The Cherenkov Telescope Array view of some peculiar AGN classes

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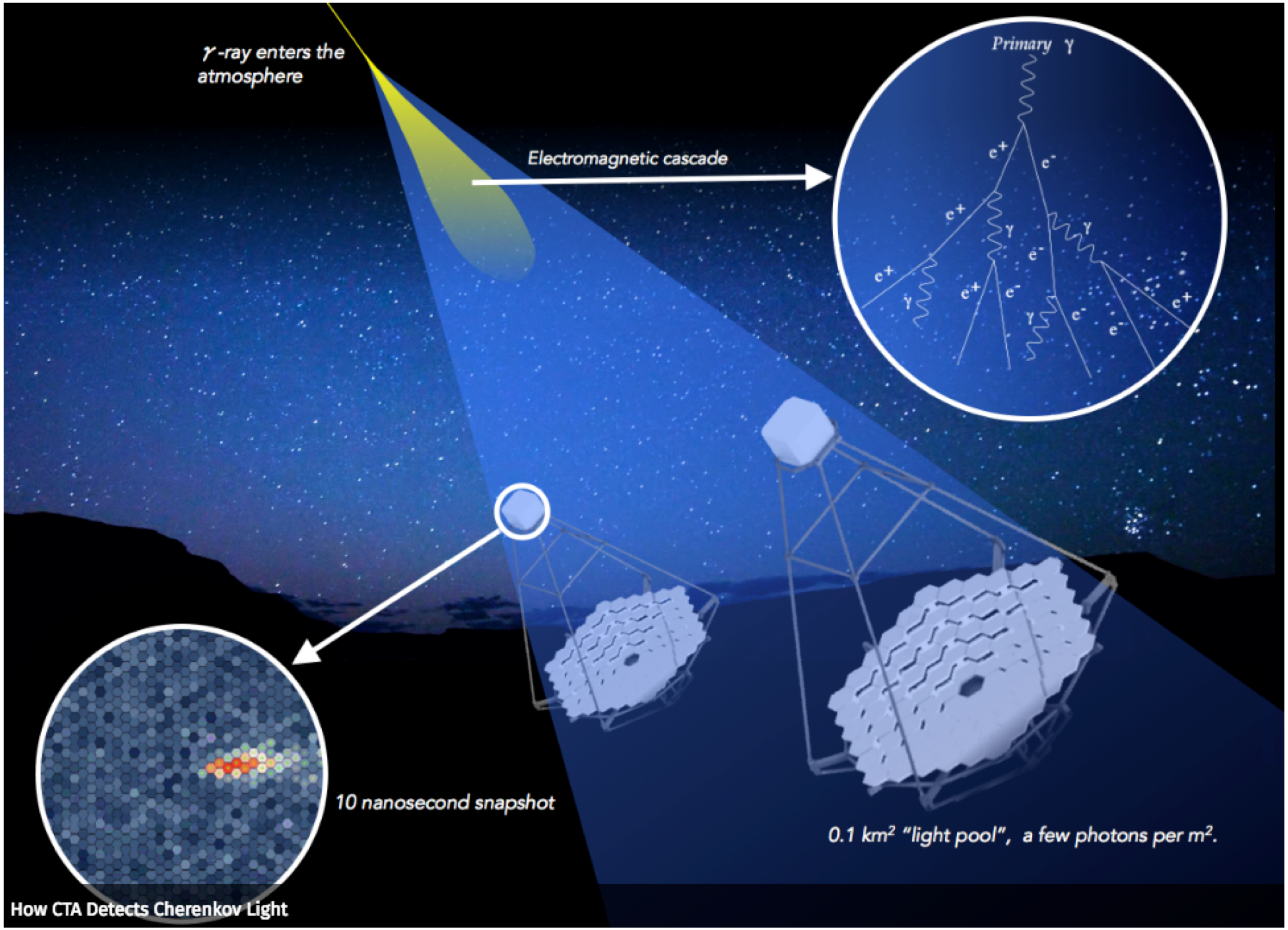
Talk outline

- Introduction to the Cherenkov Telescope Array
- The idea: propose **peculiar science cases** (extragalactic) besides KSP.
- Case 1: Hadron beam from Blazars
- Case 2: Prospects of Observations of NLS1
- Case 3: Game of Winds (the case of NGC1068)

