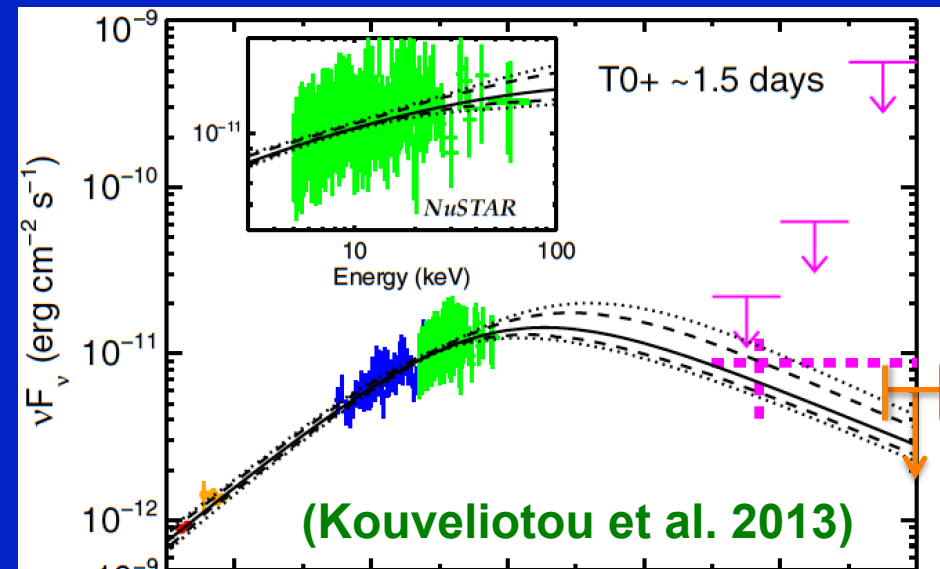
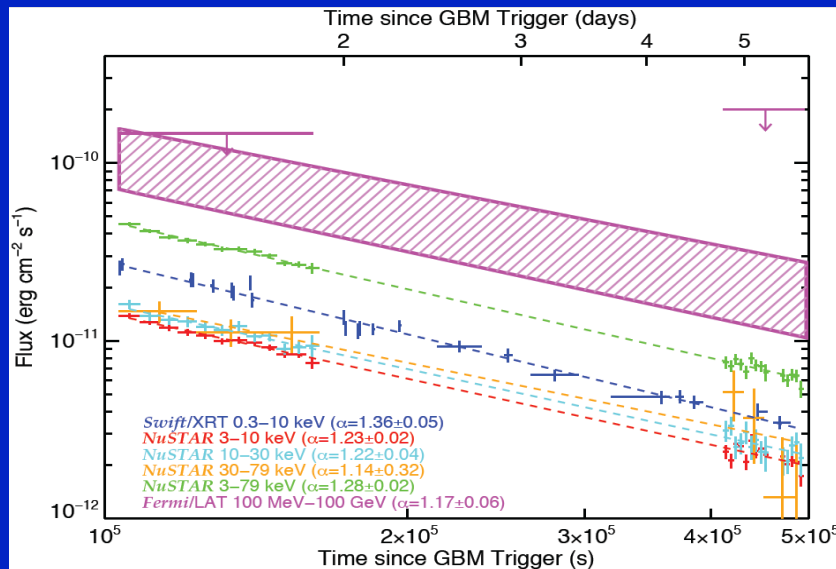


