Supporting Citizens' Search for New Glitch Classes

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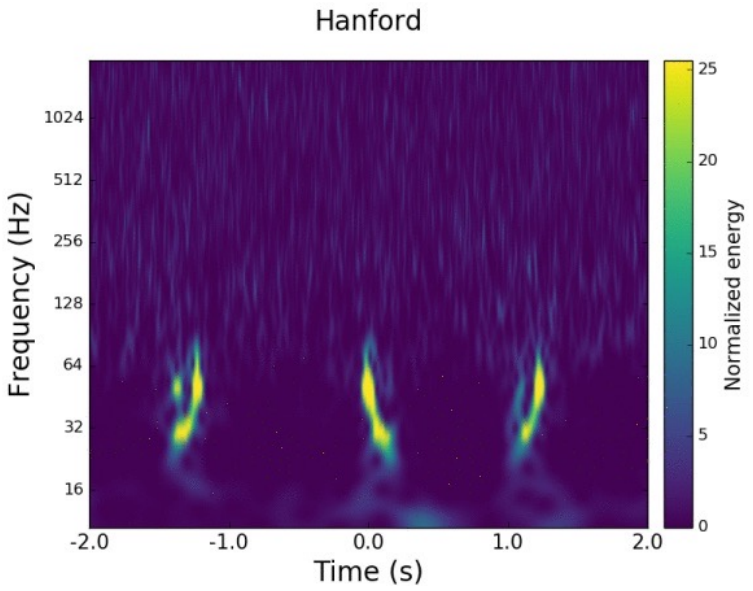
Supported by National Science Foundation (NSF 12-11071)

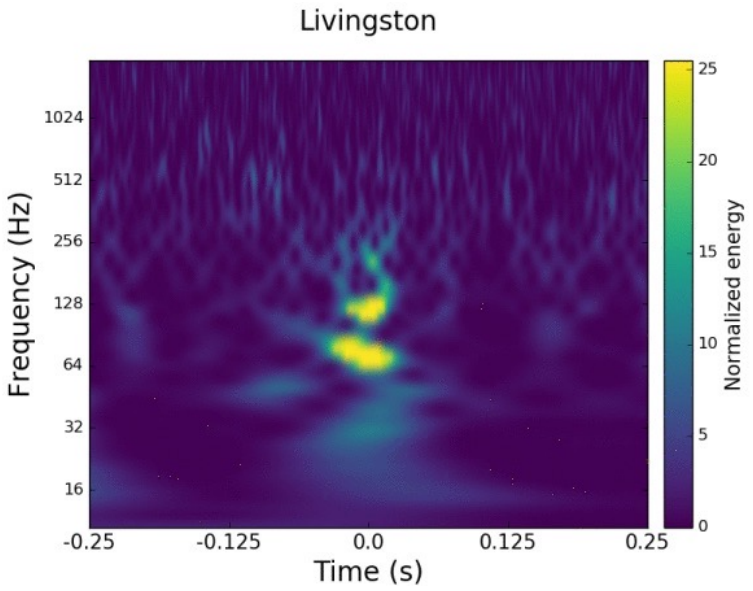
Supporting Citizens' Search for New Glitch Classes

- What kinds of background knowledge about a dataset are useful for non-experts to be able to understand and work with that data?
  - How does the type of knowledge required change as volunteers gain experience?