Detecting High Energy γ–ray photons

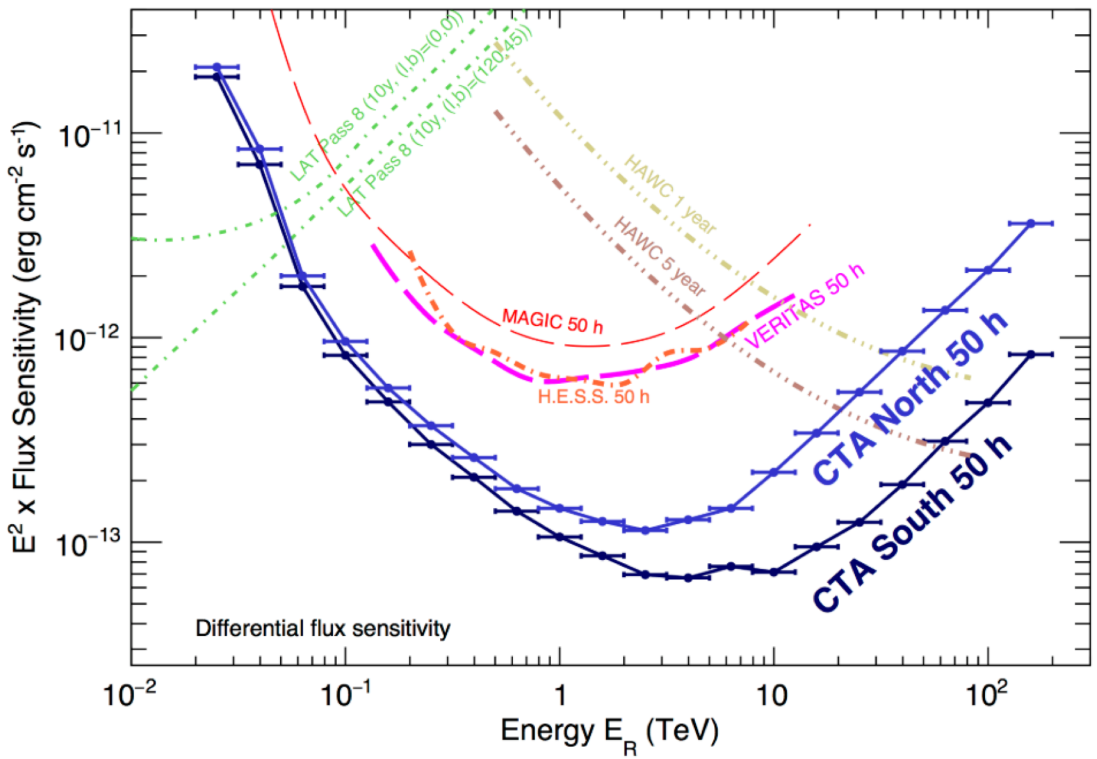


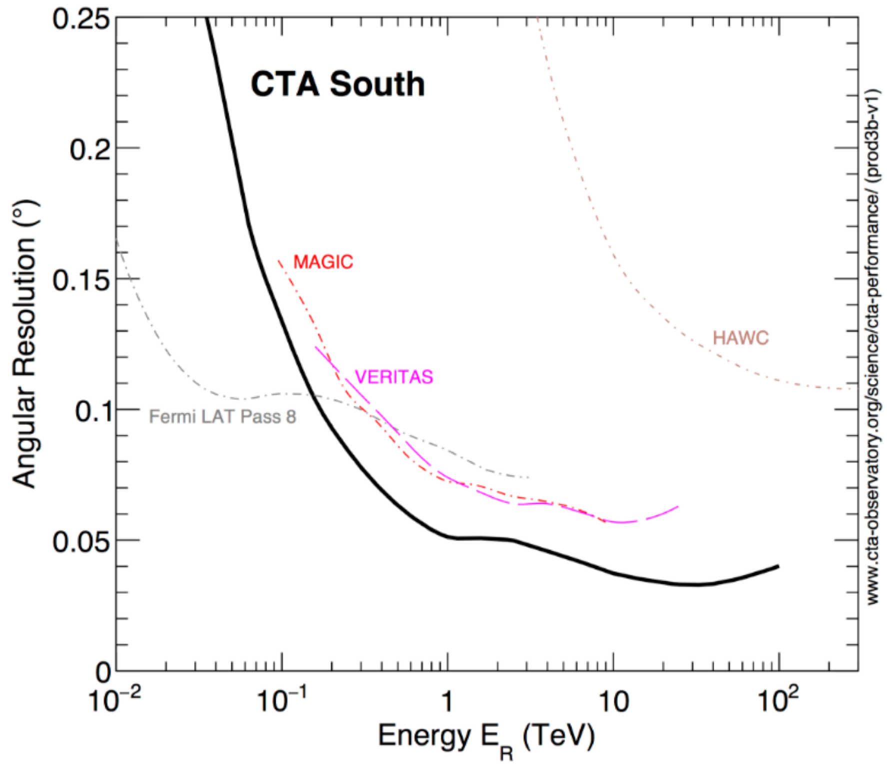
The Cherenkov Telescope Array

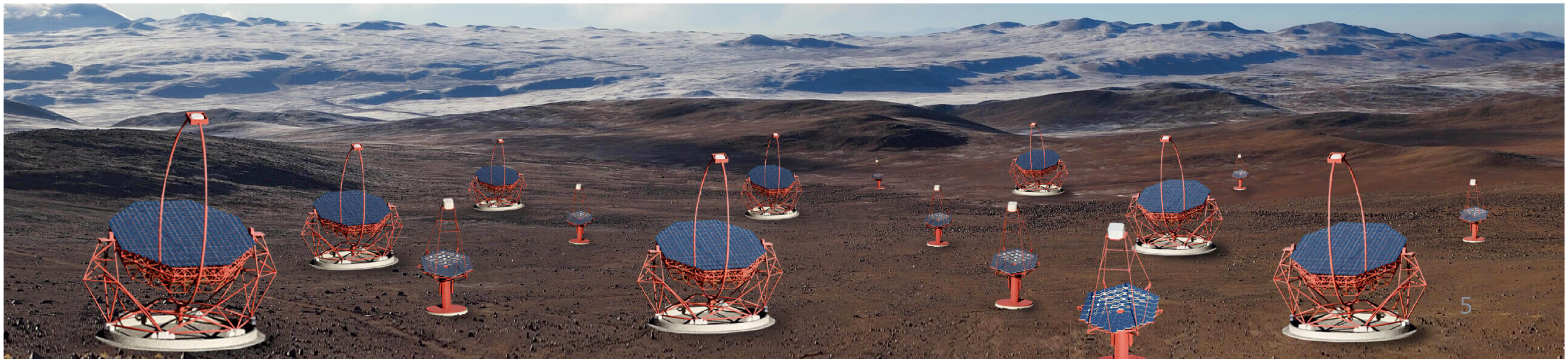
- It will be composed of three arrays of different telescopes:
  - Large-Sized Telescope (LST). Optimized for low energy primary photons (20 GeV – 150 GeV)
  - Medium-Sized Telescope (MST). Characterized by large FoV (7-8 deg) and optimized for energy range between 150 GeV – 5 TeV
  - Small-Sized Telescope (SST). Optimized for high energy primary photons in the energy range 5 TeV – 300 TeV.

Type of telescopes	Number in the Northern site	Number in the Southern site
LST	4	4
MST	15	25
SST	-	70

