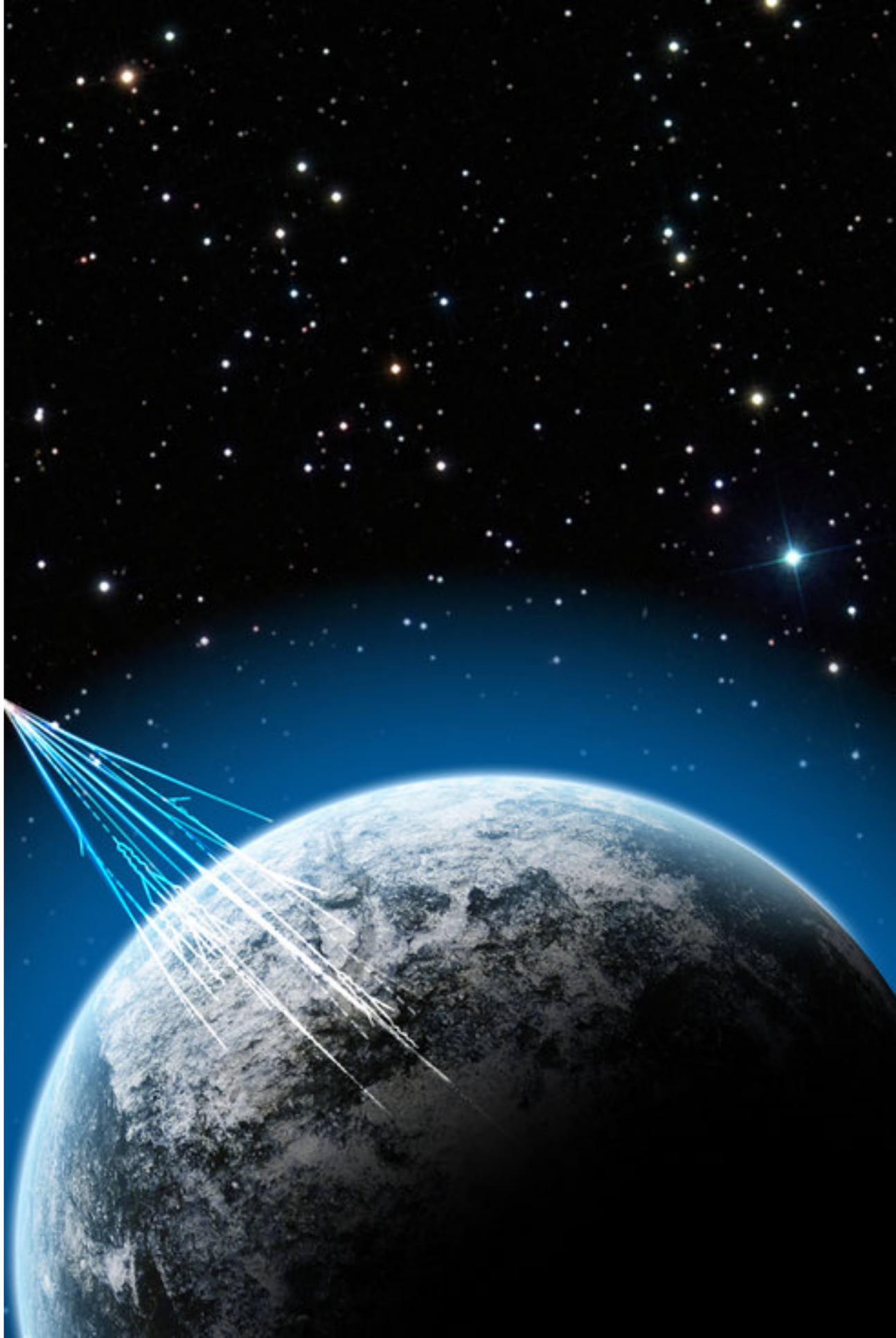
Hands-on session

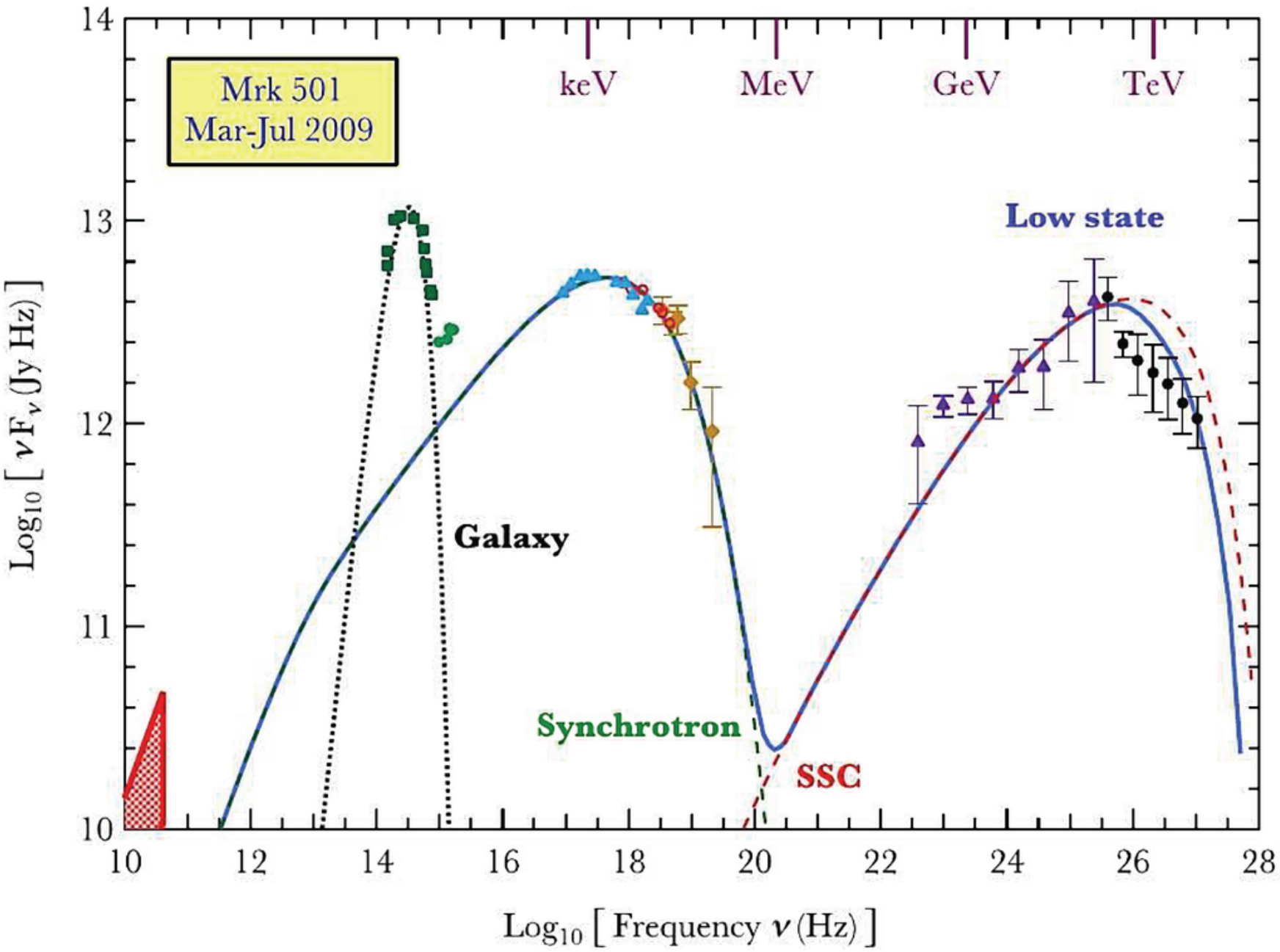
Getting familiar with blazar multi-wavelength emission



Plan for this session

- Work in **groups**
