GRBs, Fireballs and Processing Gamma Jets
Since GRB980425 we argued (Fargion 1998-2000) that GRBs and SGRs can be explained by a comprehensive theory where a thin (tens of seconds) γ beam Jet, spinning in multi-precession, is sprayed by a Neutron Star, NS, or a Black Hole, BH, flashing and blazing the observer. Indeed the extreme energy released in GRB000123 and GRB000131, (\( \geq 10^{54} \text{ erg} \)), (or even twice as much, keeping into account neutrino budget) leads to a conflict with any isotropic GRB model: Schwarzschild scale times (corresponding to the needed solar masses), above milliseconds, disagree with the observed GRBs fine time structures (below a fraction of millisecond). GRBs and SGRs share, in a few cases, the same spectra (Fargion 1998-1999-2000; Wood et al. 1999) and time structure, suggesting an unique model. The γ Jet for GRB and SGR is produced, through Inverse Compton Scattering (ICS), by GeVs \( e^+ e^- \) (secondaries of penetrating GeVs \( \mu^+ \mu^- \)), scattering on infrared photons, (Fargion, Salis 1995-1998), leading to a collimated, spinning and precessing γ (MeVs) precessing Jet.

![Image](image_url)

**Fig. 2.** Lower figures show two different angular Jet patterns, as traced in Fig.1. Their b-axis opening angles while spinning and precessing, are blazing the observer at the center (origin \((0,0)\)) leading, by ICS, to the consequent GRB signal described above. Upper figures show the the consequent X, GRB intensity evolution (time in see) derived by the ICS formula and the corresponding geometrical Jet patterns evolutions below. The X ray precursor may naturally arise in some pattern configurations.

The peak γ Jets has power of a Supernova (\(10^{54} \text{ ergs}^{-1}\)) appearing beamed as \((10^{52} \text{ ergs}^{-1})\) decaying by power law \(\sim t^{-1}\) in 3-6 hour scale times, to ancient,
lower power SGRs stages. SGRs are powered by X-ray pulsars Jet \( (10^{35} \text{ergs}^{-1}) \)
whose collimated beam is amplified up to \( (10^{43} \text{ergs}^{-1}) \). Both of GRB and SGR
show an apparent luminosity amplified by the inverse of the beamed solid angle
\( (10^7 - 10^8) \). The earliest and puzzling X-Ray precursors in few GRBs (as well as
SGRs) is an obvious peripherical off-axis flashing followed by main in-axis GRB blaze, in some geometrical configurations, as shown in simulations in Fig. 2. Data
on X-Ray precursor and GRB are shown for comparison in Fig.3.

![Graphs showing GRBs and X-ray precursors](image)

**Fig. 3.** Up: Time evolution and X precursors in GRB 971210 and GRB 971212. Down:
The same evolution in GRB 900518 and in most distant (red-shift 4.5) GRB 00131; note the (surprising for Fireball) tiny X-Ray precursor a minute before the main GRB.

**References**