

Cosmic Ray Events and the MKID

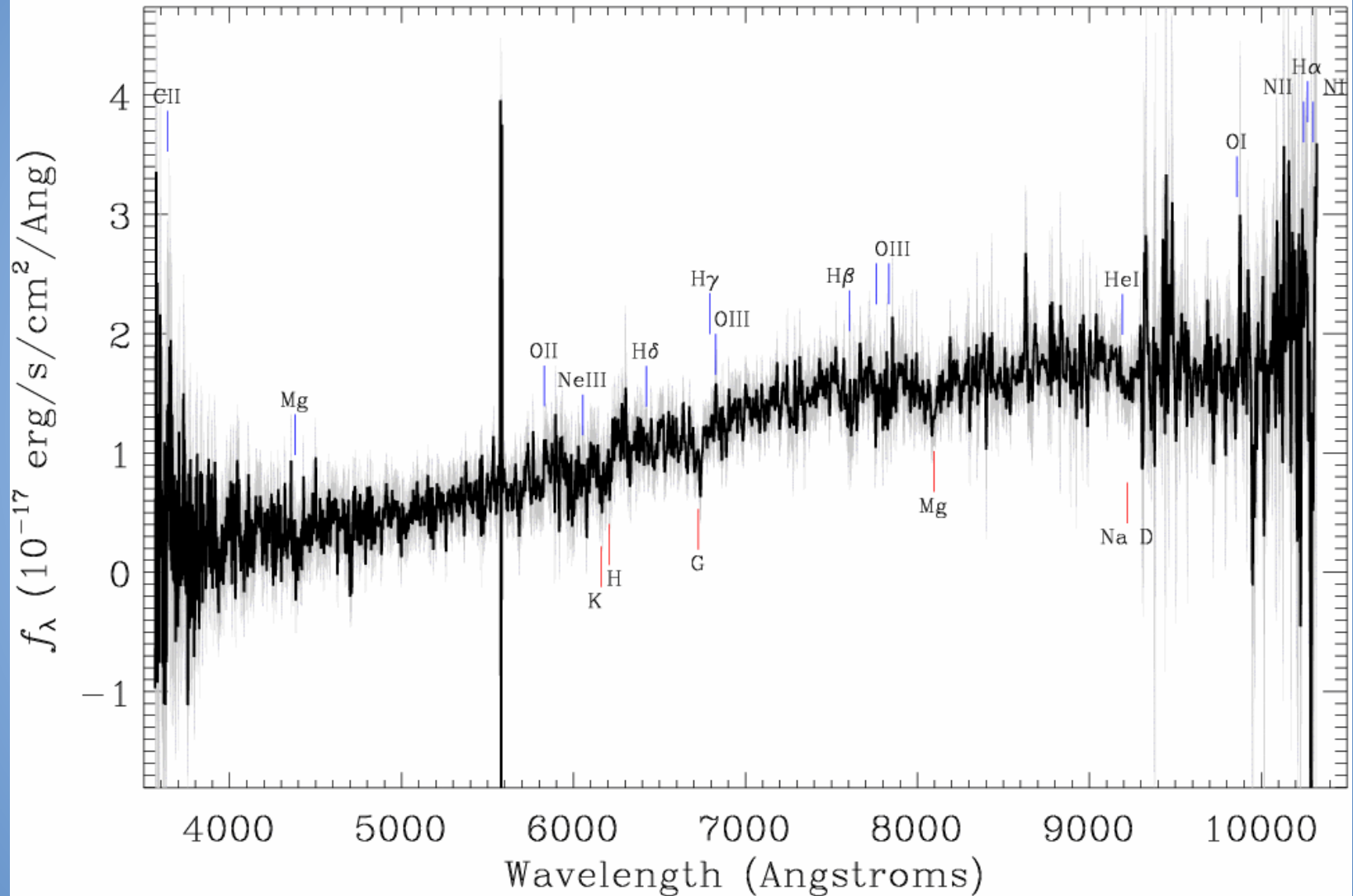
By Alexandra Kirchner

The Sloan Digital Sky Survey (SDSS)