The Cherenkov Telescope Array

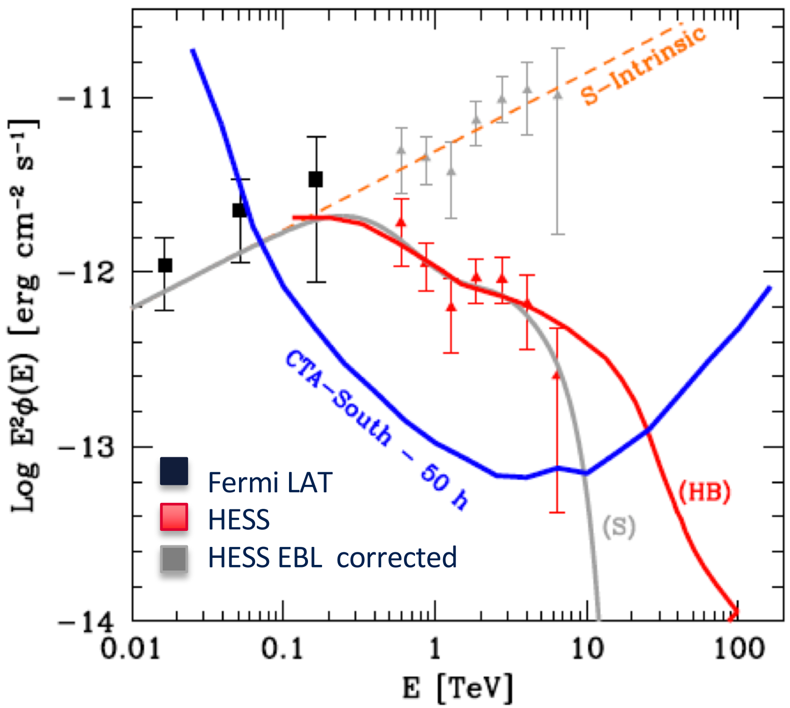


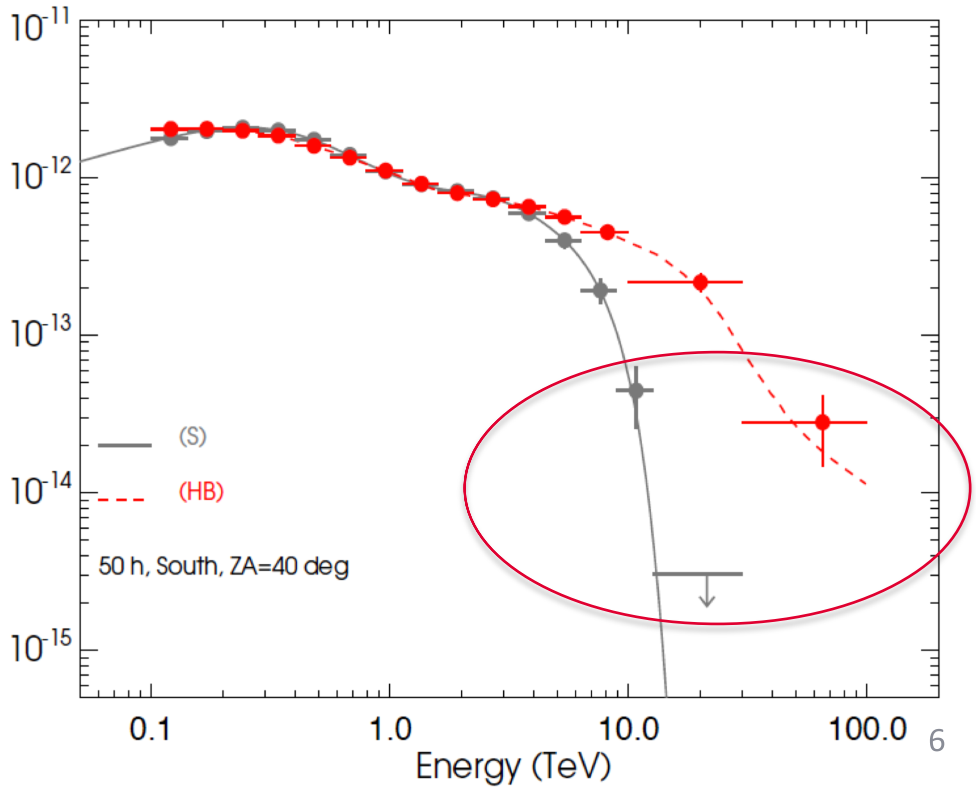




Case 1: Hadron beams with CTA

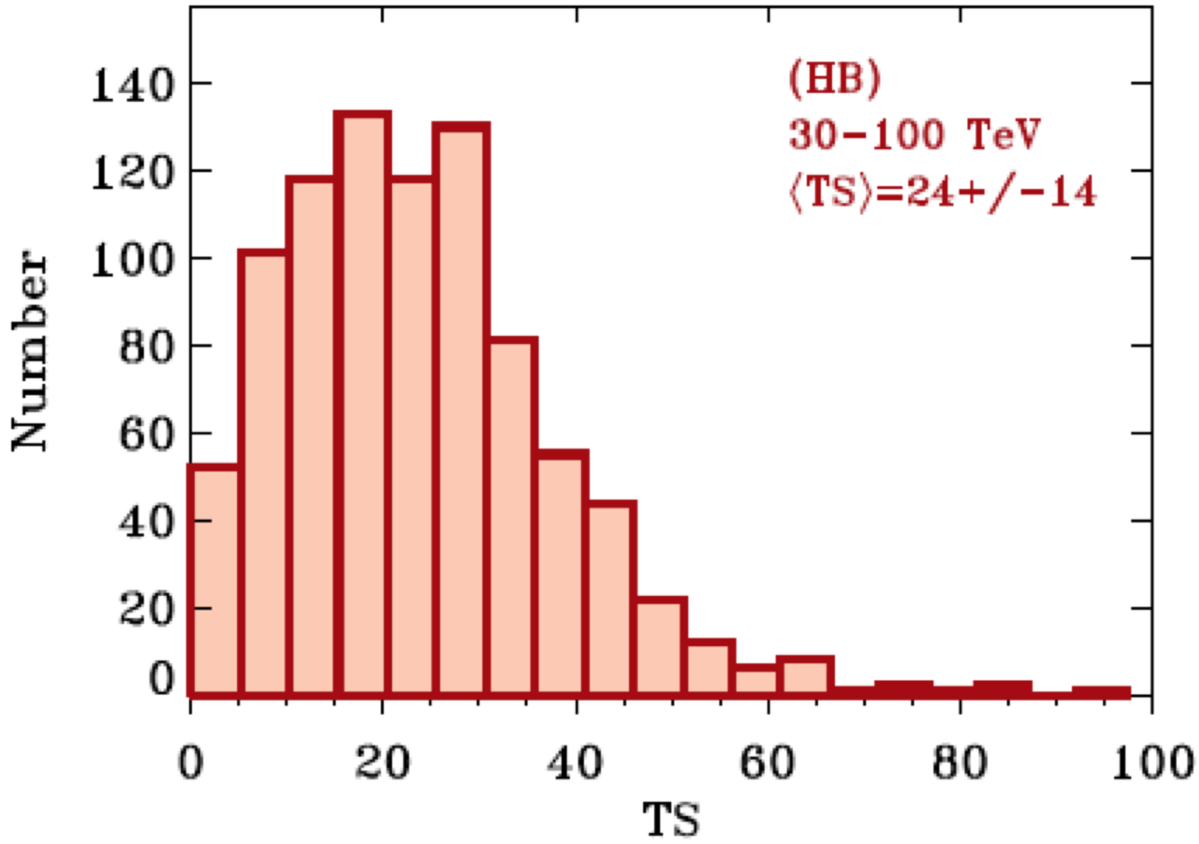
- The main goal: disentangle between pure leptonic + EBL model emission and hadron beams from relativistic blazar jets.
- We took the most promising source 1ES 0229+200 and tested the two different scenarios with deep simulations (using ctools, see also poster from Landoni et al 2018).