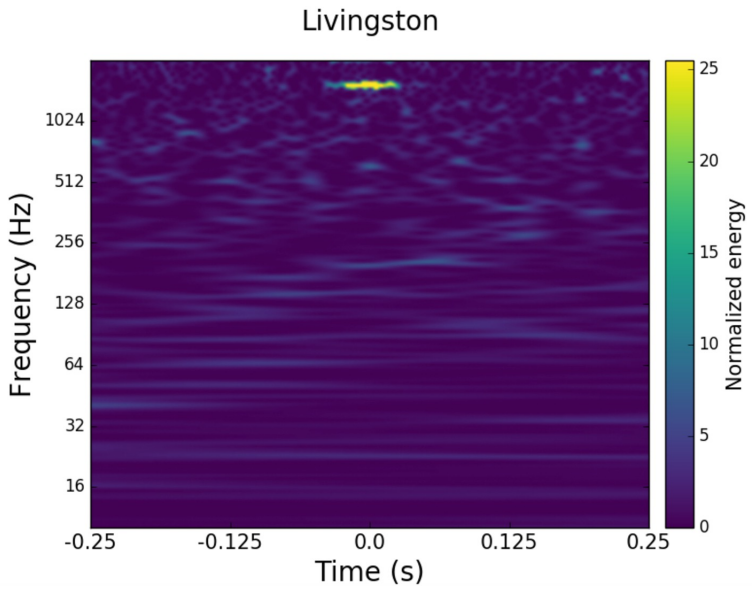
Some of Volunteers' New Class additions



Paired Doves

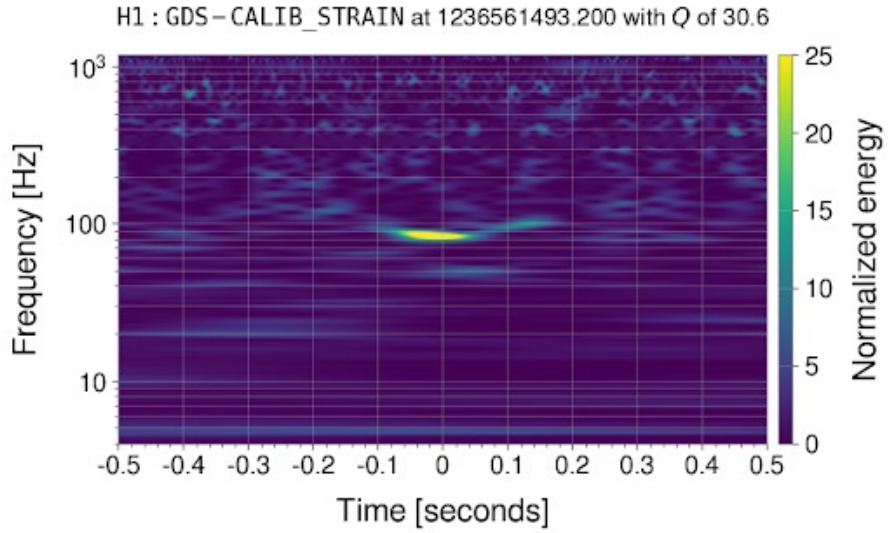


Helix

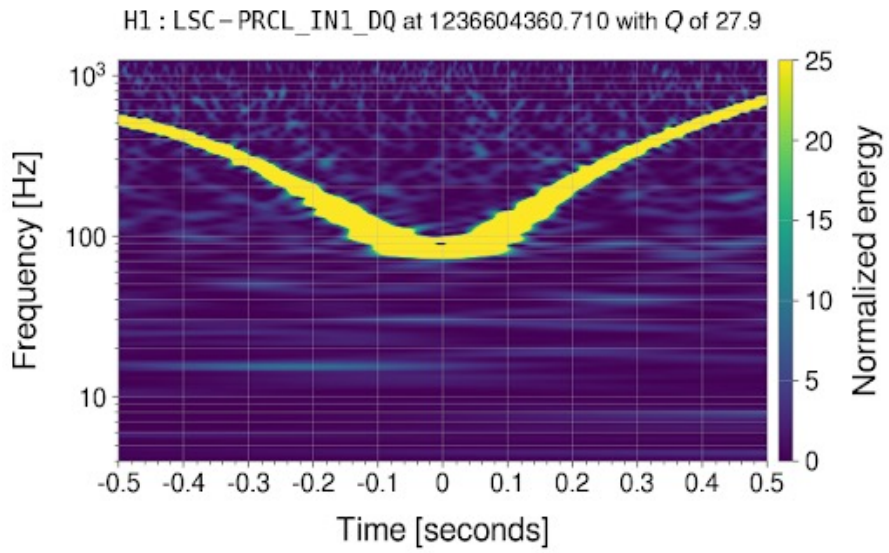


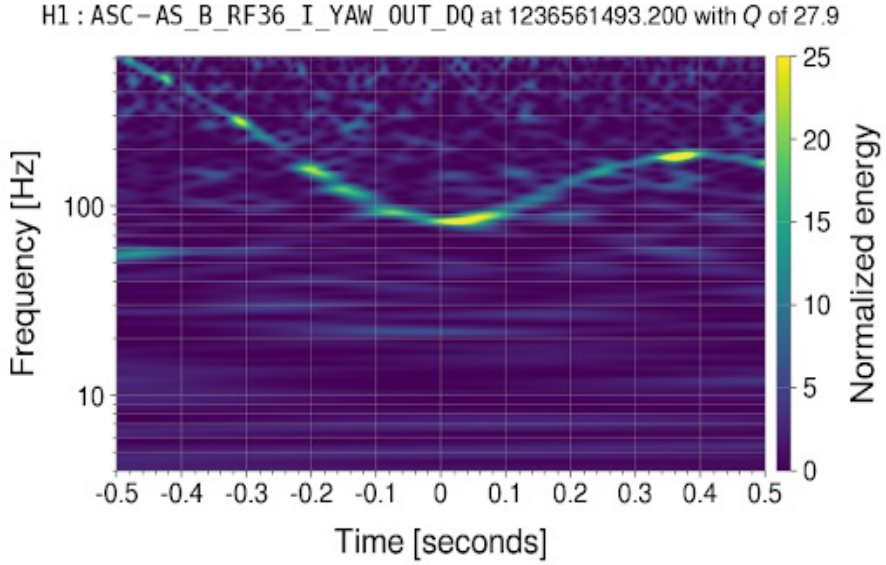
1400 Ripple

Gravitational Wave Channel

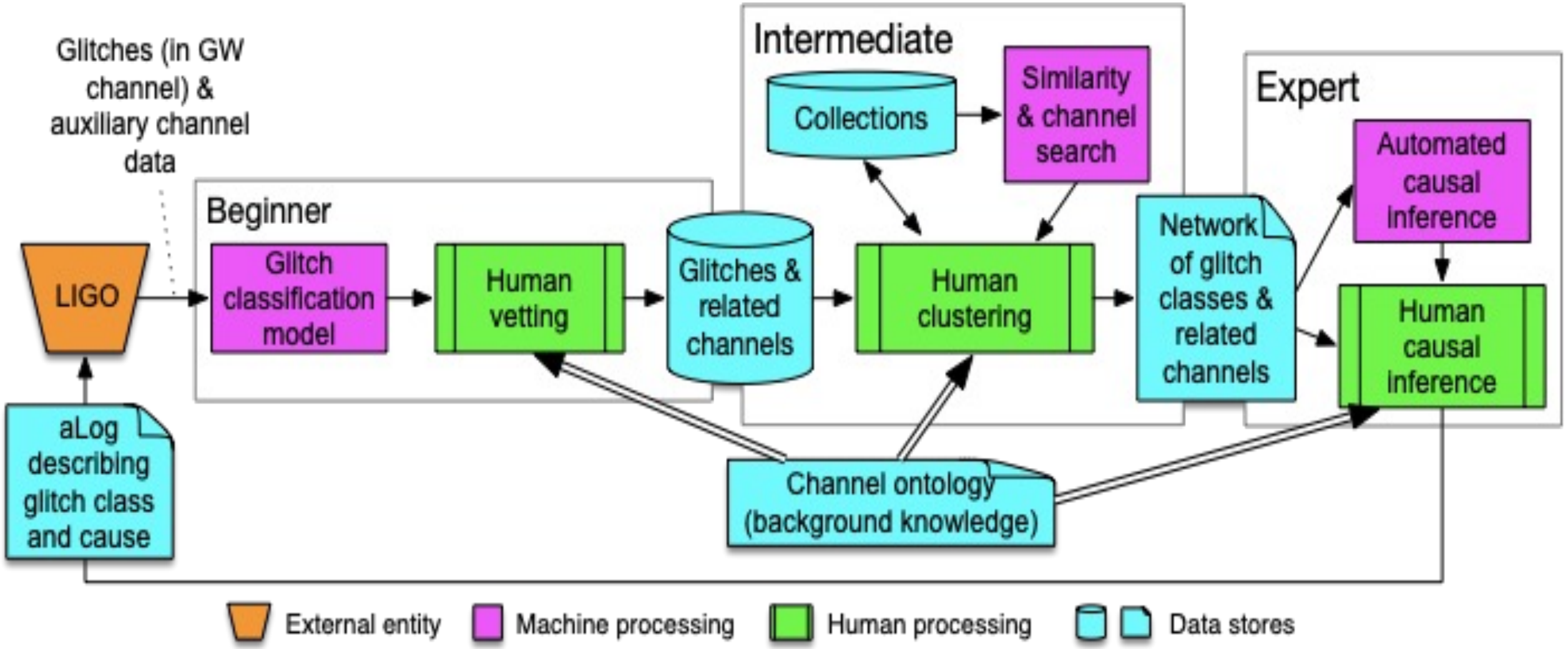


Auxiliary Channels





Gravity Spy 2.0



Task & mode of participation

Beginner

Compare auxiliary channel images with one glitch image in highly structured environment.