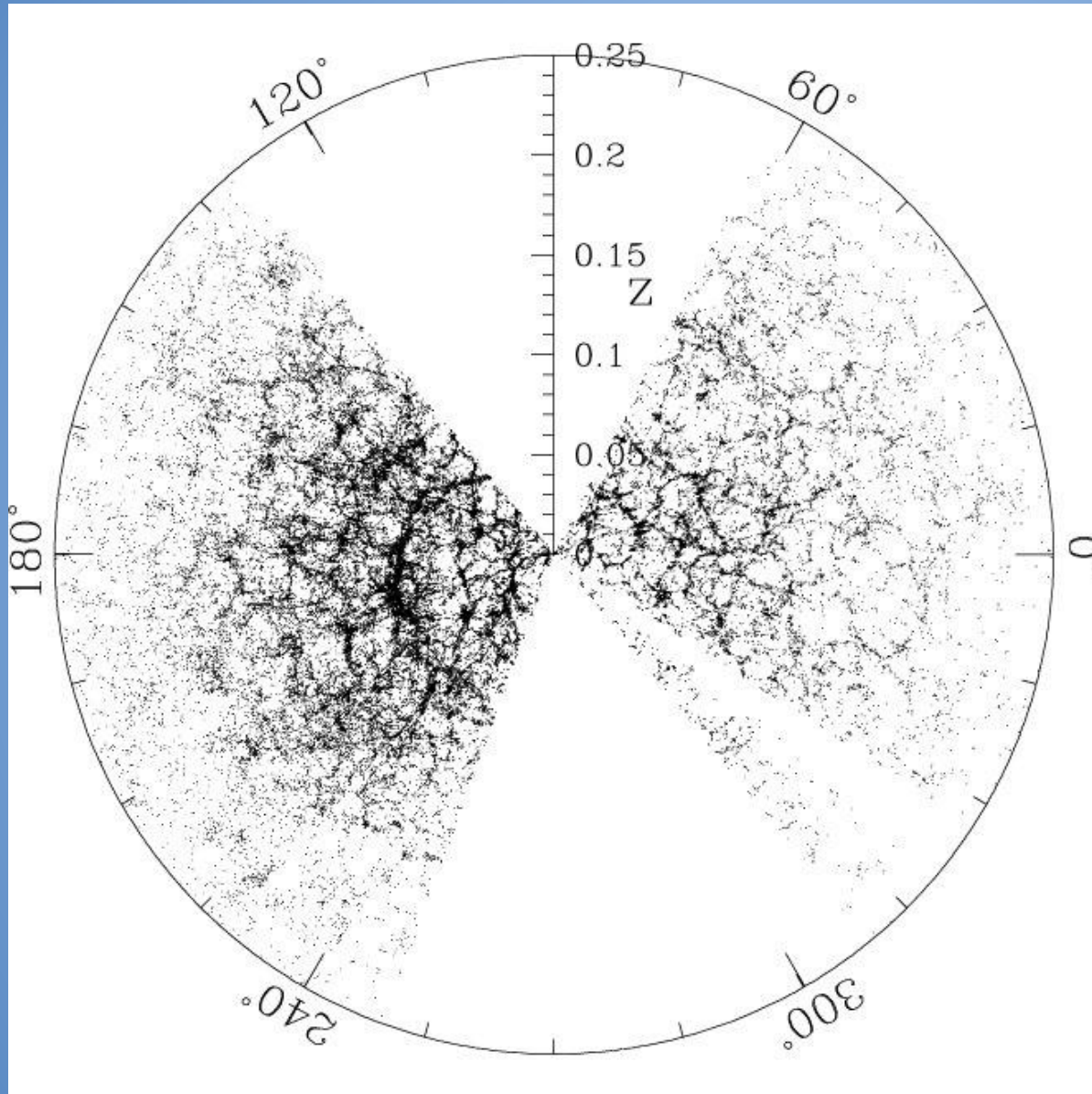
The
telescope
used by
SDSS



Survey: boss Program: boss Target: GAL_CMASS GAL_CMASS_COMM GAL_CMASS_ALL
RA=319.90642, Dec=-2.85237, Plate=4382, Fiber=9, MJD=55742
z=0.56429±0.00021 Class=GALAXY
No warnings.



A typical spectrum taken by SDSS



A slice of
the map of
the
Universe
produced
by SDSS

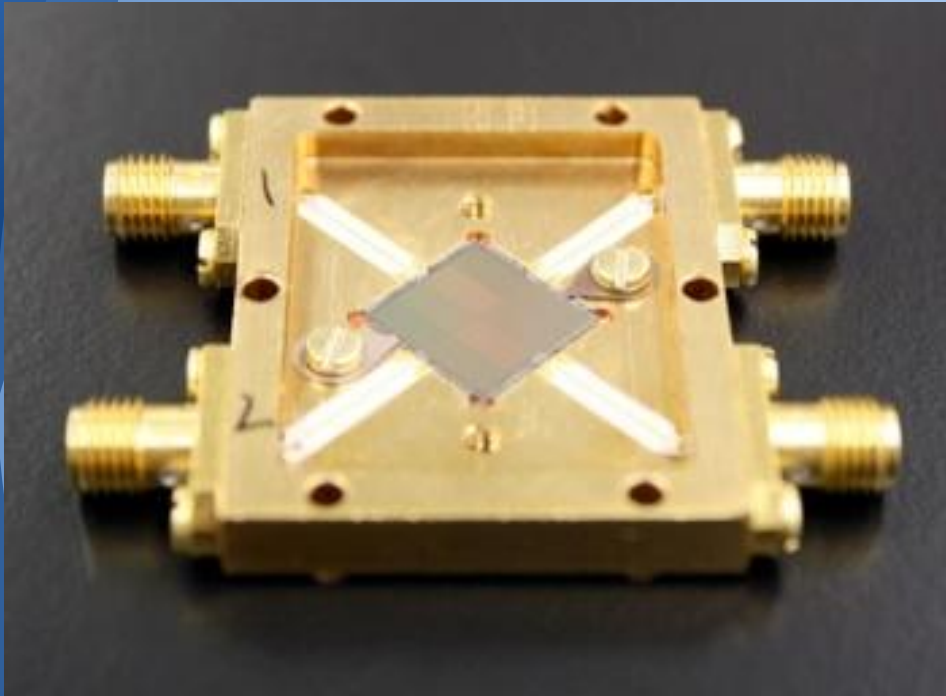
The Energy Involved



All photons deserve to be
detected!

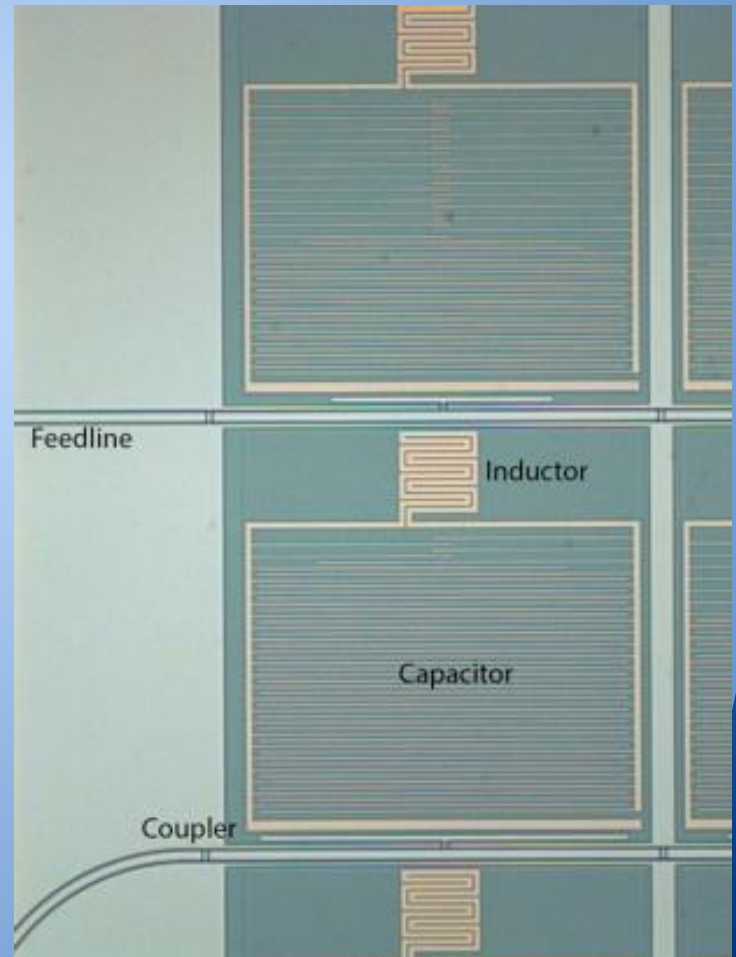


The Microwave Kinetic Inductance Detector (MKID)