Tavecchio et al 2018 MNRAS, submitted

Hadron beam detection significance



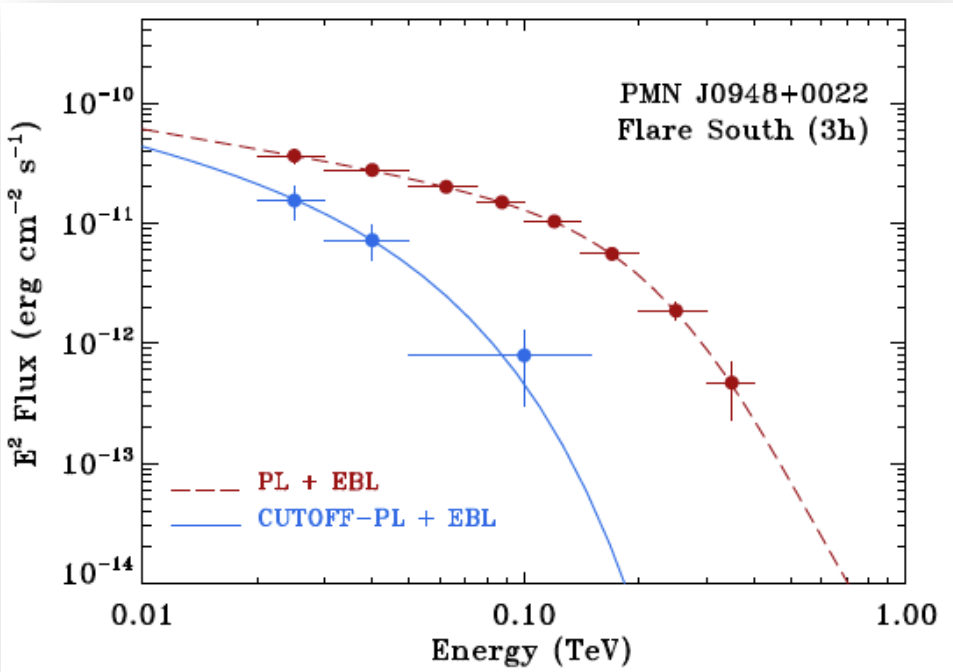
Case 2: NLS1 prospects with CTA

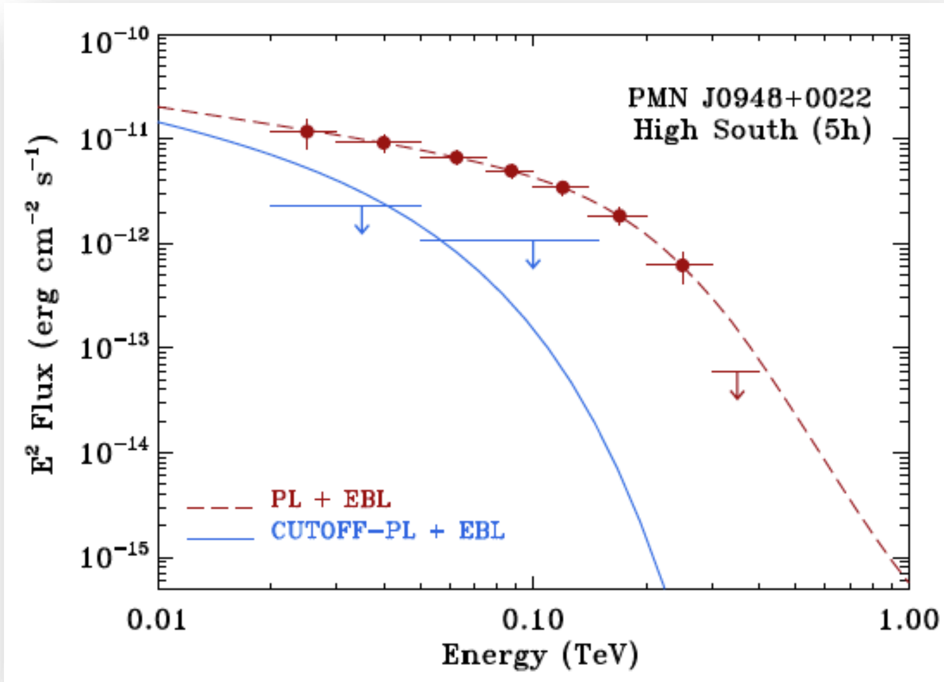
- Looking for VHE emission from NLS1 galaxies
  - About 4-7% are radio-loud and present flat radio spectrum resembling jetted sources
  - Sample of 18 sources γ-ray NLS1s (+2 candidates)
  - None of them have been detected at VHE by current imaging atmospheric Cherenkov telescope.
  - High and flaring states can last 1-3 days, a promising time-scale for CTA, when compared with Fermi-LAT in the overlapping energy ranges.
  - See Poster by Romano et al for detailed discussion
  - **Romano+2018, MNRAS, in press, arXiv:1809.03426**

Case 2: NLS1 prospects with CTA, results

The γ-ray emitting region may not always be placed at the same distance from the central black-hole during different flaring episodes of the same source [Foschini+2011].

Detection of TeV photons [Albert+08, Ahnen+15] and the dramatic change of the position of the sync. & IC peaks in some blazars during extreme flares [Ghisellini+13, Pacciani+14, Ahnen+15] support the idea of a dissipation region outside the BLR.