- We will work with **online tools**
- We work together step-by-step
- I will give some extra time to get familiar with the tools proposed

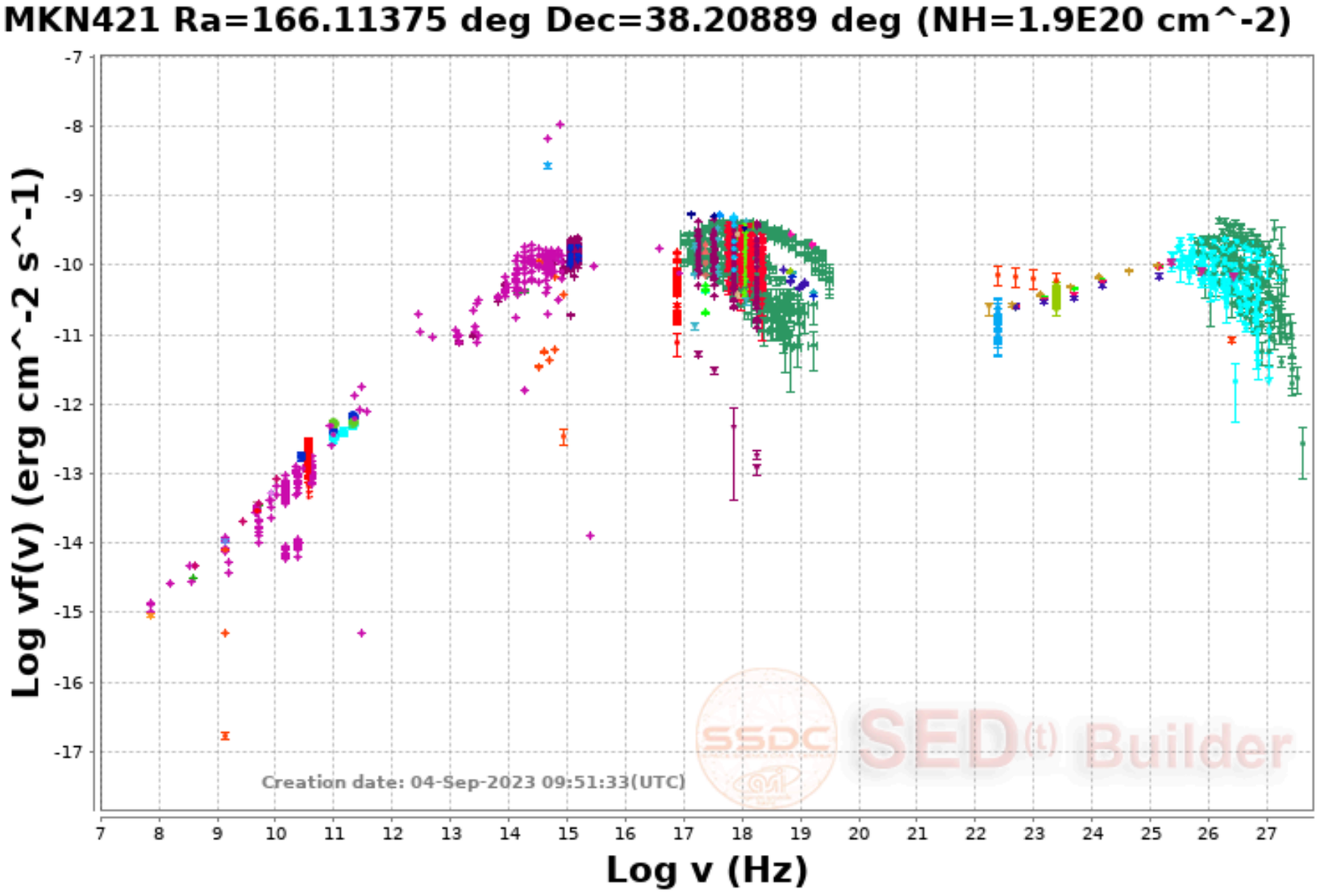
Recap: blazar spectral energy distribution (SED)