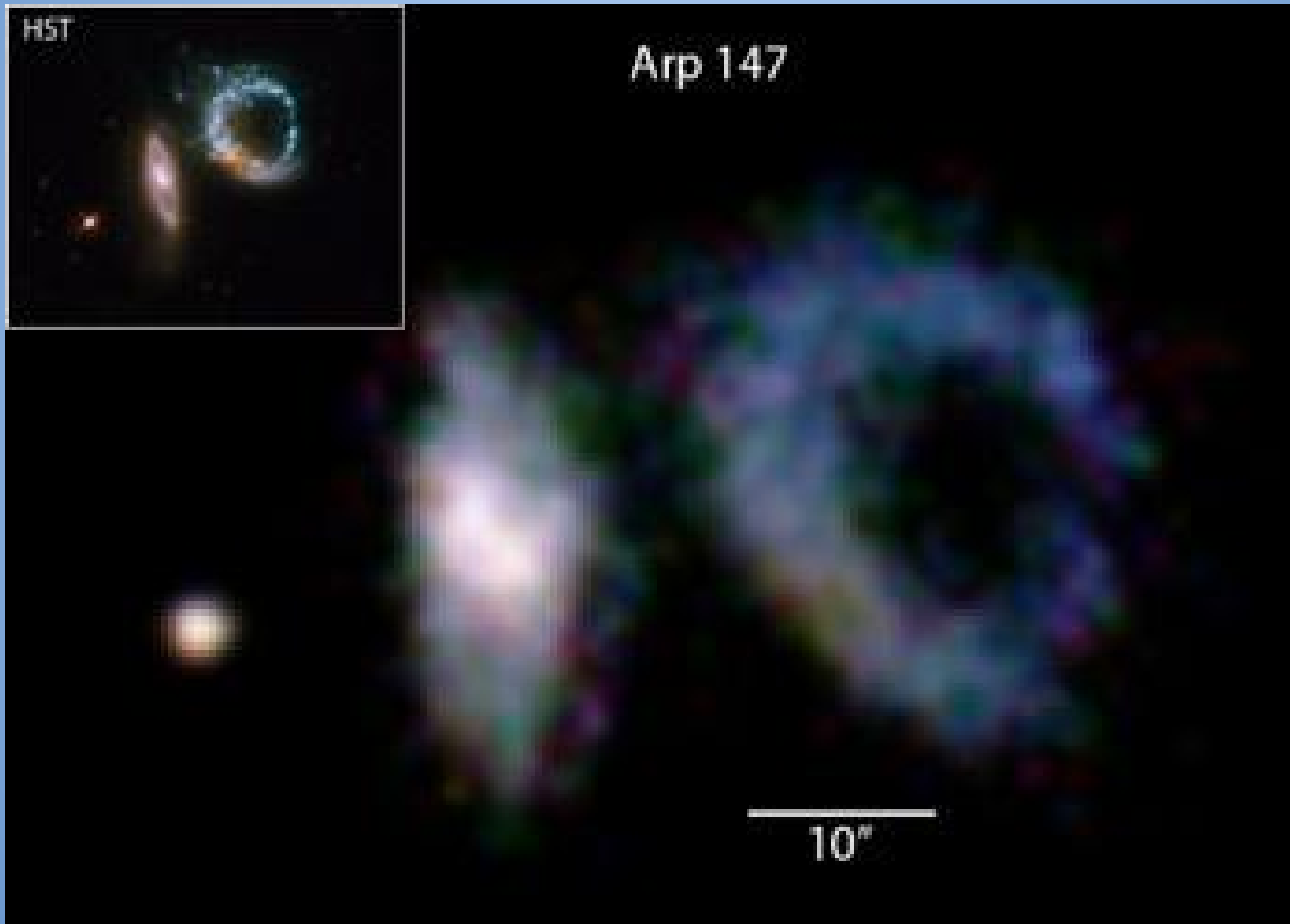


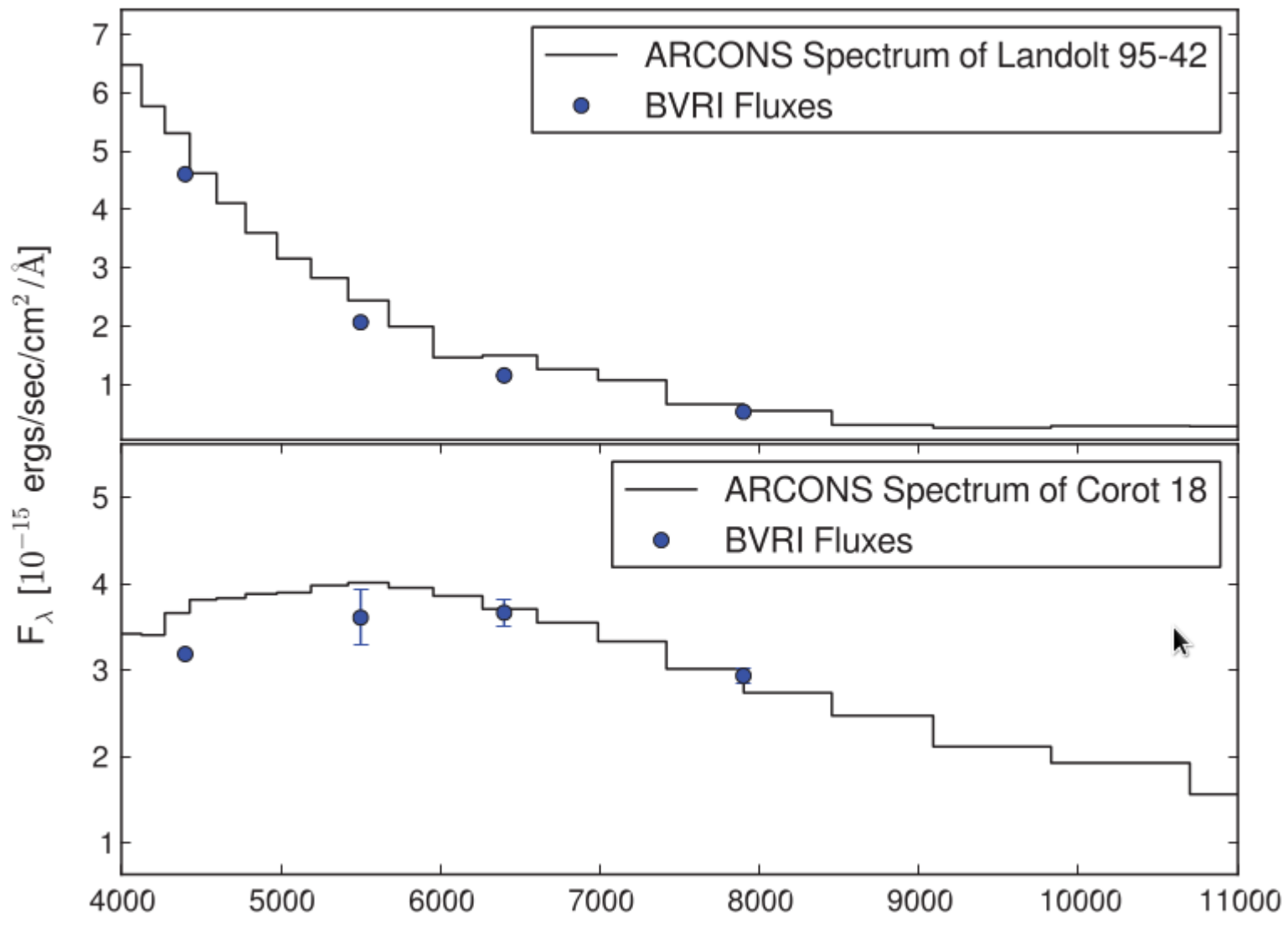
The array of pixels that captures the image, much like the pixels in a digital camera