Intermediate

Create collections of possible new glitch classes and associated auxiliary channels

Advanced

Collaboratively review proposed causal reasoning and write reports

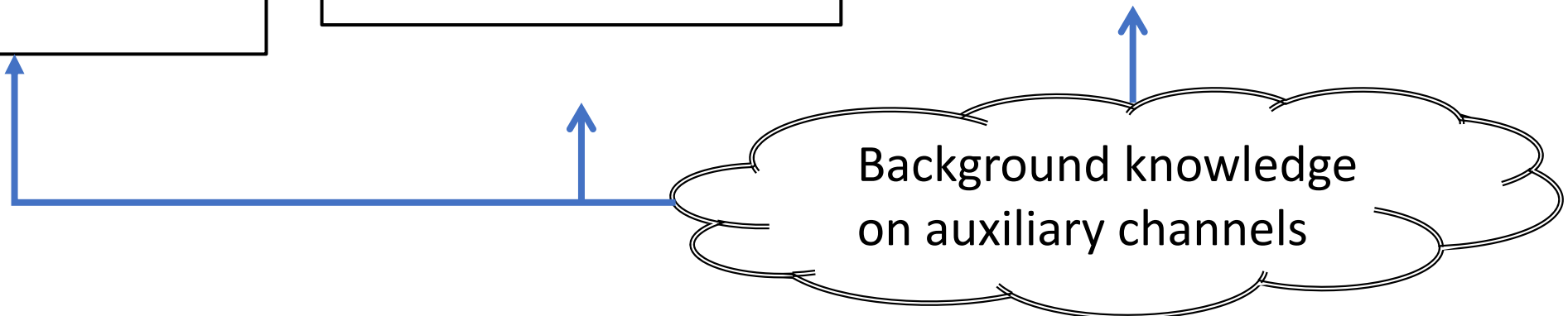
Intelligent System Support

Beginner | **Intermediate** | **Advanced**

Machine selected auxiliary channels correlating with glitch.

- Dynamic mapping of glitch and auxiliary channel correlations
- Glitch similarity search
- Interface to examine auxiliary and glitch data

Talk and Discussion features - Reporting feature to be shown to science team via the aLOG.
- Causal analysis
- Science team access (Report and Talk)



Existing Resources

- Tutorials
- Discussion Boards
  - Individual tagging
  - Hashtag lists
  - Discussions of volunteers' collections
  - Q-value discussion
  - Detector background sources
  - Science team blogs
  - Science articles
- Collections

Hyperlinks & Forms of Knowledge

Hyperlinks

- URL, Hashtags #, @
- Hyperlinks mark the references people make as part of their knowledge production
- Different hyperlinking practices demarcate different forms of knowledge production

Forms of Knowledge Production

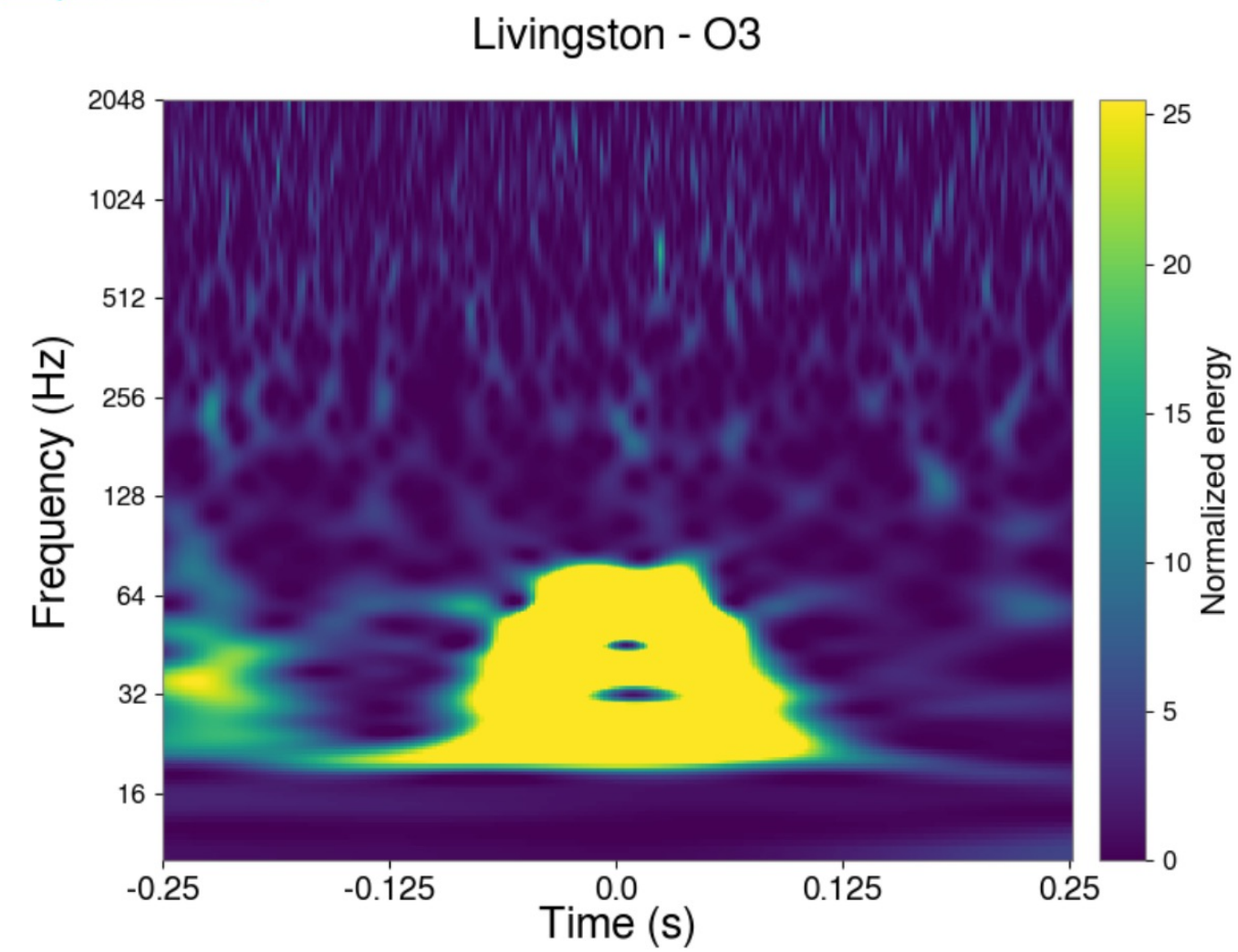
- Individual
- Collective
- Authoritative

