INSIGHTS INTO THE PHYSICS OF VERY HIGH ENERGY TRANSIENT EVENTS WITH IMAGING ATMOSPHERIC CHERENKOV TELESCOPES

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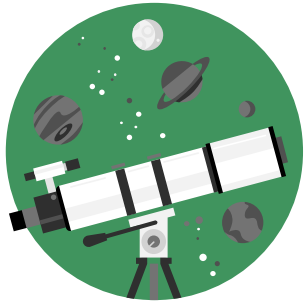
INAF / OA Roma

1st VHEGAM Meeting, 15-17 January 2024

Credit: MIT Technology Review



WHAT WE DO KNOW

- **Transient** events: $10^{-3}s(\mathrm{sGRB}) - 10^{2}s(\mathrm{lGRB})$.
- **Isotropic** sky distribution.
- $\mathrm{E} \sim 10^{50} - 10^{54}\mathrm{erg}$.
- **High-redshift** sources.
- **Prompt** emission (hard-X/soft-γ) and **Afterglow** (X/radio).
- **VHE** emitters (some of them).
- Observed link with **CCSNe** Ib/Ic events and with **GWs**.

Credit: NASA/DOE/Fermi LAT Collaboration

WHAT WE DO NOT KNOW

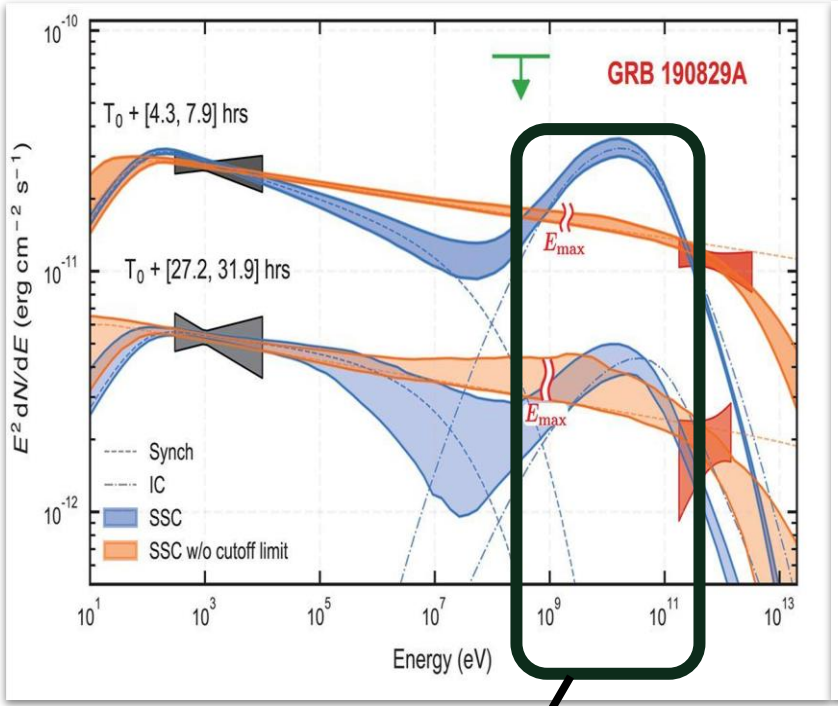
- Which is the emission **model** at work?
- Which are the emission **mechanisms**?
- Do all GRBs have a **VHE component**?
- How GRBs are linked with **GWs events**?
- How to explain the **connection** between GRBs and CCSNe?

Credit: NASA/DOE/Fermi LAT Collaboration

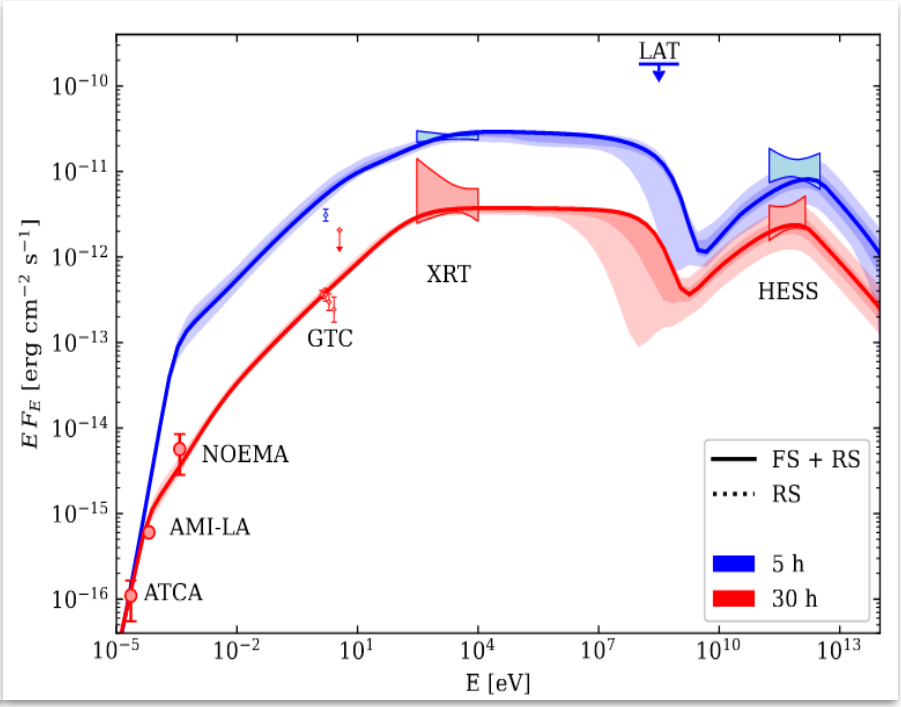
An example: Synch vs SSC models for GRB 190829A