GRB130427A: evidence for genuine violation of $E_{\text{syn,max}}$

Jonathan Granot

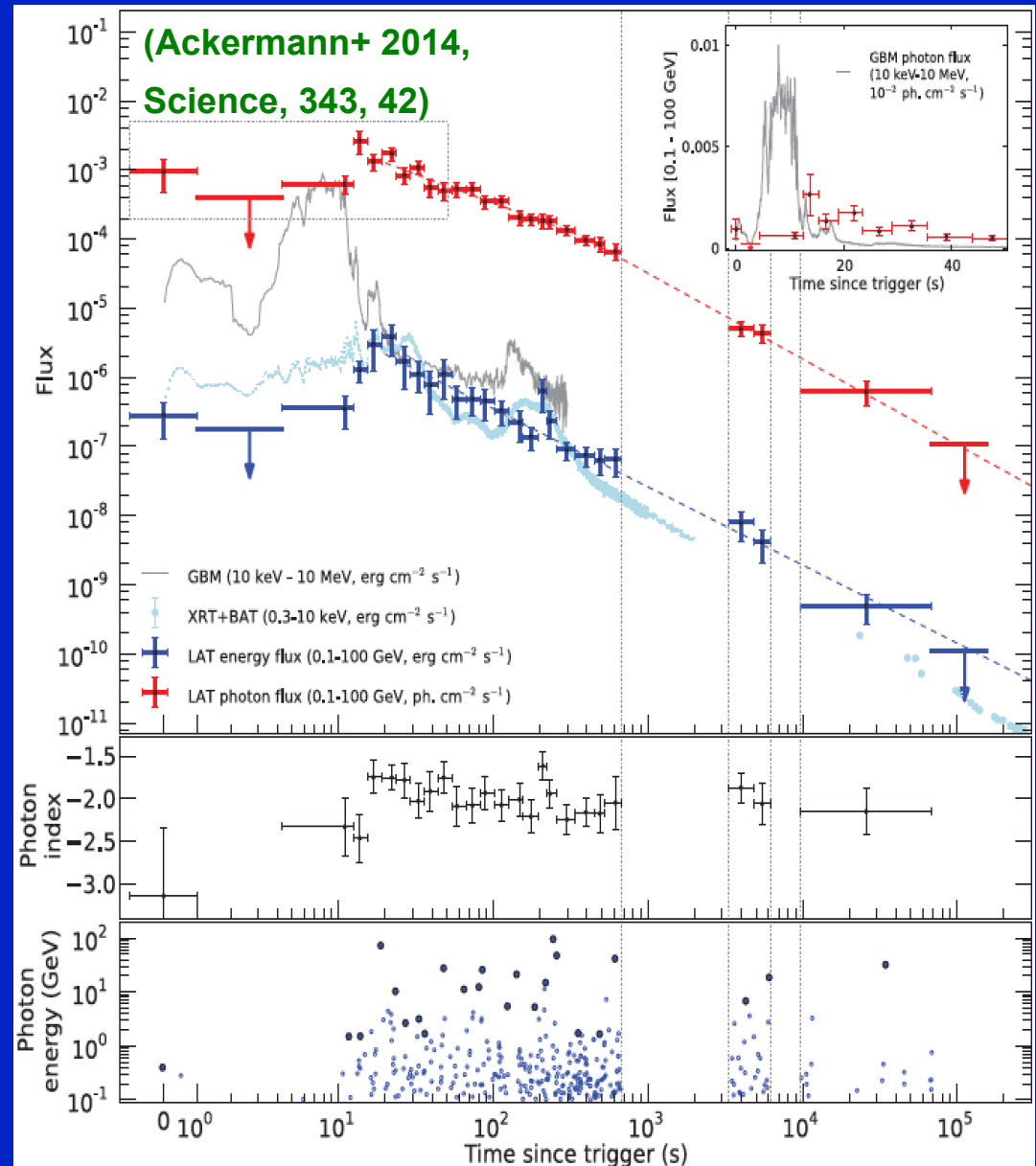
Open University of Israel



The 1st Capitol Chat, on “GRBs and their prompt emission radiation mechanism”, June 9, 2015, GWU, Washington DC, USA