A close up on two of the pixels in the array.



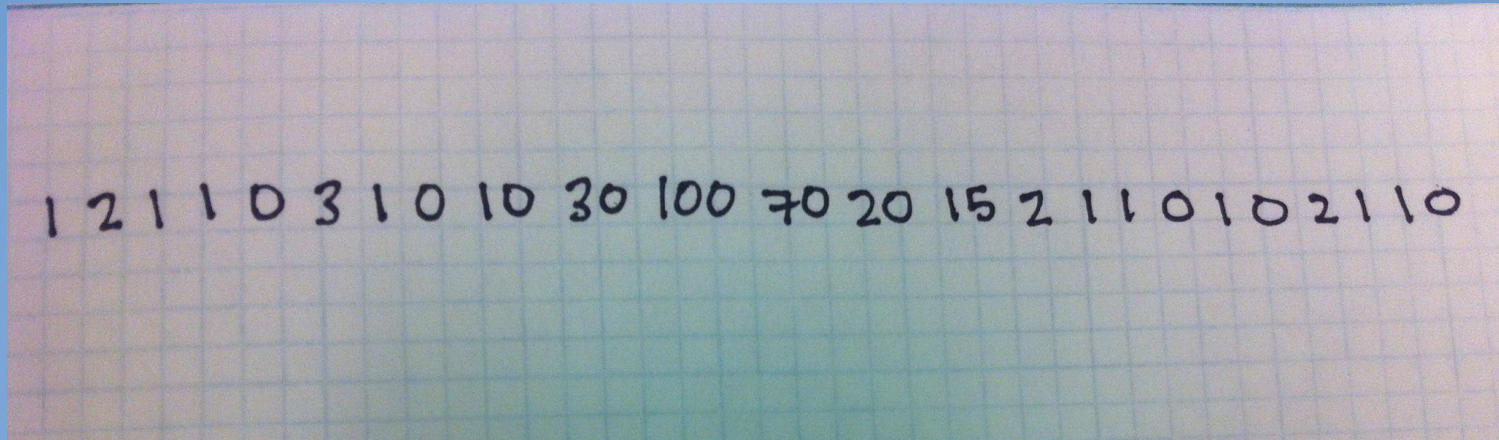
An image of Arp 147 taken by the MKID compared to one taken by the Hubble telescope (top left corner)



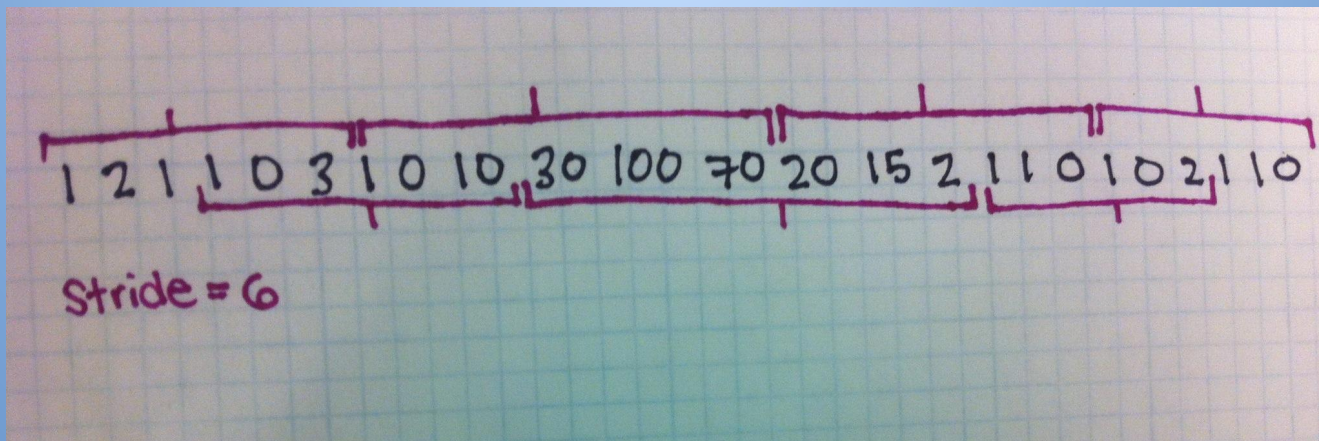


The black lines show the spectra of Landolt 95-42 (a blue object) and Corot 18 (a more reddish object) taken by the MKID. The blue dots show the standard spectra of these two objects. These plots indicate that spectra taken by the MKID are accurate. (<http://arxiv.org/abs/1306.4674>)