- **Which are the emission mechanisms?**

HESS Coll. 2021, Science , 372, 6546



Salafia et al. 2022, The Astrophysical Journal Letters, 931.2, L19

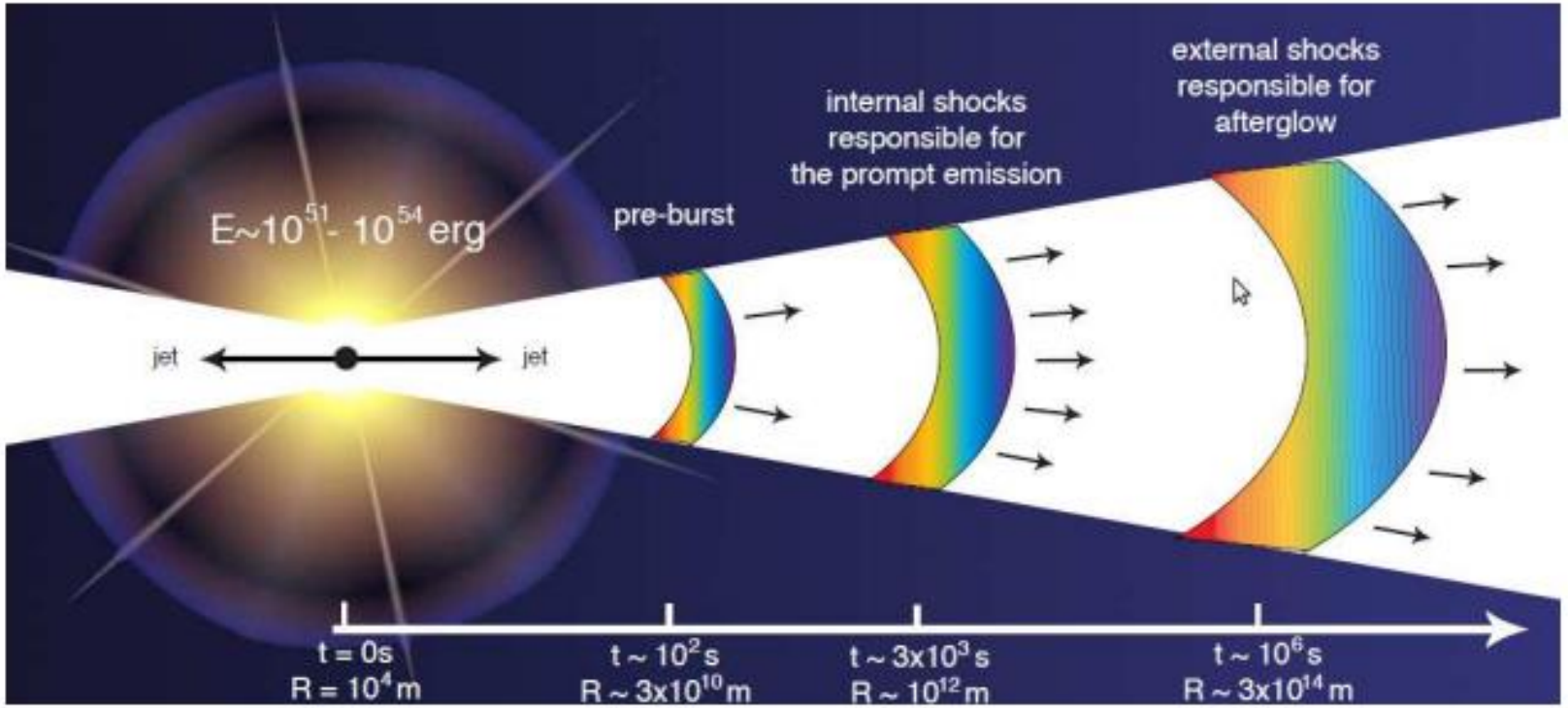


Crucial region to discriminate between models we expect CTA/LST to explore.