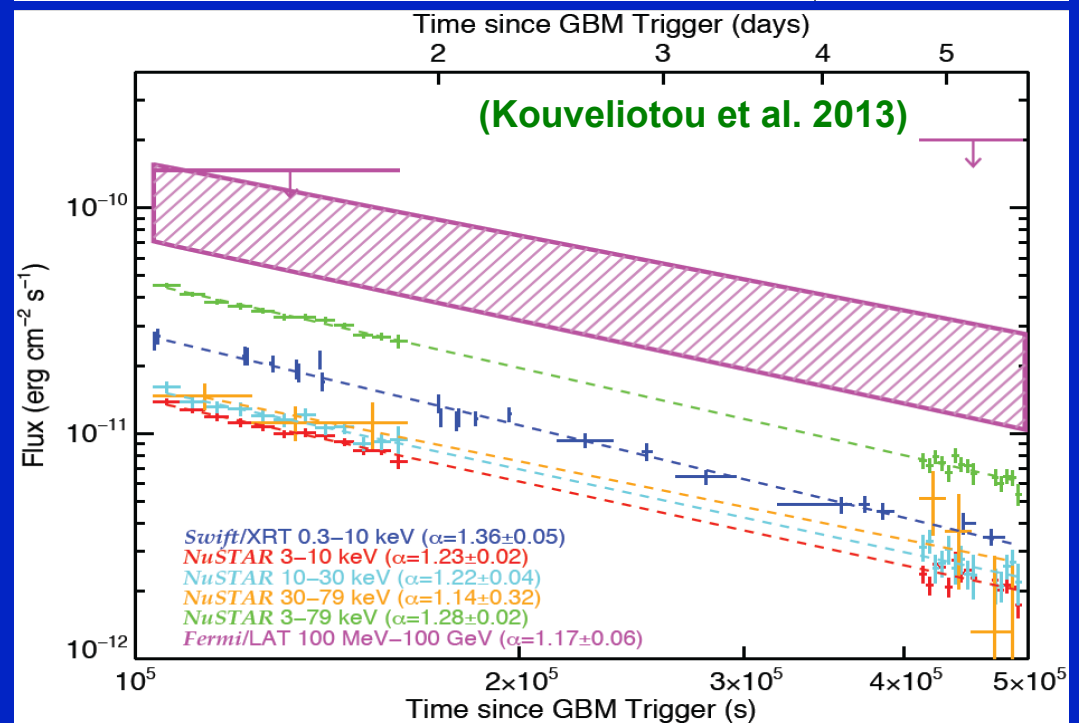
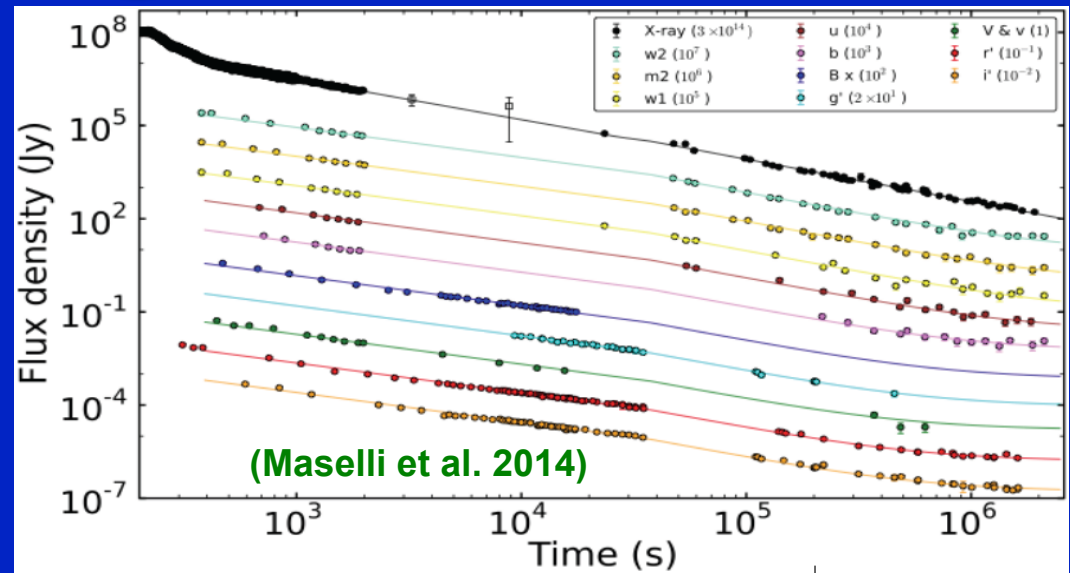
High-Energy Afterglow: GRB130427A

