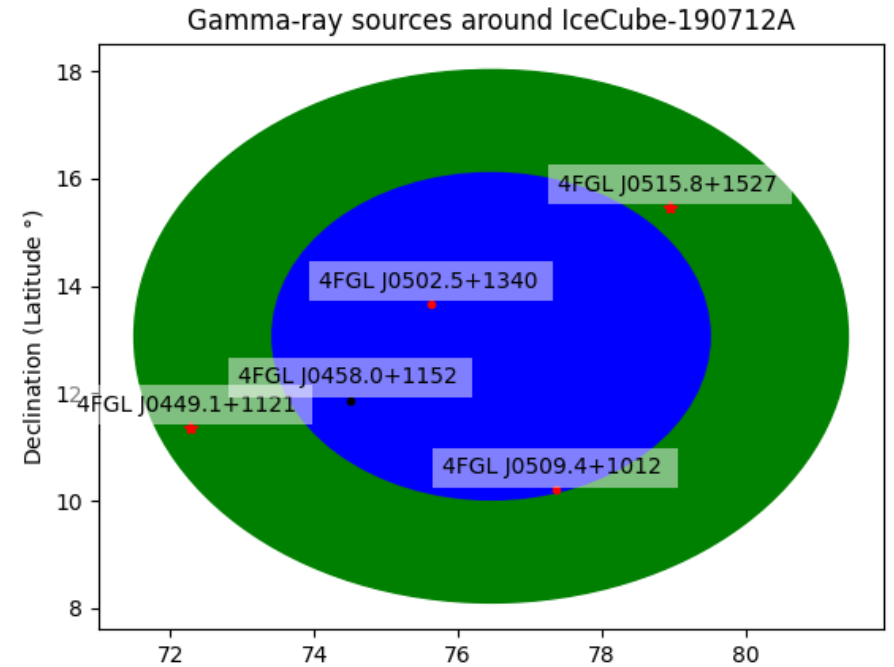


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# hetDB

- Python interface
- Integrates data from Fermi catalog
- NASA precomputed  $\gamma$ -ray light curves for variable sources



# General ~~Gamma-ray~~ Coordinates Network

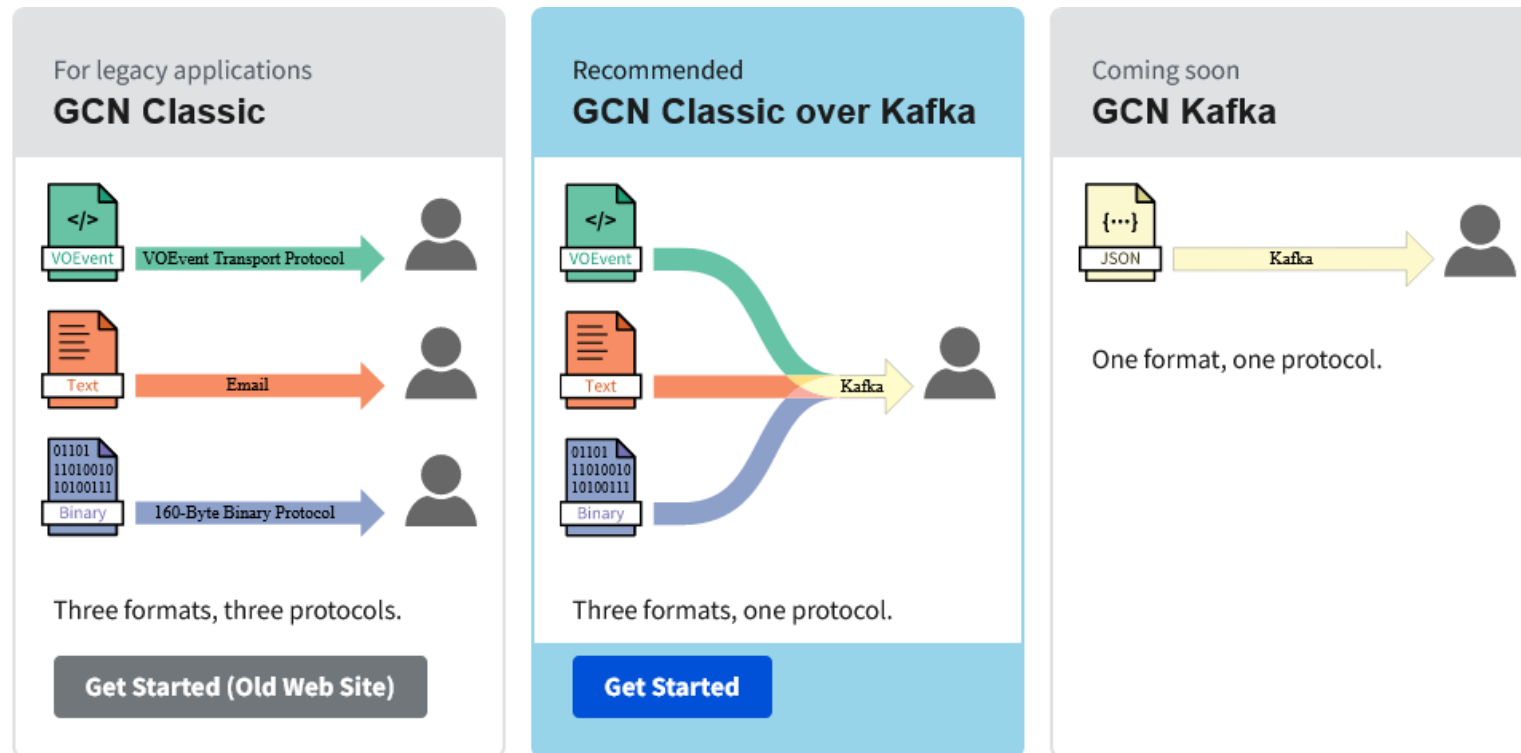


Image provided by NASA GCN

- New protocol!
- New format!
- New accounts!
- New names!
  
- Old service still operational!

# Want to try it out?

- Source code available at [github.com/queens-lemma/hetDB](https://github.com/queens-lemma/hetDB)
  - Bootstraps from NASA's GCN archives
- Database instance available on Cedar CC cluster

# Special Thanks

- Tai Withers
  - Coded hetDB's proof-of-concept.
  - All-around swell person
- Dr. Nahee Park
  - Supervisor, mentor, and an excellent resource
- All my McDonald Institute and LEMMA coworkers
  - Thanks for helping this summer fly by!