data

models

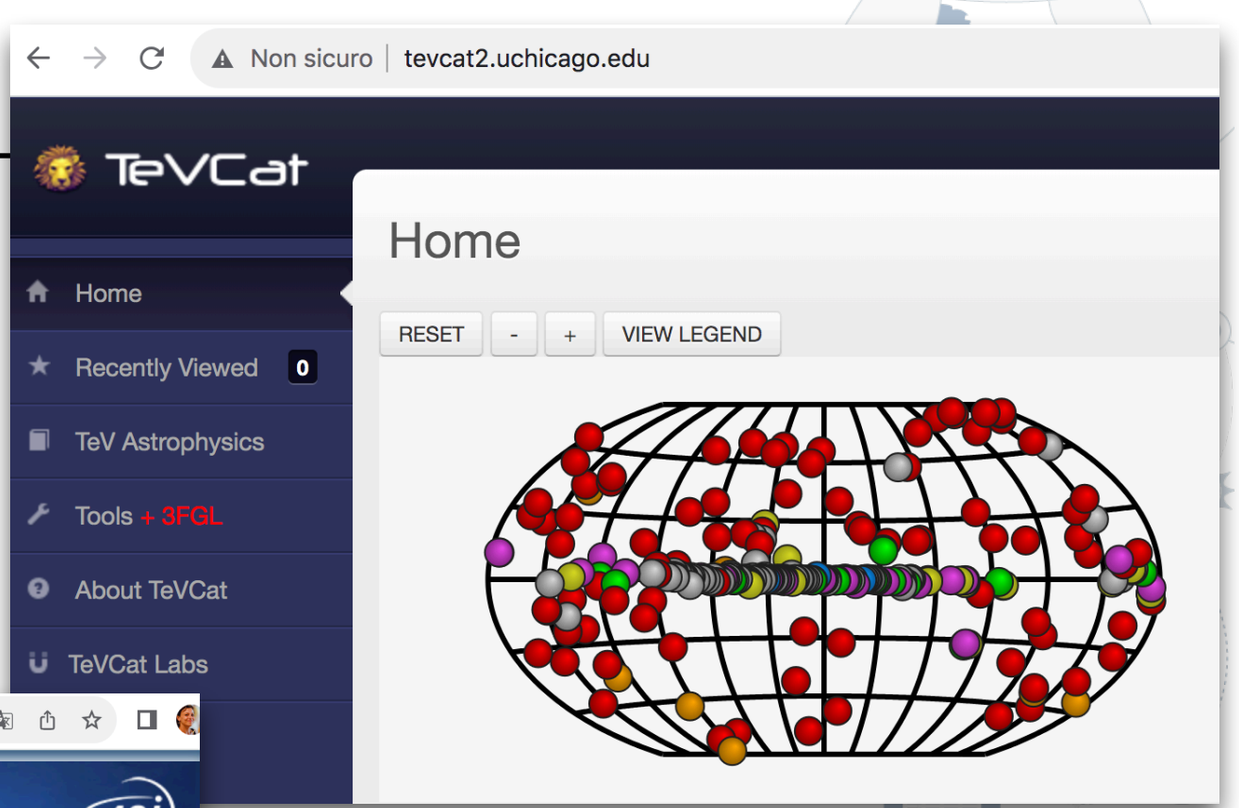
Recap: blazar spectral energy distribution (SED)