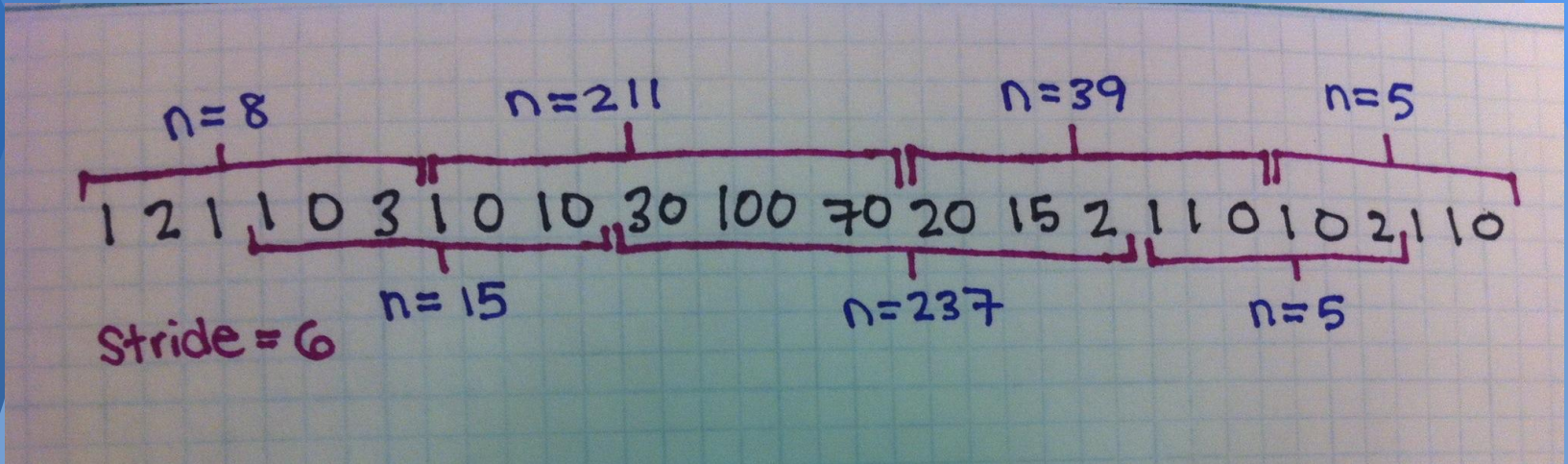
How do we find Cosmic Rays?



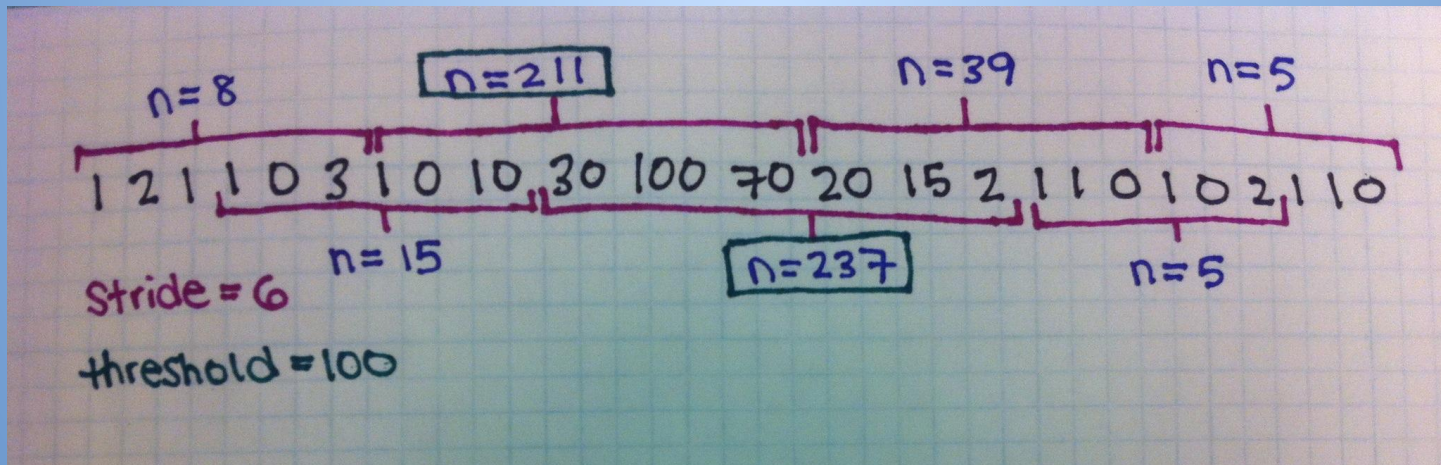
An average stream of data with a cosmic ray event



The data is then put into bins with a stride (size) of six. The bins each have an overlap of one half.