Glitch Class Groundwork

Caspastro

@Caspastro

Subject 37854483



1 2 3 4 You should sign in!

#lily #tooth

Individual Work

Popular Tags:

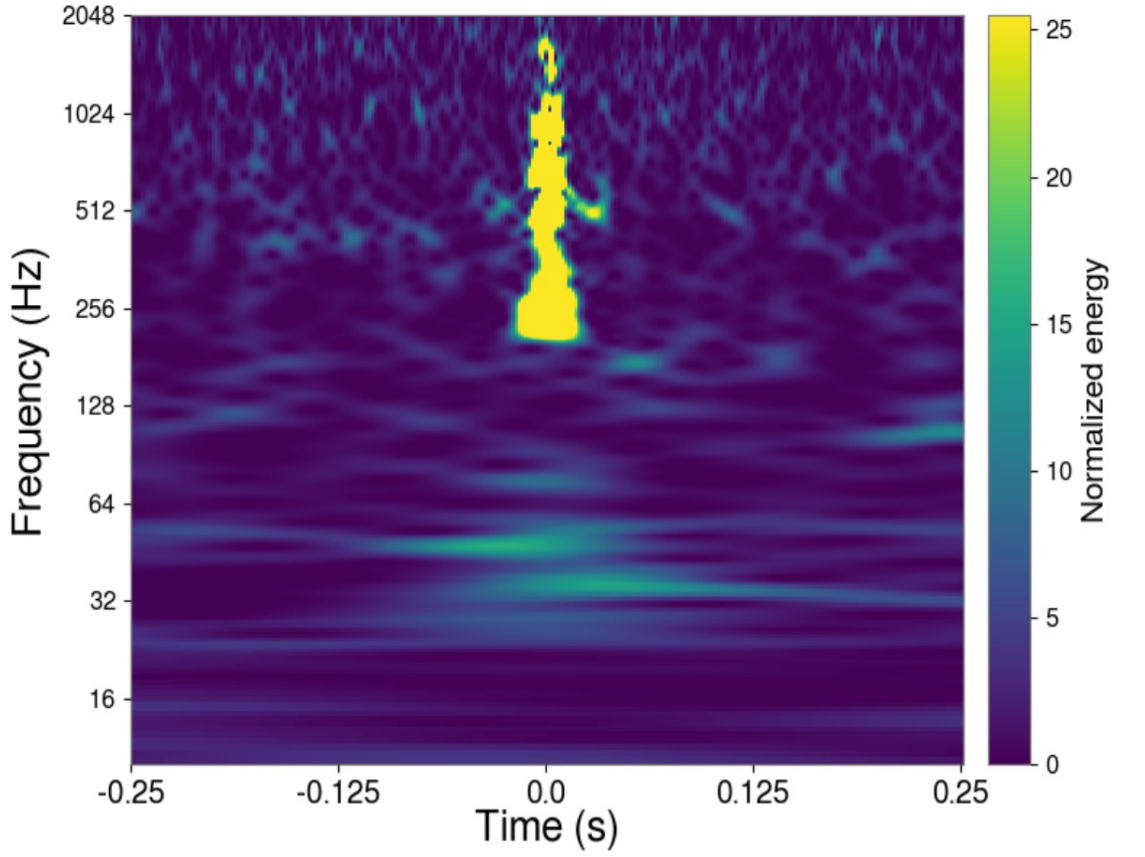
possiblenewglitch
blip
chirp
koi
noneoftheabove
1400ripple
fly
tomte
whistle
scratchy
2000hz
koifish
doubleblip
helix
nota
pizzicato
jewel
repeating
scatteredlight
midfrequencyline

1 Active Participants:

ZngabitanT

Projects:

Individual to Collective Knowledge



This looks like a #blip but the frequency range is too high (250 - 2000 Hz). So should it be classified as none of the above?

Thanks.

Helpful (1) Reply Link

Individual

In reply to orionlee's comment

March 22nd 2020, 10:30 am

Hello @orionlee, interesting find, thanks for the note!
It is similar to a relatively new type some of us started to call decorated pizzicato (you can read about this type in this thread) but this glitch is even more different from that. I will do similarity search with this subject (you can reach this tool here if you feel like trying it) and come back to you with what I'll found.

Helpful (0) Reply Link

Individual

Authoritative

March 22nd 2020, 8:14 pm

#ecceruelme The frequency range matches what is described in the pizzicato thread, but the shape isn't quite the same.

Helpful (0) Reply Link

In reply to orionlee's comment

March 24th 2020, 12:14 am

I've checked by the similarity search tool, it has returned mostly whistles. In my opinion it is neither whistle, nor pizzicato. This glitch is from 2019 April. As far as I remember pizzicato (or hfb500er14) started to appear in Hanford detector later (I haven't checked when exactly).

By similarity I found LIGO fireball like Subject 28681824 might be the closest match, especially if we consider their different q-values, but there were no fireballs from Hanford yet (proposal of LIGO fireball and collection).

