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# GRB 080928 AFTERGLOW POLARISATION ANALYSIS AND GAMMA-RAY BURSTS SPECTRO-POLARIMETRY

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In the context of modern astrophysics, transient phenomena are among the most fascinating and challenging to observe and analyse, usually arising from physically extreme conditions. Gamma-ray bursts (GRBs), the most energetic phenomena in the whole Universe, fall into this category, being produced after the collapse of a massive star or a compact binary merger. Their main emission, lasting from a fraction to hundreds of seconds, peaks in the gamma-rays and it is followed by an afterglow, covering the whole electromagnetic spectrum at different timescales. Despite several years of observations and the large number of GRBs analysed to date, a unique, general picture describing GRBs physics is still missing: further observations and additional, independent techniques are needed to reconcile observations with theoretical models and predictions. Polarimetry constitutes a really powerful tool since it allows us to investigate some features of the source that are difficult to determine with different techniques, such as the geometry of the emitting region and the local magnetic field configuration. Time-resolved polarimetric analysis of GRB afterglows would allow us to compare observed light curves and polarisation curves with theoretical expectations, possibly inferring some features of the burst emitting region and of the physics behind the event.
A not so diffused - yet extremely efficient - technique is spectro-polarimetry, which can allow us to investigate the spectral dependence of the polarised radiation and to identify possible contributions given to the total polarisation by different sources. Indeed, the total detected polarisation could be the combination of intrinsically-polarised radiation emitted from the burst and interstellar polarisation induced by the dust aligned along the line of sight, both in the host galaxy and in the Milky Way. Spectro-polarimetric analysis can tell us if the observed polarisation is due to a standard afterglow (i.e. constant behaviour with lambda) or if it comes from a dominant dust-induced contribution, which is wavelength dependent. However, despite its importance in this context, only a handful of bursts detected by space telescopes were accompanied by ground-based spectro-polarimetric follow-up to date.
In the talk I will present (spectro-)polarimetric analysis of GRB 080928, an event not yet properly analysed, for which multi-epoch polarimetric observations were obtained, both in the imaging polarimetry and spectro-polarimetry modes. The analysis revealed the detection of a polarisation degree $P \sim 4\%$ after 1.70 days from the trigger at $4\sigma$ confidence level, and the comparison with theoretical models suggested the presence of a homogenous jet observed inside the cone. More in general, I will discuss the role of spectro-polarimetry in GRBs afterglow analysis, also showing how it was applied to the other very few bursts analysed with this technique, i.e. GRB 020813, GRB 021004, GRB 030329, GRB 191221B.

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