- LAT detected emission up to ~ 20 hr after GRB
- >10 GeV γ 's observed up to hours after GRB
- May arise at least partly from the prompt γ -ray emission up to few 10^2 s
- At later times there is no prompt emission, only a simple power-law decay: **afterglow**



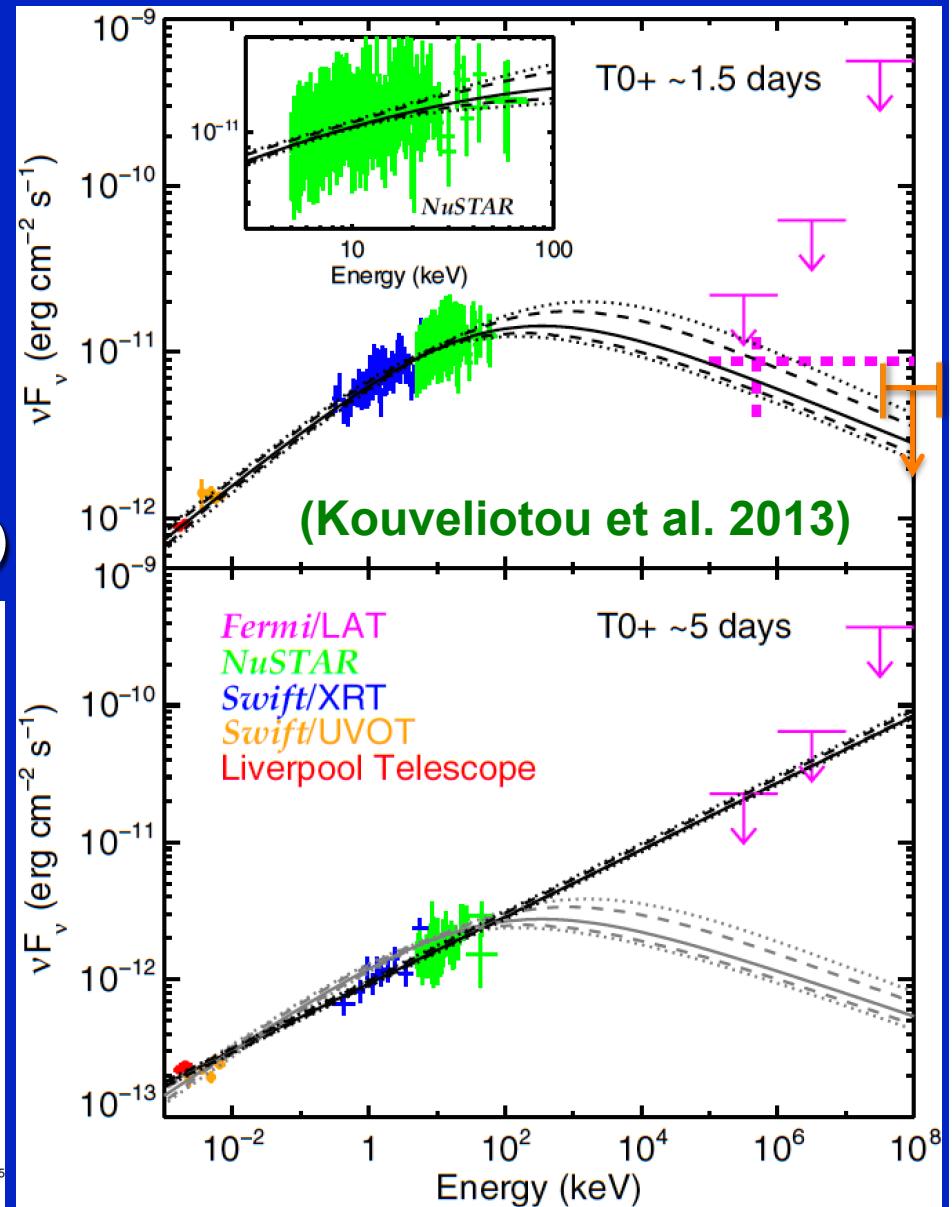
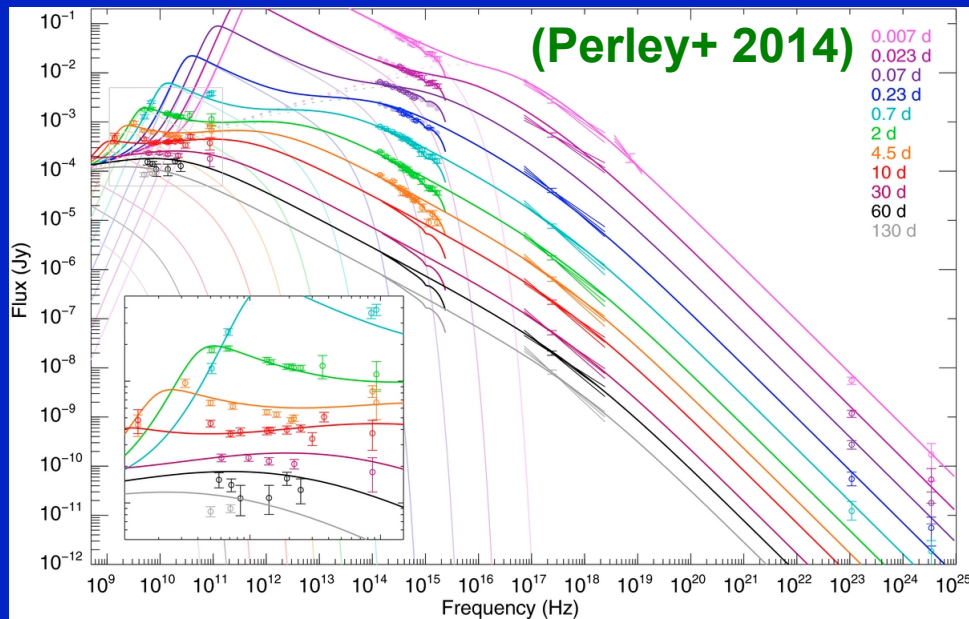
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High-Energy Afterglow: GRB130427A

- **NuSTAR**: 1st late-time GRB afterglow detection at **3-79 keV**
- A **single-component synchrotron spectrum** nicely fits all energies
- No need or much room for SSC
- Also supported by VERITAS obs. (see poster 9.08 by Jeremy Perkins+)



High-Energy Afterglow: GRB130427A

- LAT HE photons violate:

$$E_{\text{syn,max}} \sim \frac{\Gamma}{(1+z)} \frac{m_e c^2}{\alpha} \approx 5 \left(\frac{\Gamma}{100} \right) \text{ GeV}$$

- Based on a one-zone model balancing electron energy gains and losses: $t_{\text{acc}} \sim t_{\text{syn}}$

- $t_{\text{acc}} \sim 1/\omega_L = R_L/c$ (extremely fast) or $P_L = 2\pi/\omega_L$ (still very fast but a bit more realistic)

- An “easy way out” would be if SSC emission dominated at highest LAT energies (Fan+ 2013; Liu+ 2013), but it doesn't work

- $\Rightarrow E_{\text{syn,max}}$ appears to be truly violated $\Rightarrow \geq 1$ assumption must break

- Non-uniform magnetic field?

$E_{\text{syn,max}}$ grows by a factor of B_1/B_2