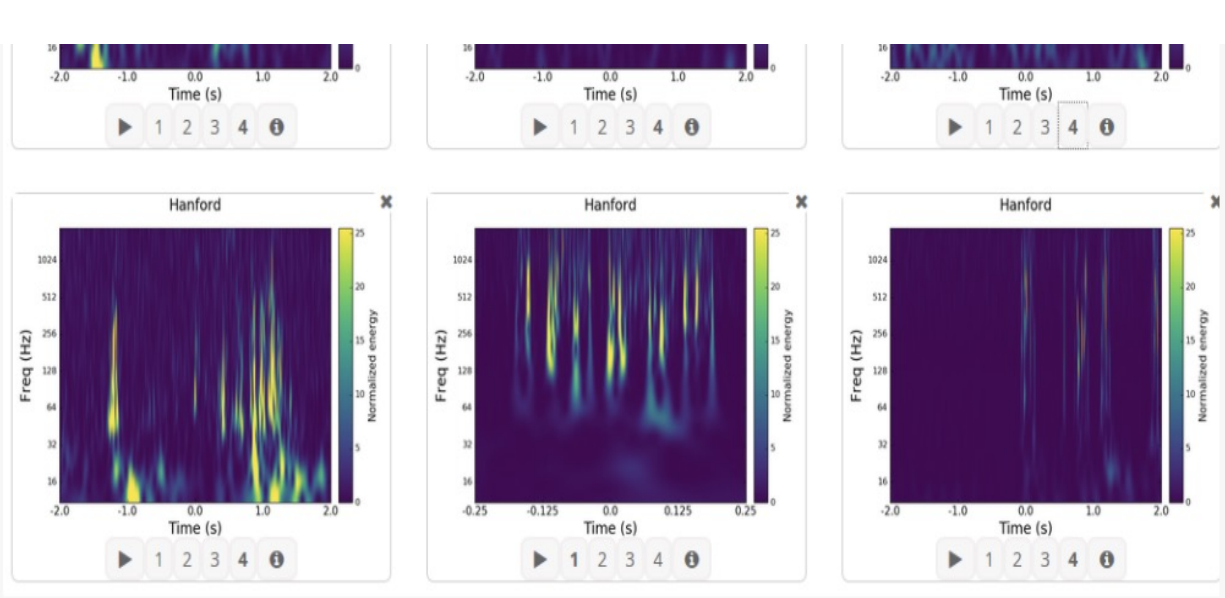
I think it is also possible that Subject 35071259 is an injected noise.
@ZngabitanT

