Time Stretching of the GeV Emission of GRBs





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GRB 130427A X-rays, Swift

Fermi-LAT 100 MeV — 300 GeV

100 MeV - 1 GeV 1 GeV - 300 GeV

100 MeV - 1 GeV 1 GeV - 300 GeV

are the light curves in these bands similar?





Time, sec







Time, sec







Time, sec

1 GeV — 300 GeV radiation is time stretched with respect to 100 MeV — 1 GeV radiation 1 GeV — 300 GeV radiation is time stretched with respect to 100 MeV — 1 GeV radiation

Why?

t = 0







t = 1



1. Jet of plasma







1. Jet of plasma 2. $\chi = 300$





t = 3

- 1. Jet of plasma
- 2. y = 300
- 3. Plasma consists of radiators



t = 5 Geometry

1. Jet of plasma

2. $\chi = 300$

- 3. Plasma consists of radiators
- 4. Most energetic radiators near the jet axis



t = 5 Geometry

- 1. Jet of plasma
- 2. $\chi = 300$
- 3. Plasma consists of radiators
- 4. Most energetic radiators near the jet axis



t = 5

Geometry

- 1. Jet of plasma
- 2. $\chi = 300$
- 3. Plasma consists of radiators
- 4. Most energetic radiators near the jet axis

Low Energy Plasma

High Energy Plasma

t = 5



Low Energy Plasma

$$\eta(r,\theta,\omega) = \eta_0 \frac{1}{1 + \left(\frac{r}{r_0}\right)^n} \exp\left(-\left(\frac{\theta}{\theta_0 \left(\frac{\omega}{\omega_0}\right)^k}\right)^2\right) \left(\frac{\omega}{\omega_0}\right)^\alpha$$

High Energy Plasma





, Low Energy Plasma





t = 5

Geometry

Low Energy Plasma

$$\eta\left(r,\theta,\omega\right) = \eta_0 \frac{1}{1 + \left(\frac{r}{r_0}\right)^n} \exp\left(-\left(\frac{\theta}{\theta_0 \left(\frac{\omega}{\omega_0}\right)^k}\right)^2\right) \left(\frac{\omega}{\omega_0}\right)^\alpha\right)$$

High Energy Plasma







Burst	Stretching factor
080916C	0.67 — 3.32
90510	0.43 — 1.61
090902B	0.36 — 0.89
090926A	1.99 — 6.62





$$\eta\left(r,\theta,\omega\right) \stackrel{\rho^{\pm}}{=} \eta_{0} \frac{1}{1 + \left(\frac{r}{r_{0}}\right)^{n}} \exp\left(-\left(\frac{\theta}{\theta_{0}} \frac{\gamma}{\omega_{0}}\right)^{k}\right)^{2}\right) \left(\frac{\omega}{\omega_{0}}\right)^{\alpha}$$















No extra components required





No extra components required

All bursts might be the same in their rest frames

Questions?

https://github.com/maxitg/GammaRays

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Time, sec















Time, sec





















Stretching Factor