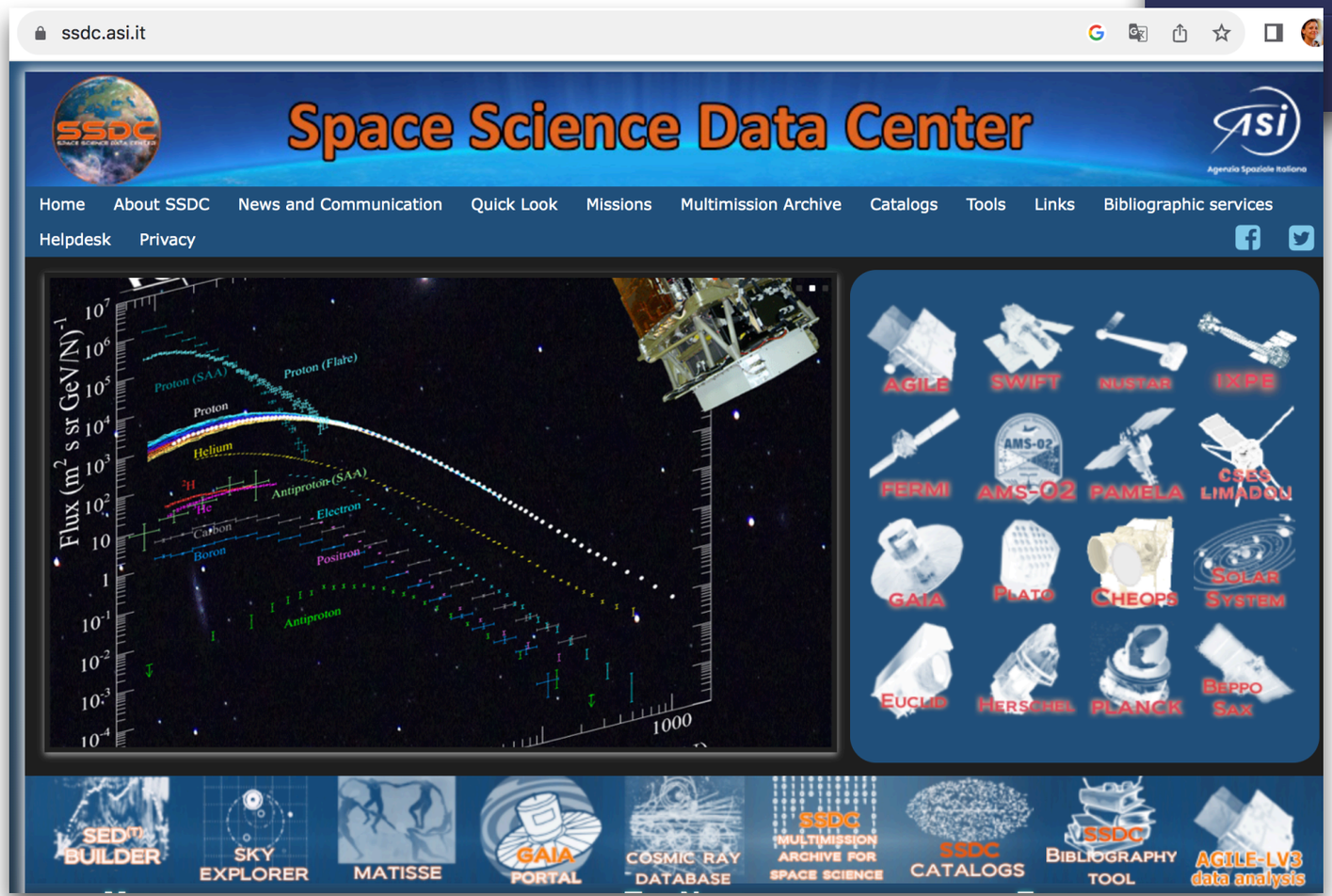


realistic example

Can you estimate by eye the location of the peaks? Can you tell which wavelength is that?

What are we going to learn?





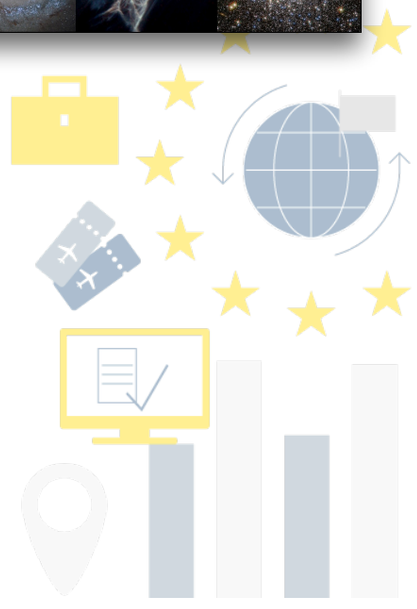
Catalogs and tools

- In astronomy very often **data are public** and you can more or less easily access these data for many different purposes!