Helpful (0) Reply Link

Individual

Collective

Collective Knowledge



Individual

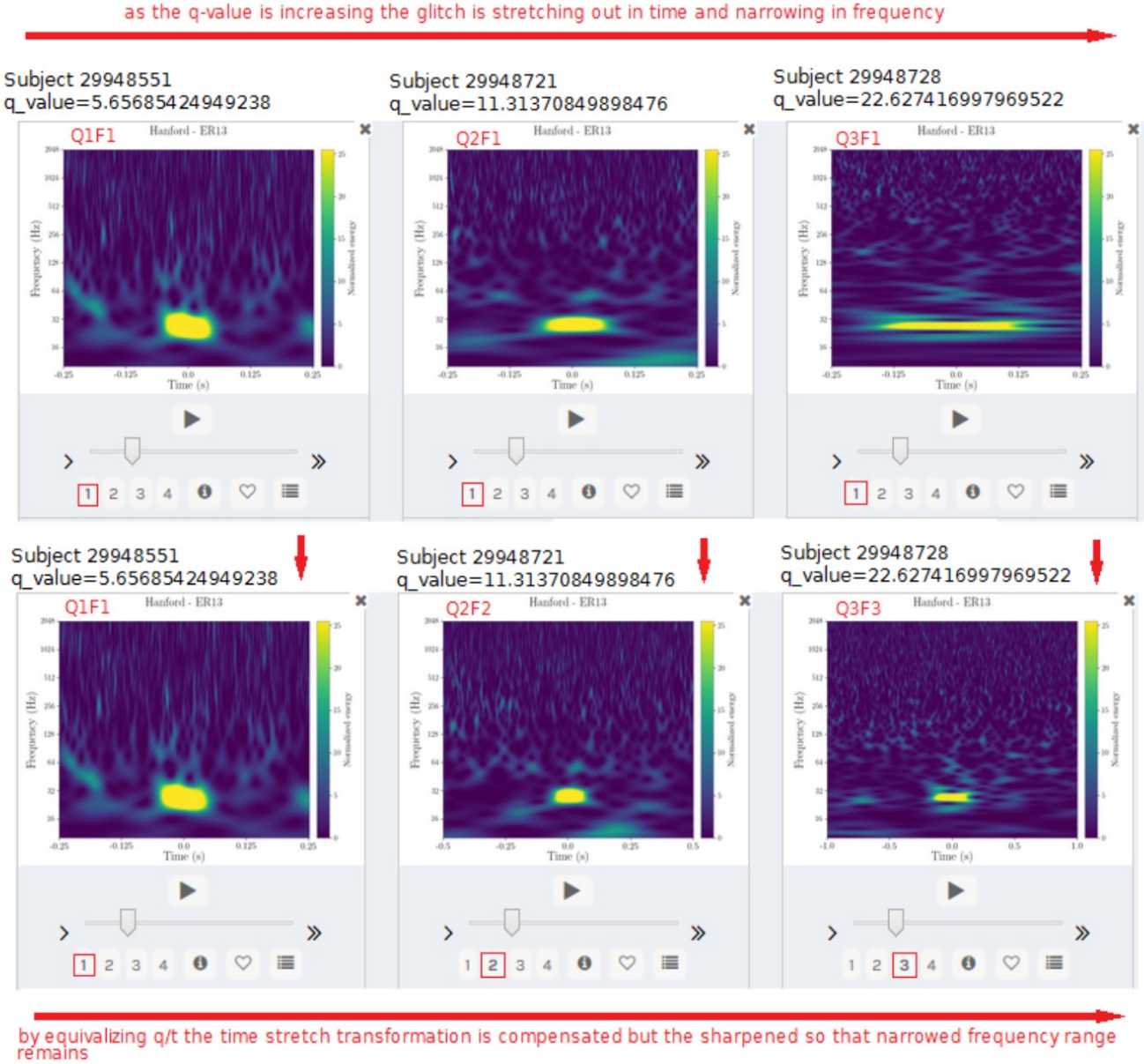
2. scratchy type of candidate classes

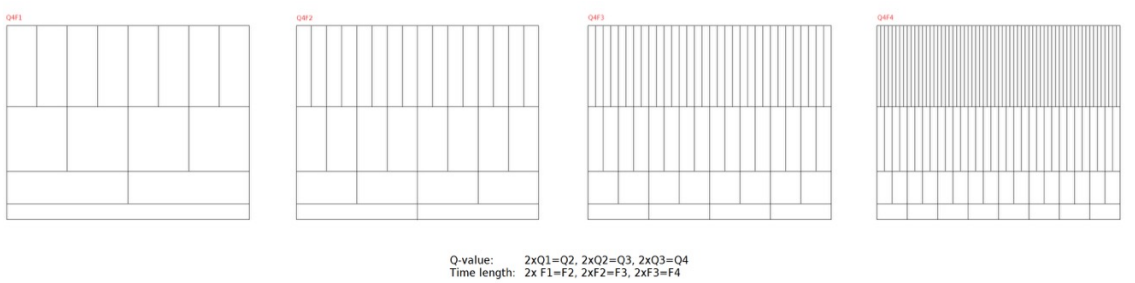
- #crown collection: https://www.zooniverse.org/collections/acceruelme/crown (Hanford, 19p) function-looking line composed by crown-shaped scratchy glitch series moving periodically between 100-400Hz
- #elf collection: https://www.zooniverse.org/collections/acceruelme/elf (Hanford, 32p) floating low freq longer glitches with higher freq run ups. irregular glitches. The overall picture to me is not similar enough to 45MHz modulation or scattered light, but probably related to them.

https://www.zooniverse.org/projects/zooniverse/gravity-spy/talk/729/54573

Examples of q/t equalization of same type of glitches with different Q:

Authoritative Knowledge





I have also compiled examples of spectrograms with different Q. These spectrograms has different time and frequency scale and colors than GS spectrograms but the Q-effect on the morphology can be examined. In the first panel (***a***) you can see a chirp signal with 4 different version of Q, the first spectrogram on the left has the lowest Q, the last one on the right has the highest Q.
Panel ***b*** starts with the waveform of the chirp, then the 3 spectrograms, the first one on the left has the lowest Q, the last one the right the highest Q.
All the other panels organized this way, until panel ***k***, which is an example for the background noise pattern @liongw
The last pane (***l***) show that lower Q gives a better representation of the time duration of the glitch (compare the wave form to the first spectrogram) and higher Q provide a better representation of (sharper) frequency resolution, that you can see if you compare the spectrograms to the 90° rotated graph of spectrum. As the Q is increasing from the left to the right the trade between frequency and time resolution can be followed. (The source of these figures is indicated on image). This image is giant again, and I don't paste it here, please click on the link below to open it:

Image of Q-effect examples

Authoritative

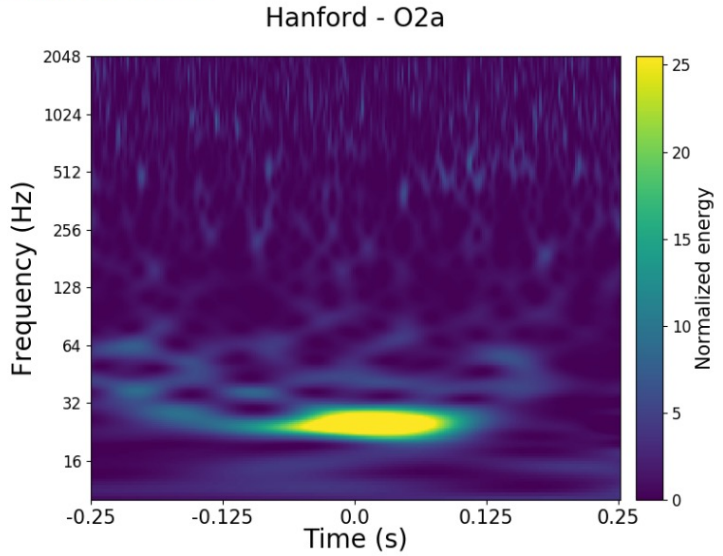
Some literature about the Q-transform:
-Calculation of a constant Q spectral transform Judith C. Brown , 1990
-Multiresolution techniques for the detection ofgravitational-wave bursts S Chatterji, L Blackburn, G Martin and E Katsavounidis MIT LIGO laboratory, 2004
-The search for gravitational wave bursts in data from the second LIGO science run Author: Chatterji, Shourov Keith Thesis (Ph. D.)--Massachusetts Institute of Technology, Dept. of Physics, 2005 - from this site you can reach the PDF of the full thesis with detailed explanation of the Q-transform.
-Compressed Sensing for Time-Frequency Gravitational Wave Data Analysis, Adesso et al. 2016 - the spectrograms on the image above are from this paper except the first one as it's indicated on the image.

Screenshot

https://www.zooniverse.org/projects/zooniverse/gravity-spy/talk/329/921257?comment=1522982&page=1

New Glitch Proposal

Subject 10971207

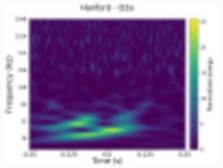


- Proposed name: **falcon**
- ID of proposer: @EcceruElme
- Date of proposal: 22 May 2018
- Link to a prototypical object: Subject 10971517
- Short description suitable for the field guide: New type of glitch from Hanford O2.
- Characteristics of the glitch (e.g., morphology, frequency, time): 4 second long glitch having a higher energy central part at lower frequency with lower energy "wings" joining the central parts. Under the wings the background noise is very weak. The glitch can be recognized the best in frame 4. The shape of the body is very dependent on the Q, for more examples and explanations please see this post. Very likely repeating type but the period is 2 second long and these glitches are well centered so we can see only 1 falcon/spectrogram (except some rare cases when a second one seems to start at -2 sec or at 2 sec.)
- List of hashtags used to describe the image: #falcon
- Link to collection(s) with more objects of class: falcon collection
  @moderators @isapatane @BLGoodwin @christingle