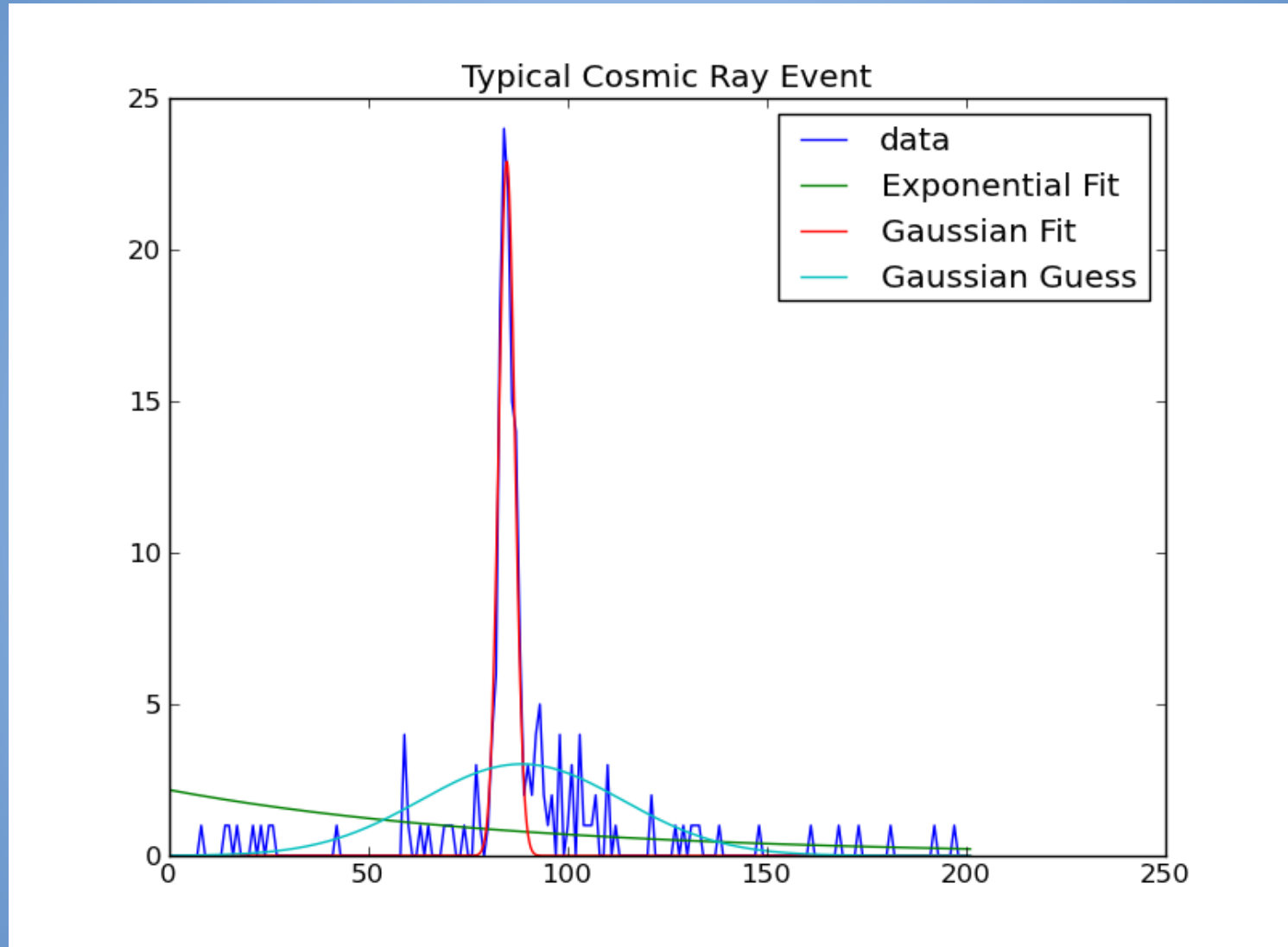


The number of photons in each bin is then added together.

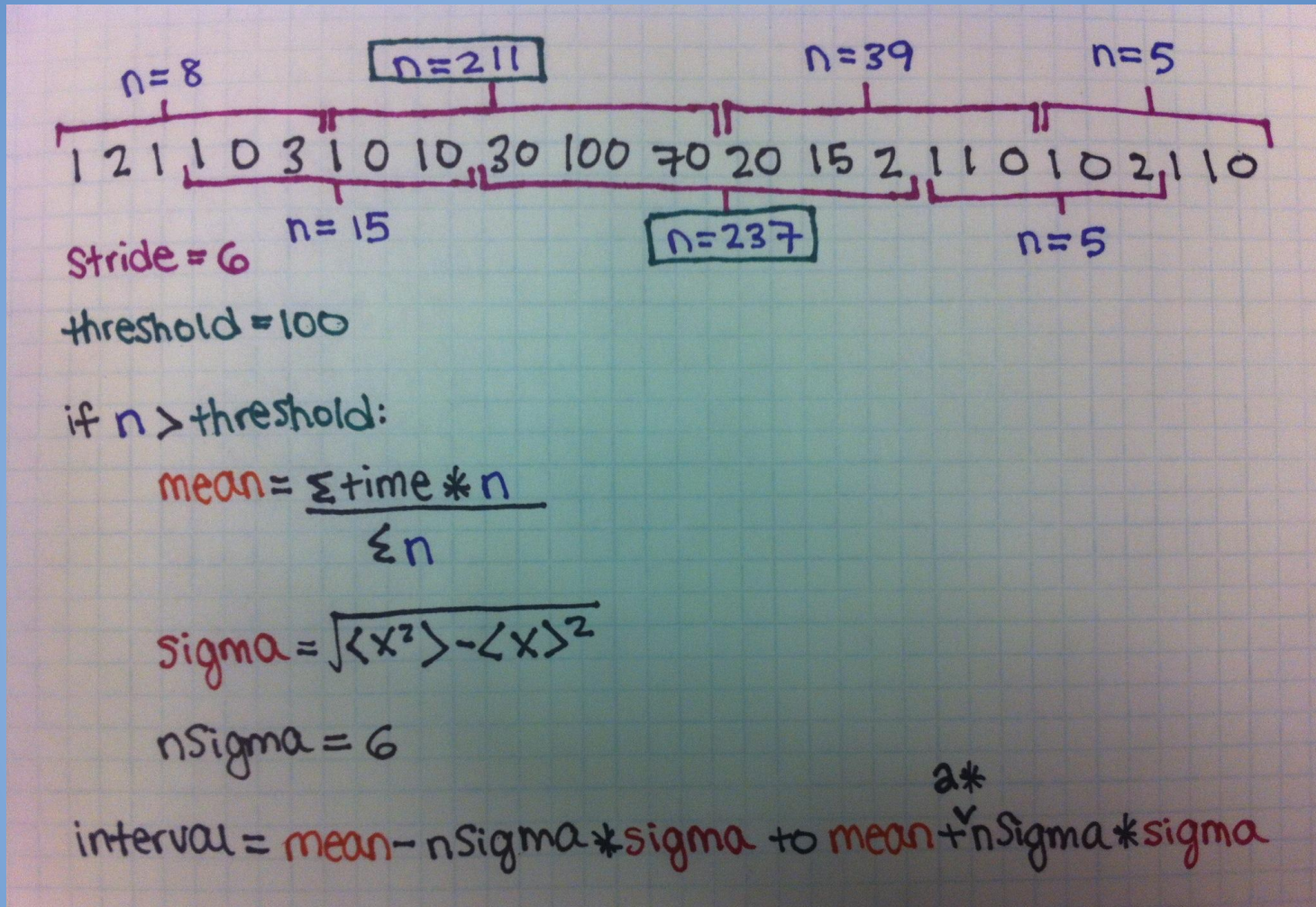


If a bin has more than the threshold number of photons (100 in this example), it is marked as a cosmic event. The bins with more than threshold photons are marked in green.