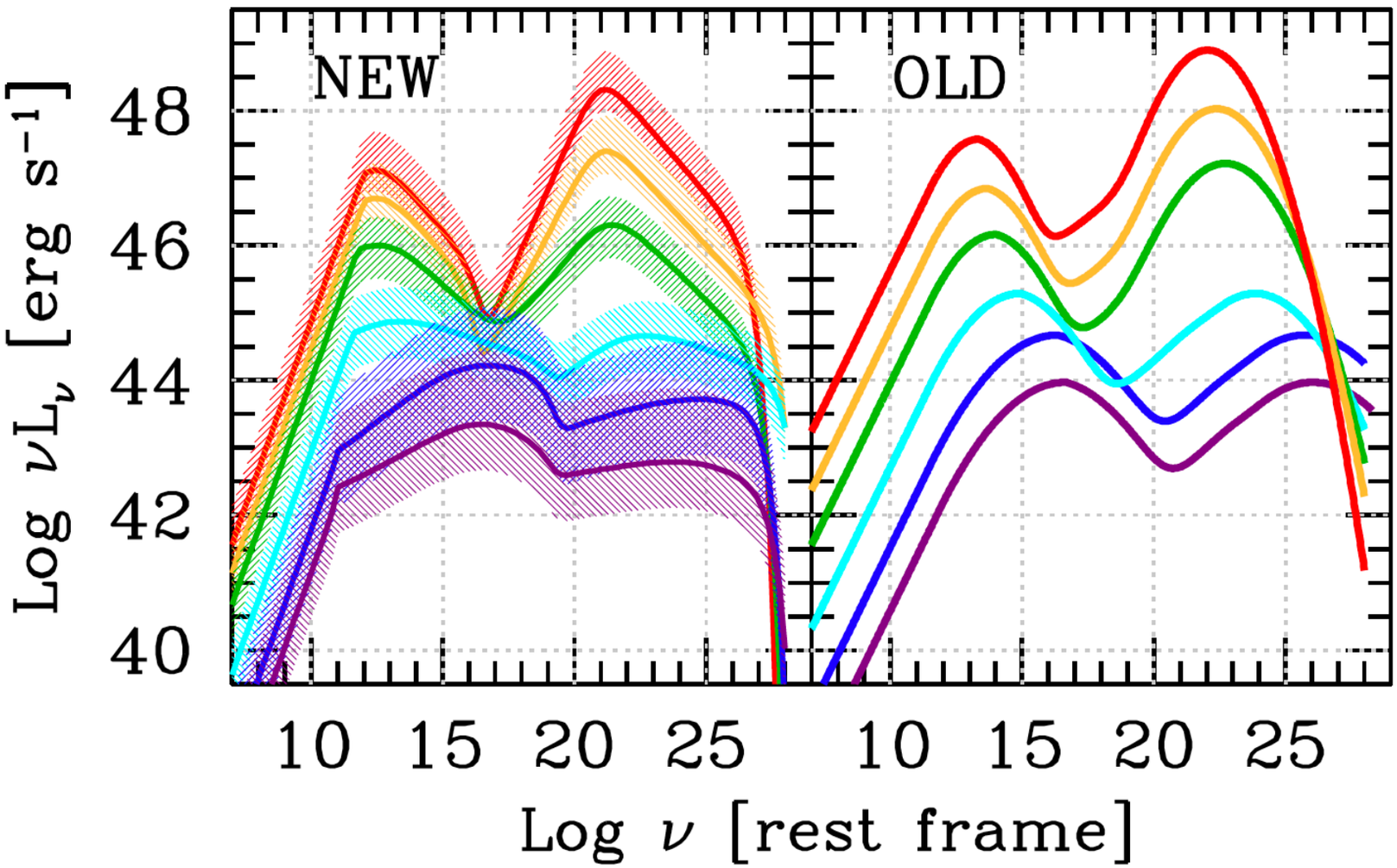
- Data are released in **catalogs**

- Almost each instrument/experiment has its catalogs (many **releases** are usually performed, with standardised names and analysis pipeline)

- Let’s have a look to the *Fermi* catalogs of gamma-ray sources



The blazar sequence



Fossati+ 1998, Ghisellini 2018

How many blazars are detected by Fermi?

- Number of blazars firmly detected with *Fermi*:

Fermi collaboration has released the updated list of cosmic gamma-ray sources to date. The third release of the **Fermi Point Source Catalog (4FGL-DR3) covers 12 years of data taken by the Large Area Telescope (LAT) on board of the Fermi Gamma-ray Space Telescope and includes 6658 sources in the energy range from 50 MeV to 1 TeV.**

The **most abundant gamma-ray sources in our Galaxy are pulsars (about 300 detected). On the other hand, the most abundant sources in the extragalactic sky are blazars and blazar candidates, which include about 3700 sources.**

With respect to the original 4FGL (8 years of data), about 1600 new sources have been found, with a population proportion that matches the previous catalogs (dominance of blazars and pulsars)

https://www.asi.it/en/2022/07/fermi-lat-collaboration-has-released-the-updated-list-of-cosmic-gamma-ray-sources-to-date/

Now we can move to the TeV catalog: TeVCAT

http://tevcat2.uchicago.edu/

1. How many sources? (look at the bottom of the page)
2. How many extragalactic (type: xgal)?
3. And how many blazars (type: blzr)?
4. Which was the first detected blazar (you have to add a column in the table) and when?
5. And the last?
6. What is the most distant?
7. Choose one blazar (you will use it for the next exercise)

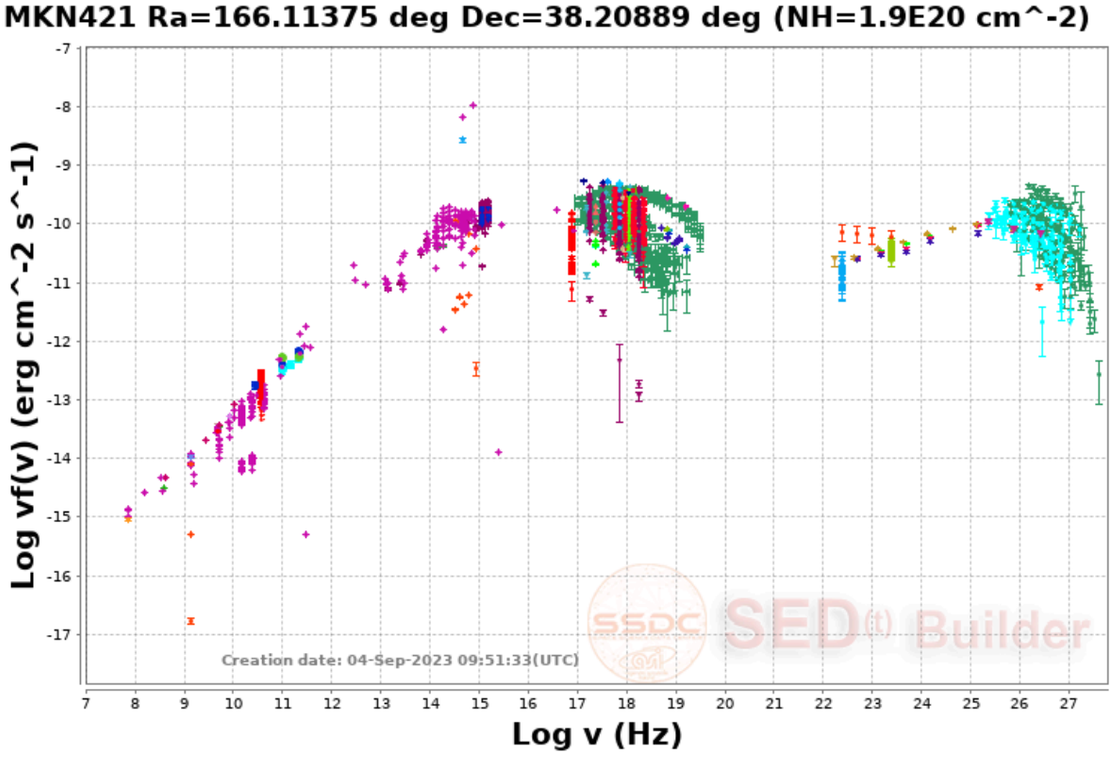
Now it is time to investigate firmamento and ssdc webpages