(was discussed earlier but not officially proposed)

Helpful (2) Reply Link Report

Science Team Involvement

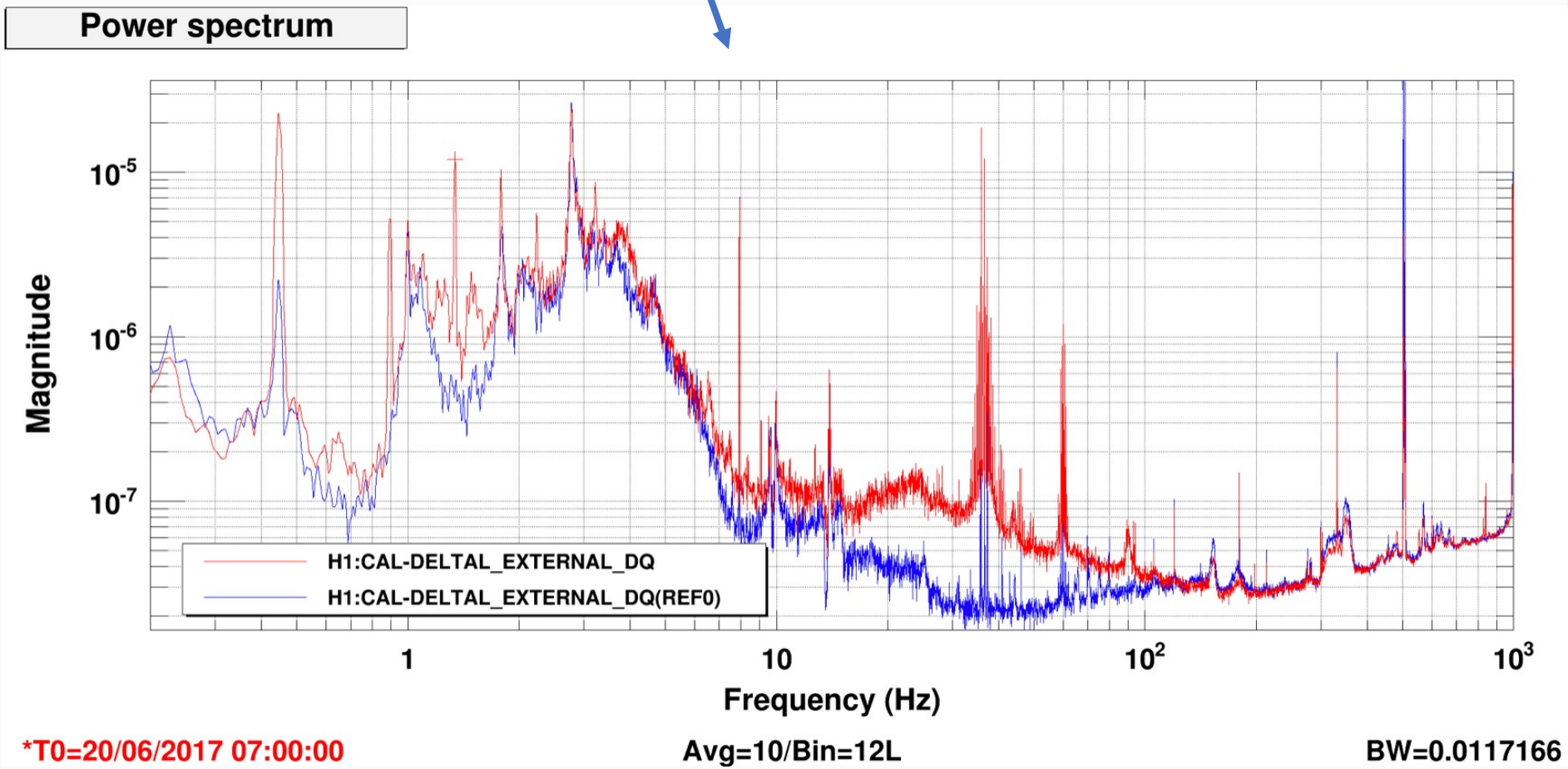


Falcon

Authoritative

Hello,

Thank you for this proposal. These glitches occurred within a two hour period back on June 20, 2017. The only possible link we could find for this was this alog that occurred on the day of the glitch. Corey explains that there are issues with ASC Pitch, and takes the detector out of lock to try and fix the problems. Below is a spectra he attached, where red is the noise and blue is a reference. Notice the giant difference between ~15 Hz and 100 Hz, with the biggest difference being between ~18 Hz and ~40 Hz.



We will be retiring these glitches, both because of the extremely narrow window of time that they occurred in, and because we want to start phasing out glitches that have not been seen since older observing runs. However, we will be using these glitches in the future to help retrain our algorithm. Thank you again for this proposal!