Finding the Right Fit

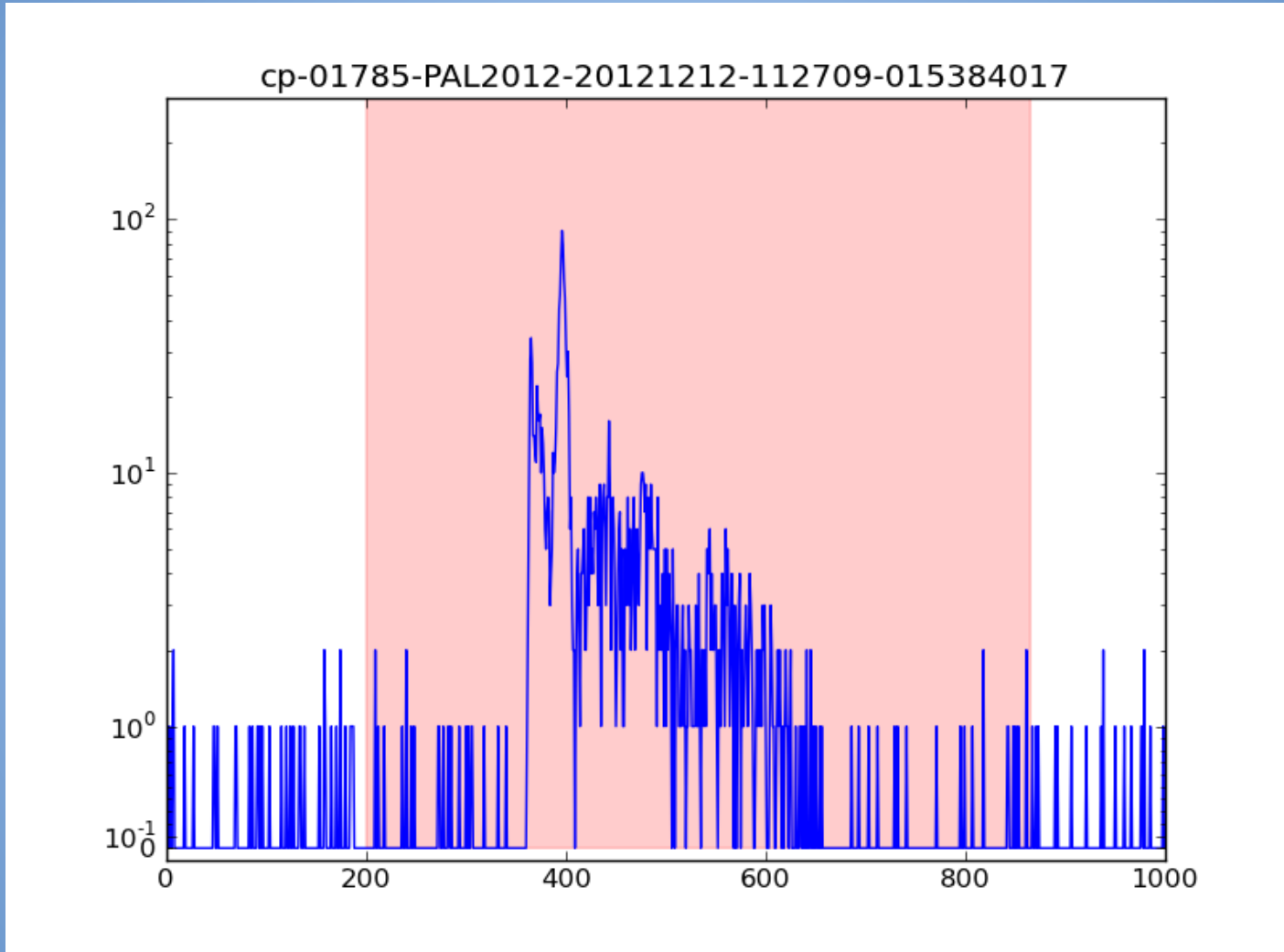


A histogram fitted with an exponential (shown in green), a gaussian (shown in red), and our gaussian guess (shown in blue)