- https://www.ssdc.asi.it/

- I would like to give you **some minutes** to have a look to these resources with your group

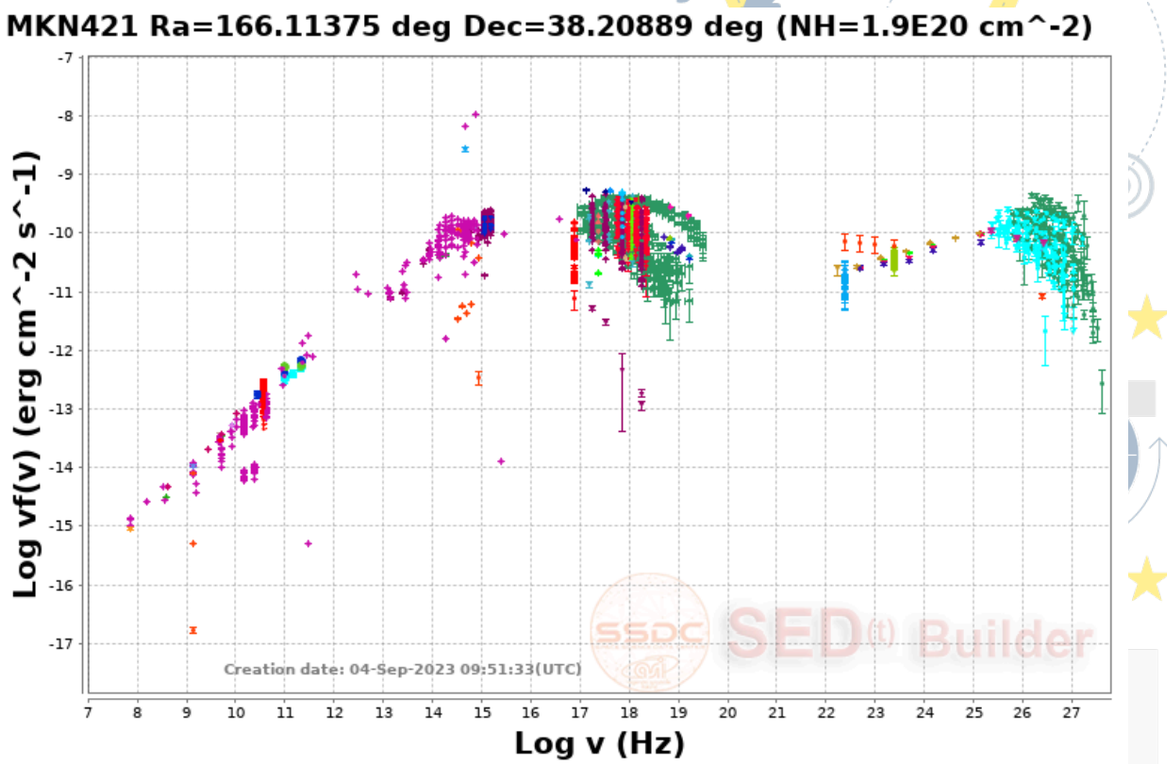
Now it is time to create some spectral energy distribution

- https://www.ssdc.asi.it/
- MKN421
- Tools -> SSDC SED builder -> source name (to be filled) -> build SED -> load data



Now it is time to create some spectral energy distribution

- Can you recognise the synchrotron peak? And the Inverse Compton peak?
- Please estimate the location of the synchro and IC peaks
- Many functionalities, e.g. download the data.



Hands on

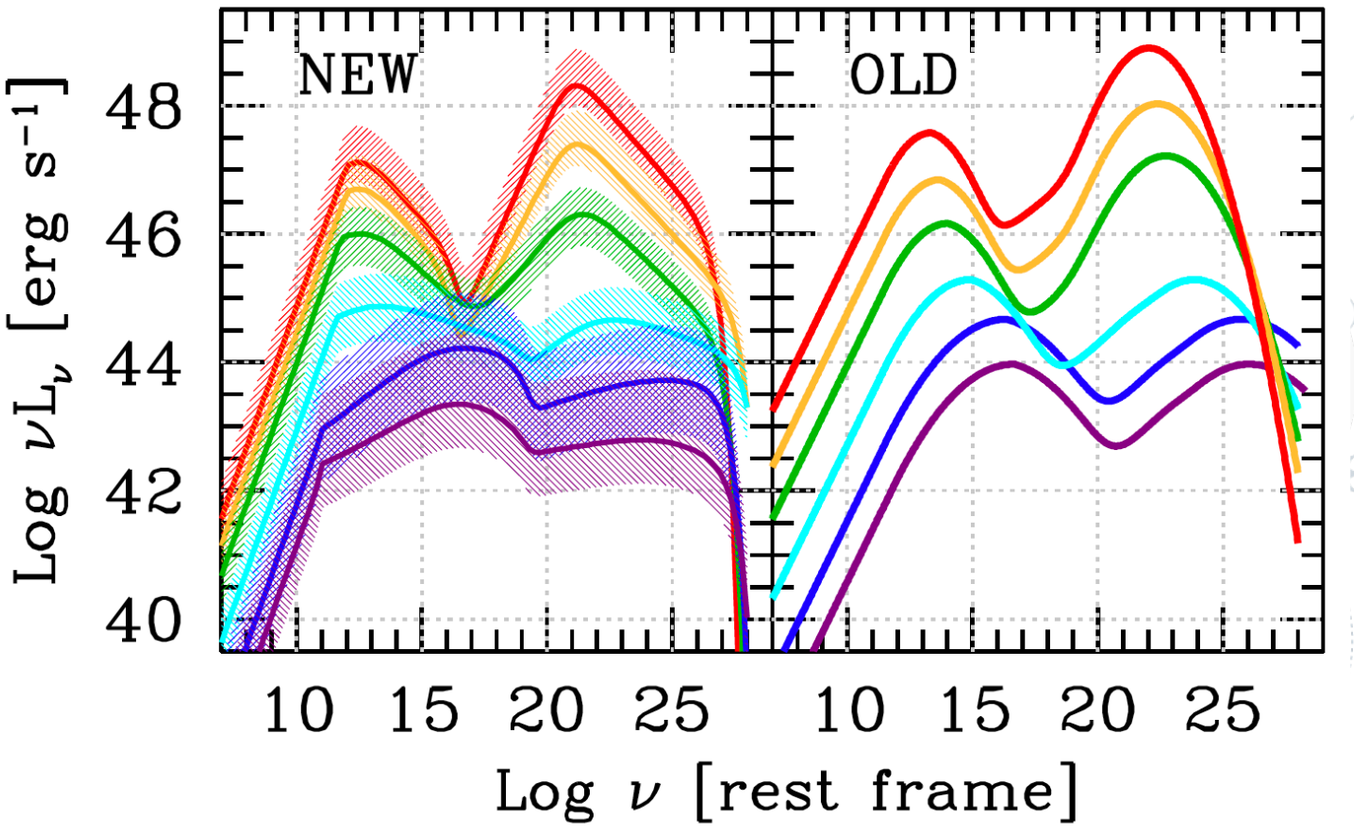
1. You can now run the SED builder on the source you have chosen. **Be careful! This must be of blazar type**