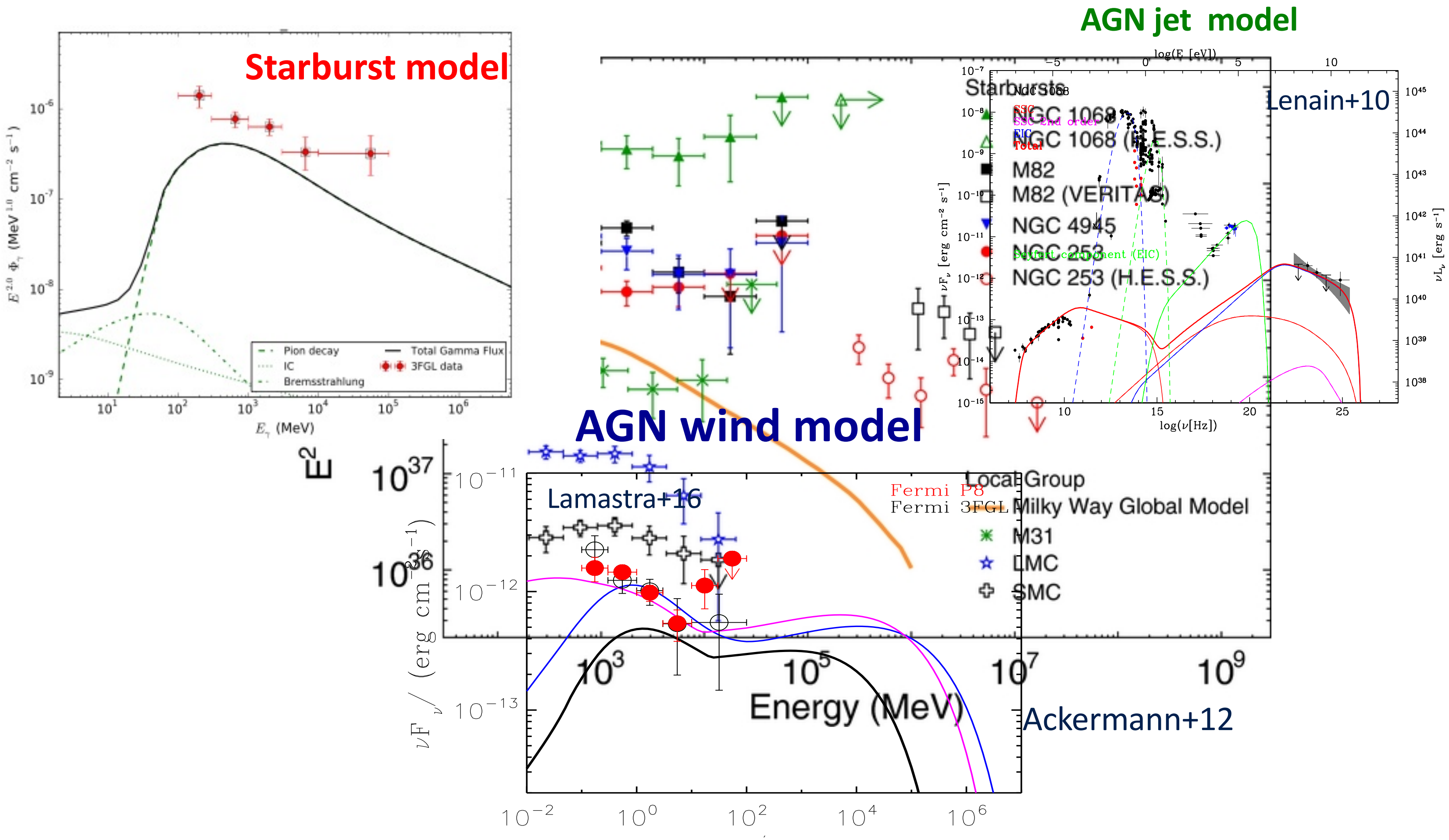




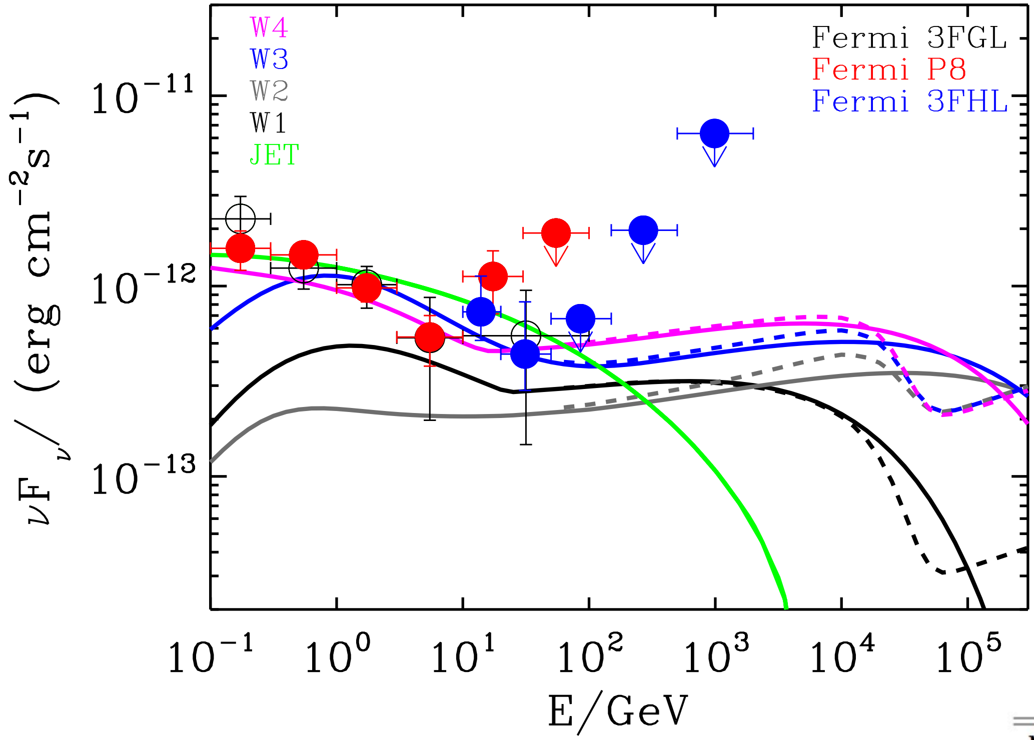
Romano et al 2018 MNRAS, in press, arXiv:1809.03426

