

Systematic study of magnetar outbursts

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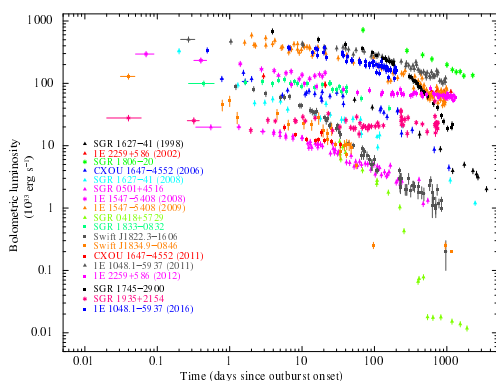


Figure 1: Temporal evolution of the bolometric luminosities for all magnetars showing major outbursts between 1998 and 2016 (Coti Zelati et al., in preparation).

a few observations by the instruments aboard *BeppoSAX*, *ROSAT* and *RXTE* (about 900 observations in total). We tracked the temporal evolution of the absorbed fluxes and the luminosities for all these events (that of the single spectral components and the total one in the X-rays, and also the bolometric luminosity; see Fig. 1 for the light curves of all these episodes). We then modeled empirically the decays of the bolometric luminosities, and we estimated the characteristic decay time scales as well as the total energetics involved for each of these events. We investigated the anti-correlation between the maximum flux (luminosity) increase reached during these episodes and the source quiescent X-ray flux (luminosity), and characterized the link between the energetics released and other parameters of the outburst, such as the X-ray luminosity in the quiescent phase and that at the peak of the outburst. We will soon publish on-line the results of our analysis on a website, making publicly available all files used for the analysis as well as all the material required to reproduce all cooling curves and investigate the interdependence between the characteristic parameters of our sample of magnetars and their outbursts. We will maintain the website with regular updates as new transient magnetars will be discovered.

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In the past decade, extensive study of magnetars in outburst has led to a number of unexpected breakthroughs which have changed our understanding of these objects. So far, several outbursts have been the object of many observational campaigns in the soft X-ray band. Although detailed studies have been conducted for each of these events, an overall systematic analysis of their spectral properties, from the very first active phases throughout the decay, is still missing. **I will present the results of our X-ray spectral modelling for 19 magnetar outbursts occurred over the past 2 decades.** We reduced and reanalysed all the available data acquired by the *Swift*, *Chandra* and *XMM-Newton* X-ray observatories, as well as data collected in