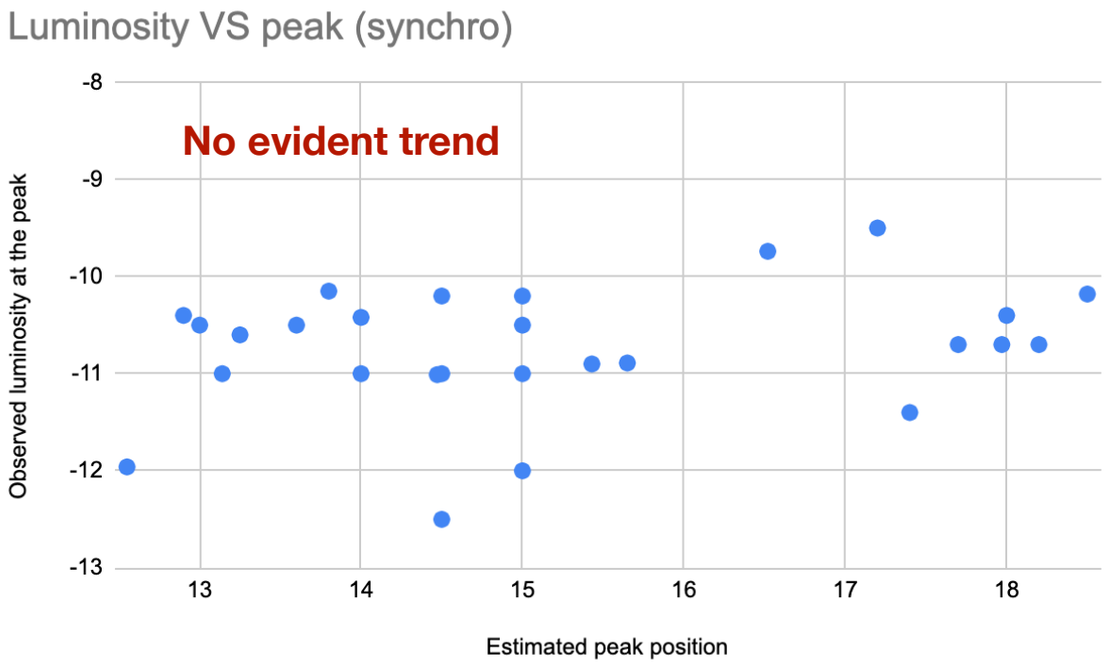
2. Please estimate the peak position and flux level of the synchrotron peak.