Credit: NASA/DOE/Fermi LAT Collaboration

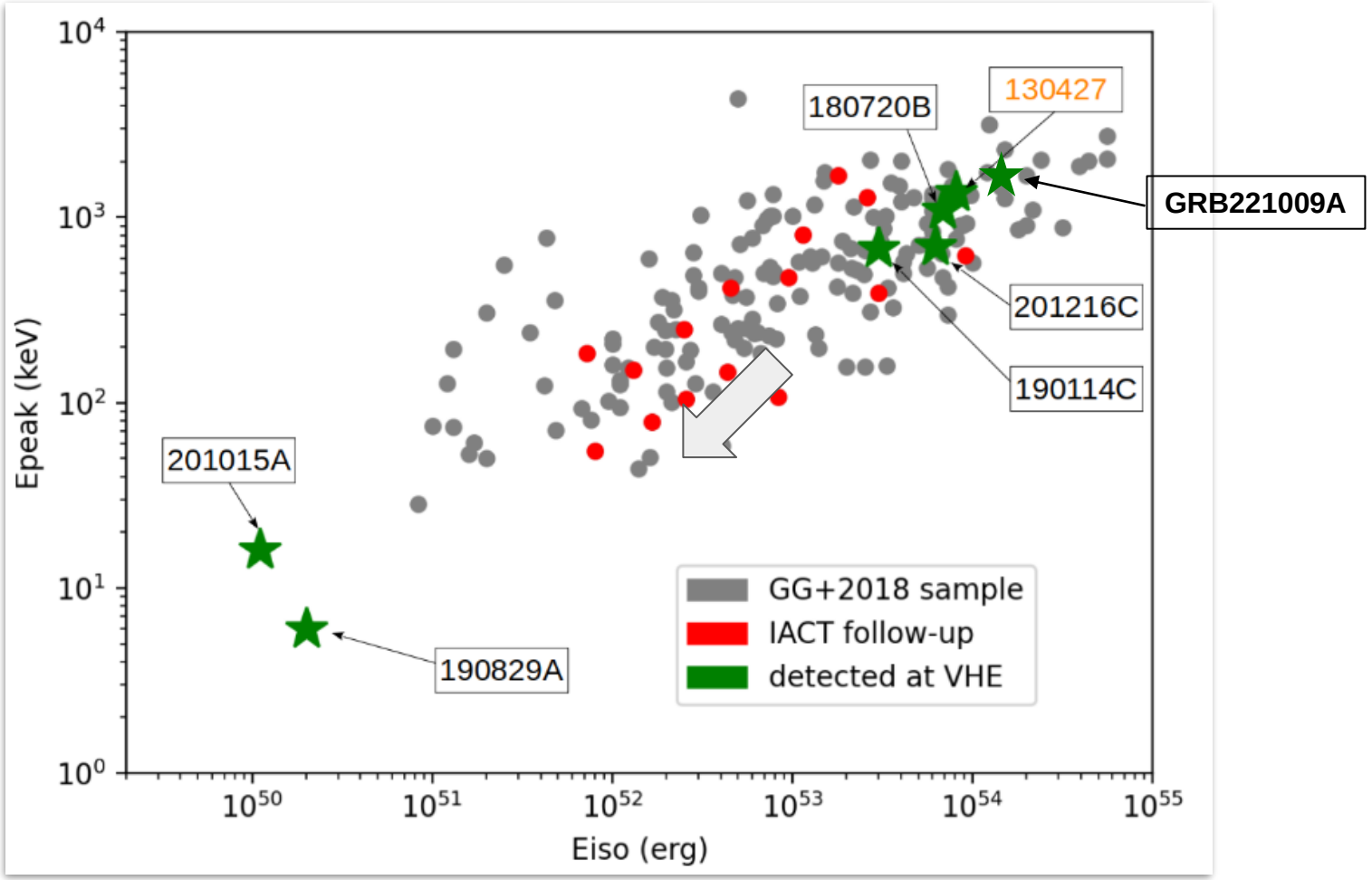
An example: the fireball model

- **Which is the emission model at work (internal/external shock model or magnetic reconnections)?**



