

# 1 Piran

## Denice Gabuzda

*Question* I understand your skepticism about the “Amati Relation”, and the impression that the data for different instruments yields different relations. Could it be that part of the confusion here is due to several different types of physical GRBs, each obeying its own “Amati Relation”? Is there any evidence for this from the available data.

*Answer* While one cannot rule out the possibility of different populations it seems unlikely. The triggering energy range for the BeppoSAX GRBM (on which the original “Amati relation was based” and BATSE are comparable (HETE has a lower energy sensitivity and hence it is detecting more XRFs, which might be different). It is not clear, therefore, what could be the reason for BATSE to detect one physical population and for BeppoSAX to detect another. On the other hand there is a clear difference between the sample with known redshifts used to derive the “Amati Relation” and the average BATSE sample. The bursts with known redshifts are all brighter (as more photons are required for identification of the burst’s position than just for detection). This selection effect can explain the “Amati Relation”.

## Christian Fendt

*Question* (Follow up on a question by Maxim Lyutikov) Do you expect a positive test (proof of the fireball model) from polarization measurements? (I am aware that recent claims of such polarization could not be confirmed).

*Answer* Polarization is indeed a very sensitive measure of the properties of the emitting region and of the emission processes. So far there have been clear measurements of optical polarization during the afterglow phase. These all are at the level of a few percent. Recently there was a claim of a very high ( $\sim 80\%$ ) polarization measurement of the prompt emission (Boggs and Coburn, ??). Let me address both issues, beginning with the latter first. By now two groups have independently repeated the analysis of the RHESSI data and both suggest that there is no evidence for prompt polarization from this burst (???, ???). There was no convincing rebuttal to the arguments of those groups. So on the observational side one can conclude that there is no evidence for polarization of the prompt emission. On the theoretical side it has been claimed that such a high level of polarization “proves” that the magnetic field within the emitting region was homogenous and therefore the flow must have been Poynting flux dominated (Lyutikov, ??). However, we (Nakar, Piran and Waxman, ??) have later shown that: (i) Homogenous magnetic field can arise in any situation in which the field is dragged away from the source. There is no need for the magnetic field to dominate the energy density. (ii) Furthermore, even inhomogeneous random field can, in some cases produce highly polarized the prompt emission. So the fairly vocal claims heard during the last year suggesting that the Poynting flux dominated model has been proved are not justified. Polarized optical afterglow has been detected in several cases.

The polarized afterglow is typically weaker than the one predicted in the uniform jetted fireball and it does not show the predicted flip in the polarization plan (Sari, 99). It has been argued that the observed polarization indicates a “Universal Structured jet” model (Rossi et al., ??). However, in my mind the polarization is best explained by the “patchy shell model” in which different small regions emit coherently but at random directions relative to each other. A beautiful example of this case is given by the theoretical modelling of the afterglow of GRB 02?? by Oren and Nakar (??).