Building Background Knowledge

Existing Resources

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  - Q-value discussion
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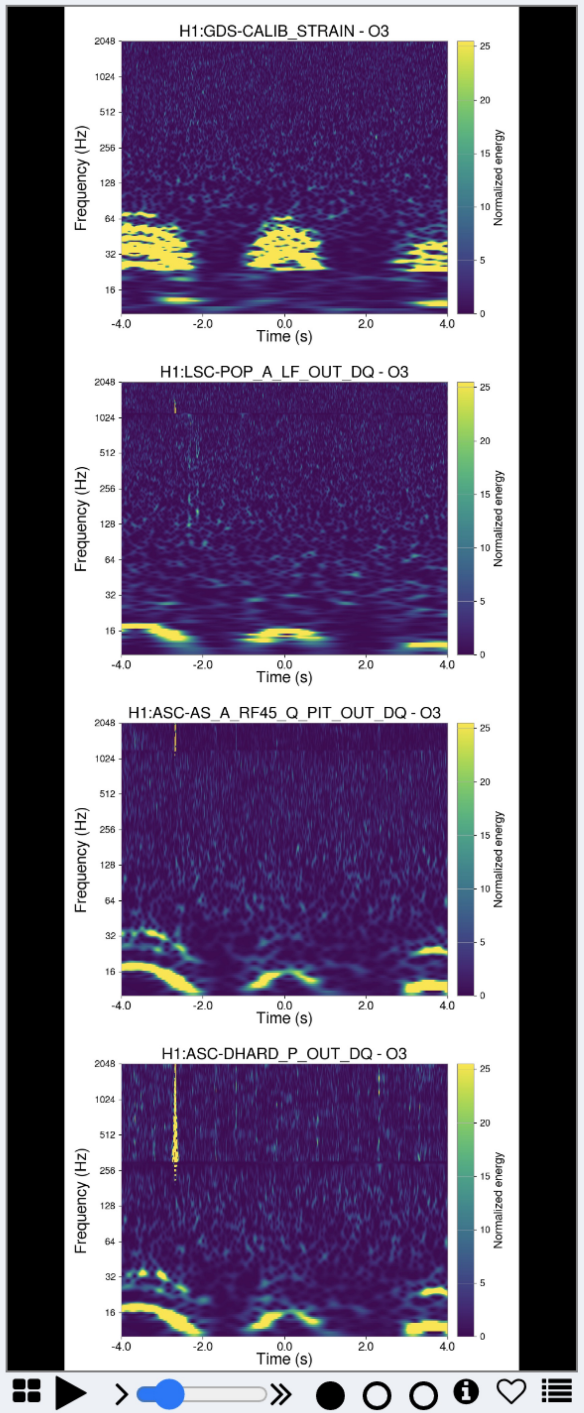
  - Science team blogs
  - Science articles
- Collections

Restructure Resources

- Tutorials
- Discussion Boards
- Collections
- Wiki

Beginner Workflow



TASK | TUTORIAL

Select all spectrograms/images where the glitch is morphological similar to the glitch in the "main" channel.

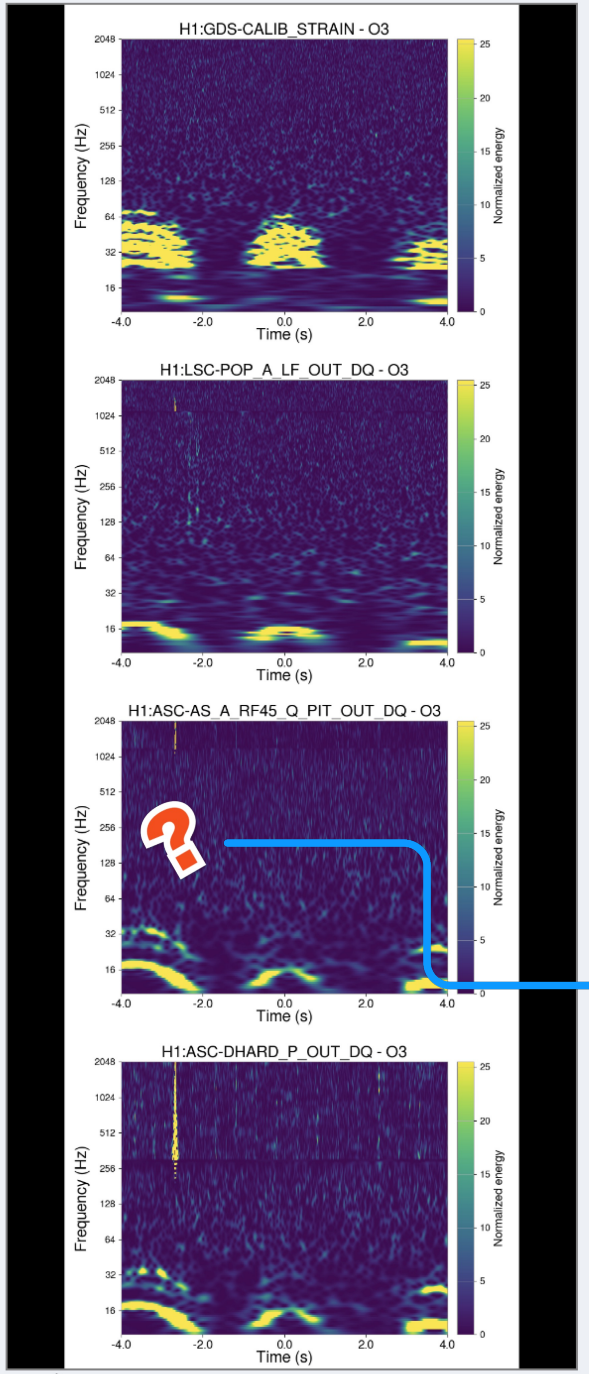
Grid Box 0 of 0 required, 3 maximum drawn

Next →

Current questions:

- Is the morphology similar?
  - Criteria
- Is time coincidence similar?
  - Criteria
- Is there a frequency similar?
  - Criteria
- Relative strength between auxillary channel and DARM?
  - Criteria

Building Background Knowledge



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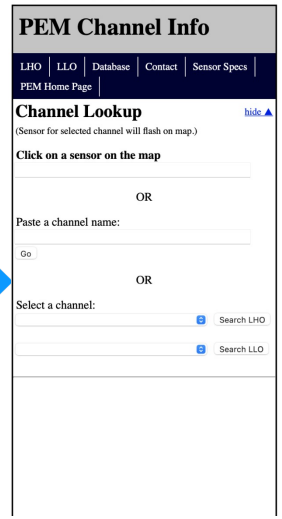

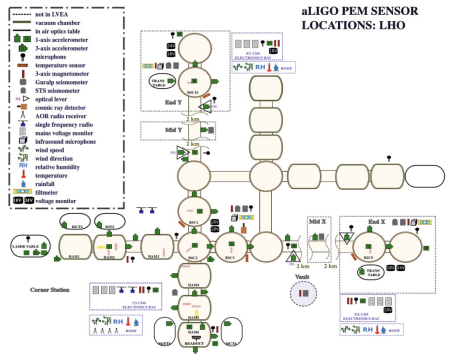

Summary

- **Gravity Spy 2.0** strives to provide volunteers the background knowledge they need as they develop new glitch classes and explore existing classes
- Will combine scaffolded tasks and modes of participation with intelligent system support
- Will restructure background knowledge sources to support ongoing learning.
- With opportunities to build background knowledge and share findings volunteers should be able to perform in-depth investigations to make discoveries