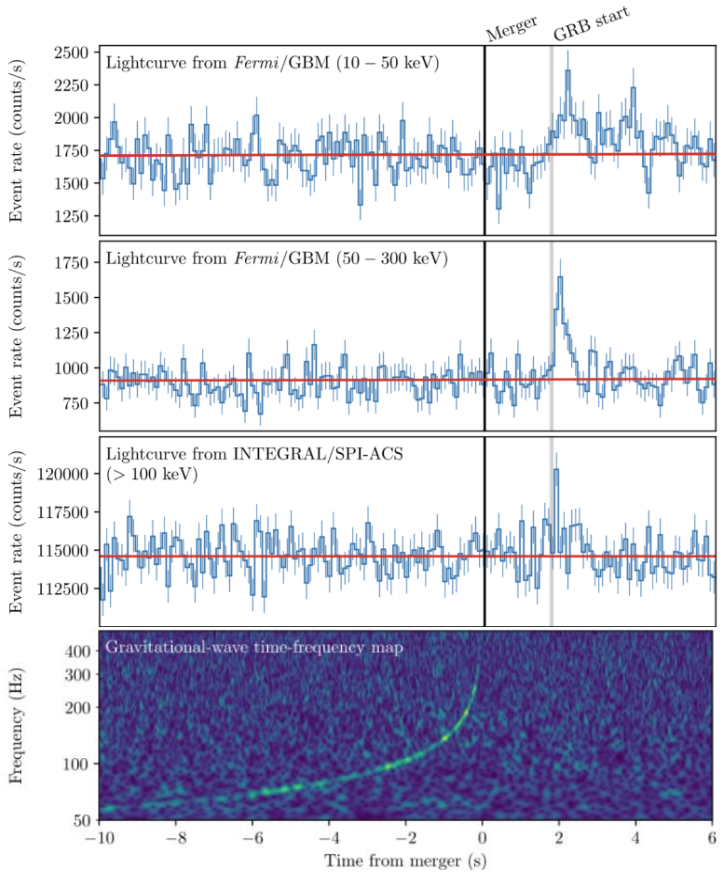
Credit: NASA/DOE/Fermi LAT Collaboration

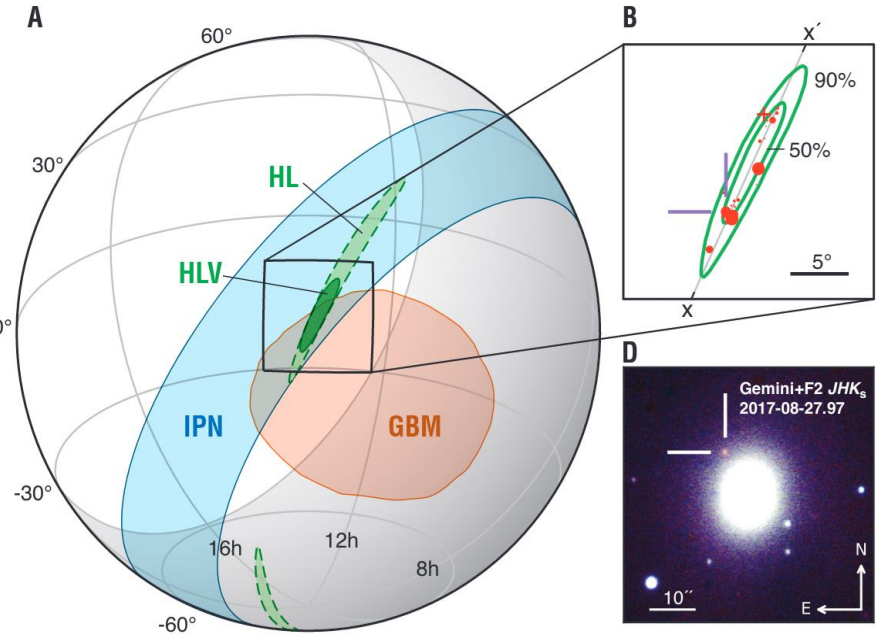
- **Do all GRBs have a VHE component?**



Credit: NASA/DOE/Fermi LAT Collaboration

- **How GRBs are linked with GW events (off-axis GRB)?**





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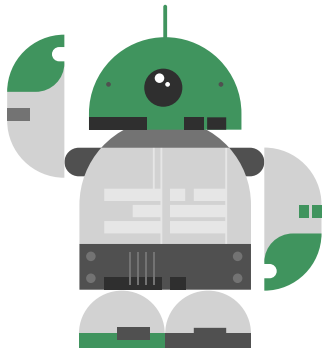

WHAT WE DO

- Use **broadband** observational **data**, including the VHE data from **MAGIC and CTA/LST1** (follow up campaigns, data analysis).
- Investigate different **emission scenarios** and **physical processes** (discrimination of leptonic/hadronic emission in prompt and afterglow emission).
- Investigate **the link between GRBs and GWs** (multimessenger event/optical counterpart from GRB /follow up of event of interest).

Credit: MIT Technology Review

THANK YOU

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