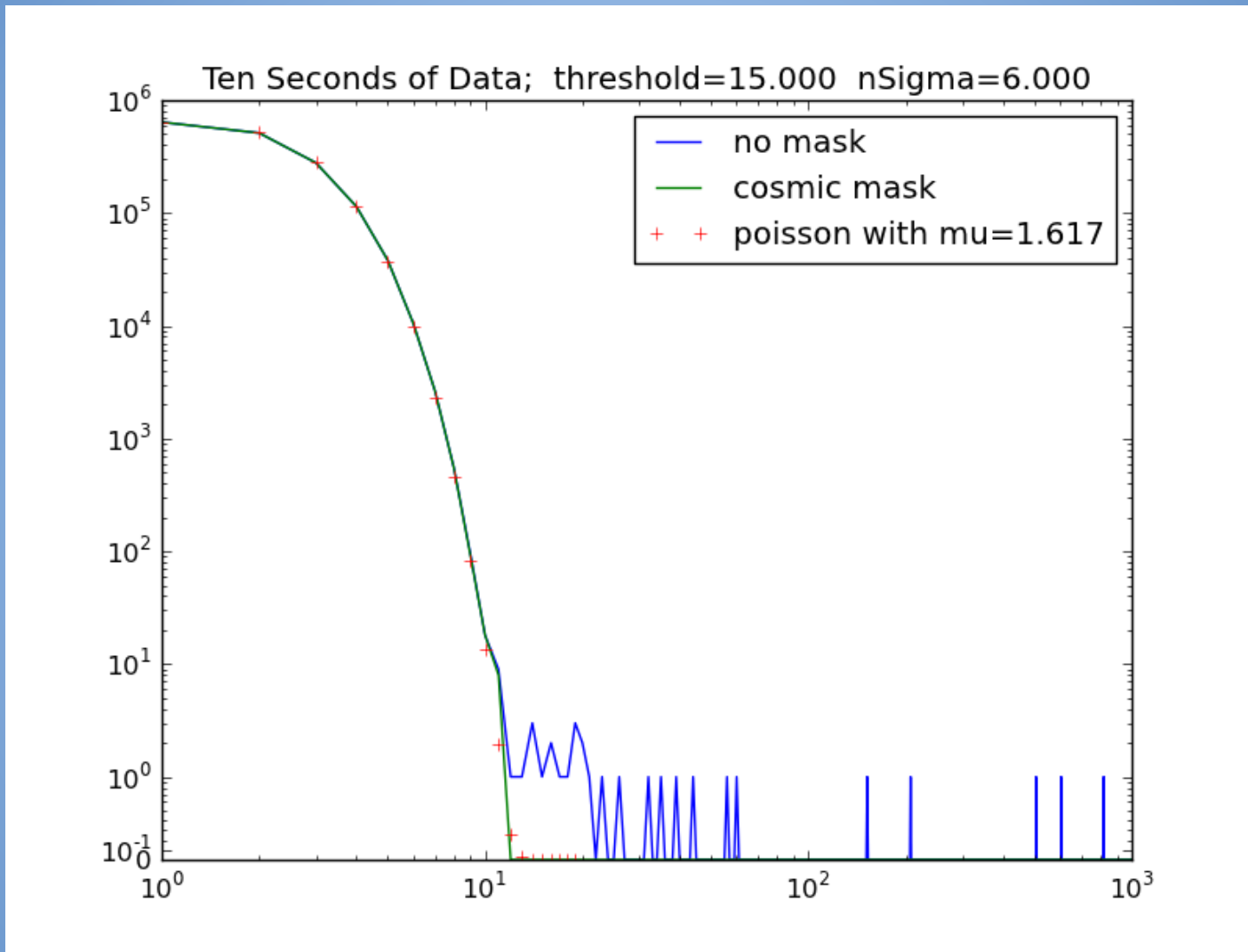
Finally, the interval is created by calculating the mean of each cosmic event, as well as the sigma (standard deviation). More data is cut out to the right of the event because there tends to be more peaks on that side.

Cosmic Ray Events



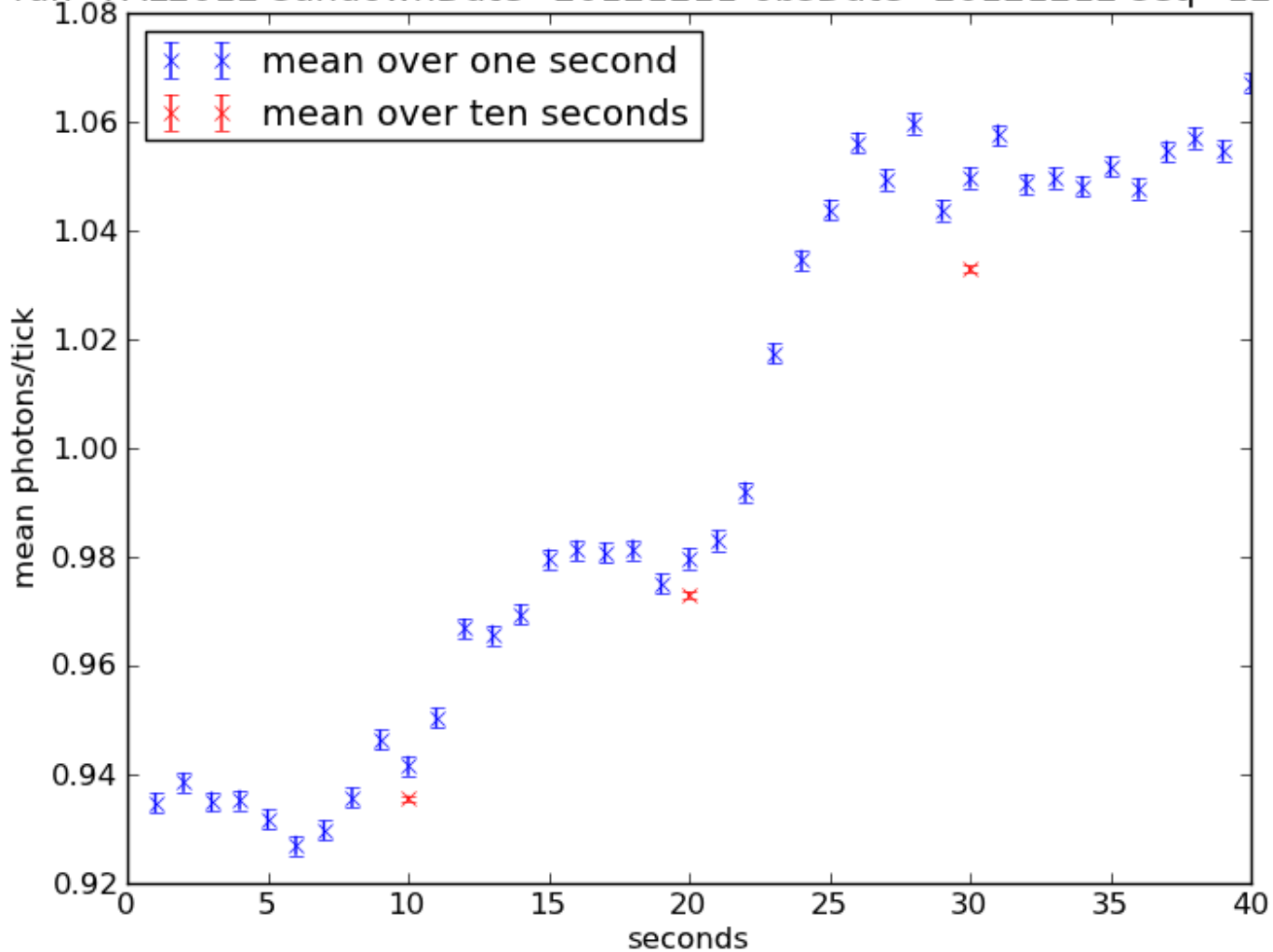
This is another example of a cosmic event. The region shaded in pink is the interval that was calculated using our method.

Poisson Distribution



The unmasked histogram is shown in blue, masked in green. The red crosses indicate the poisson distribution.

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The mean of the distribution, with error bars. Red shows the mean over ten seconds, and the blue shows the mean over one.

So What Did I Learn?