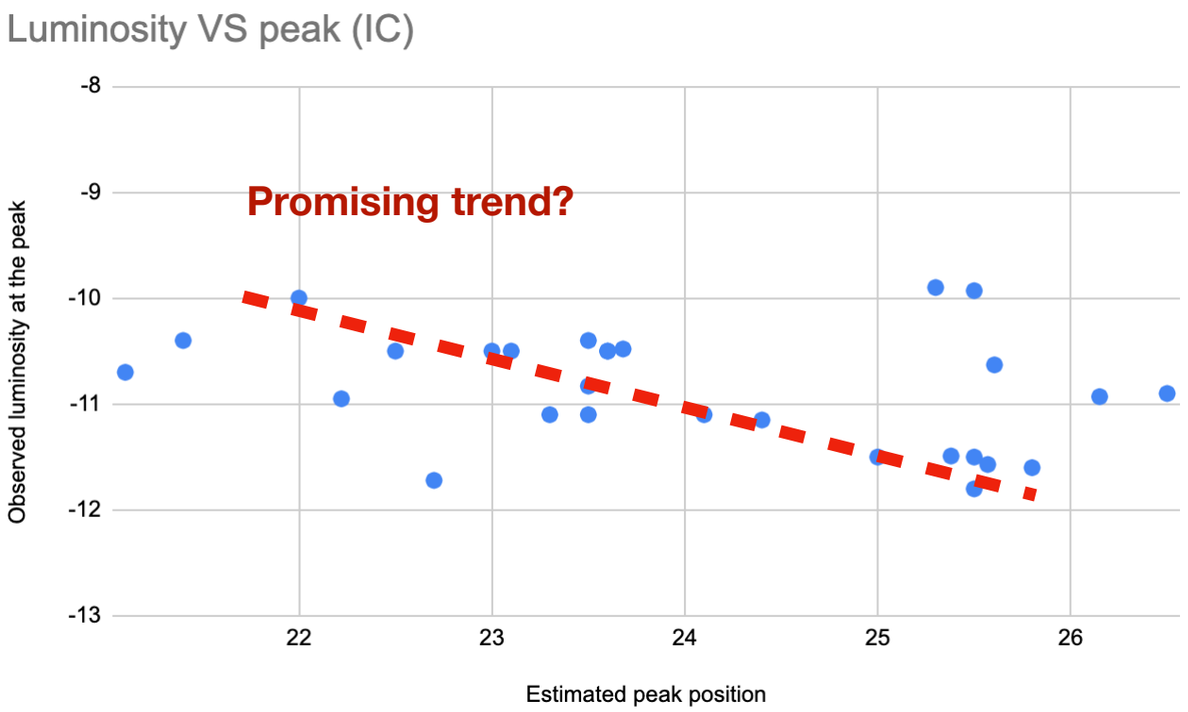
3. You can put your result in a **common document:** https://docs.google.com/spreadsheets/d/1-UqfX8I6buRuK6oz1gc_SF0ArBHk90f-MEp-uMOH6tg/edit?usp=sharing

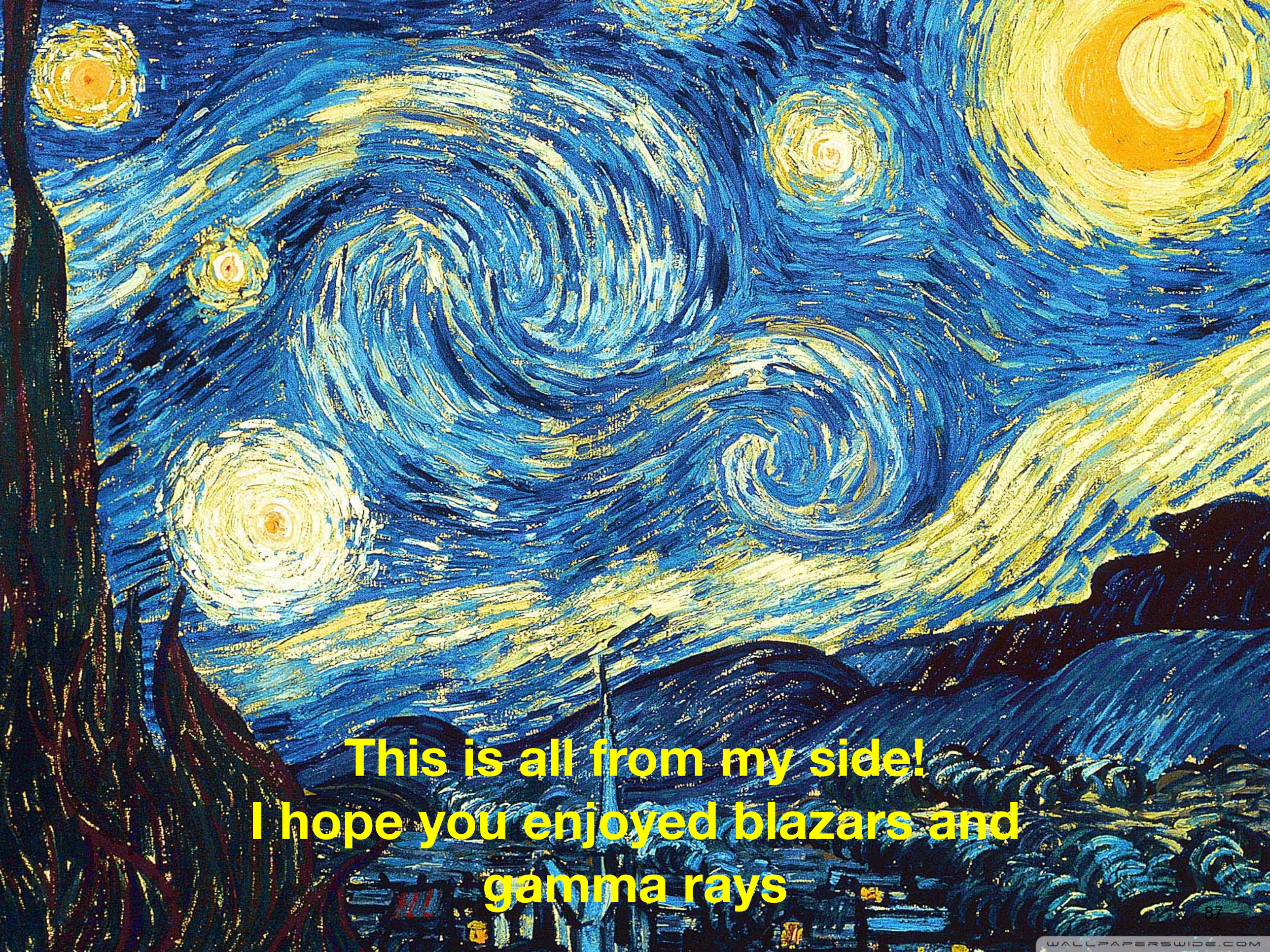
4. Once done, you can chose another source and repeat the estimate!

Final result








This is all from my side!
I hope you enjoyed blazars and gamma rays