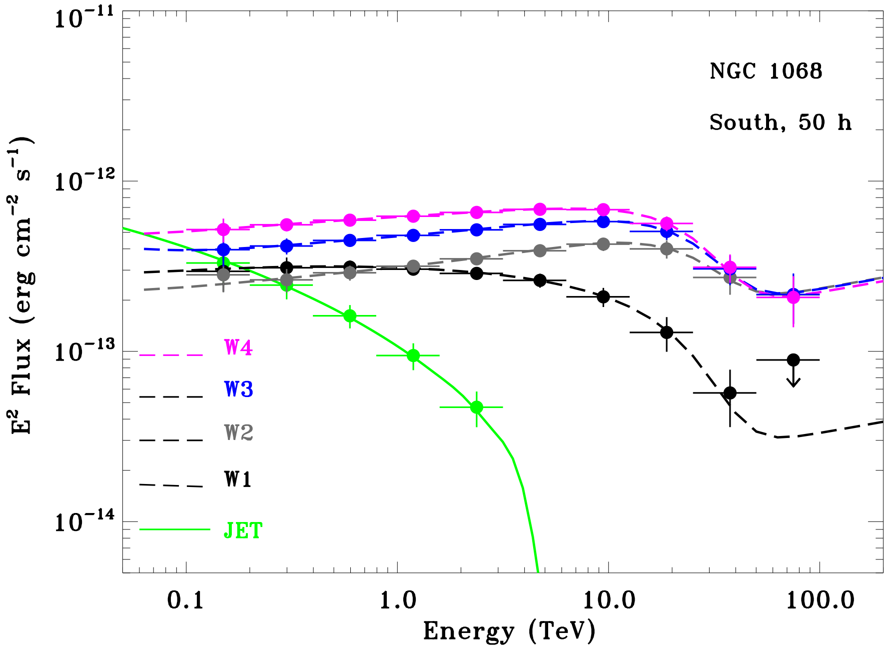
Case 3 – Games of winds

- We started from the prototypical Seyfert 2 galaxy NGC 1068.
- NGC 1068 has been detected not only in radio (VLA), infrared (ALMA) and X-Rays (NUSTAR) **but also** by FERMI at γ–rays



Simulations and analysis





Model	Site	zAngle (deg)	IRF	Expo (h)	Bins	Energy (TeV)	Number
W1	S	20	South_z20_average_50h	50h	10	0.1–100	1000
W2	S	20	South_z20_average_50h	50h	10	0.1–100	1000
W3	S	20	South_z20_average_50h	50h	10	0.1–100	1000
W4	S	20	South_z20_average_50h	50h	10	0.1–100	1000
Jet	N	20	North_z20_average_50h	50h	5	0.1–3.2	1000
Jet	S	20	South_z20_average_50h	50h	5	0.1–3.2	1000

AGN wind model: Lamastra+16 model + EBL absorption + electromagnetic cascade

AGN jet model: Lenain+10 model reproduced using the code by Maraschi & Tavecchio 2003

Conclusions

- We started a program to exploit the capabilities of the new CTA Observatory for new science cases in addition to KSPs.
- We adopted our novel approach to distributed and parallel computing (see poster from Landoni et al 2018) to optmise the simulation tasks and explore many science cases at a time.
- We presented three extragalactic main science cases in the context of the PRIN «Probing particle acceleration and γ-ray propagation with CTA and its precursors»
- New ideas and collaborations are welcome!