

Fig. 4. Scatter plot of the PCA fluence vs duration for 281 SGR 1900+14 bursts which shows a correlation between them ($\rho=0.54$). The solid line is a power law with an exponent 1.13 obtained using via least squares fitting.

Statistical properties of SGR 1900+14 bursts

Authors: Ersin Gogus, Peter M. Woods, Chryssa Kouveliotou, Jan van Paradijs, Michael S. Briggs, Robert C. Duncan, Christopher Thompson

Comments: 11 pages, 4 figures, accepted for publication in ApJL

We study the statistics of soft gamma repeater (SGR) bursts, using a data base of 187 events detected with BATSE and 837 events detected with RXTE PCA, all from SGR 1900+14 during its 1998-1999 active phase. We find that the fluence or energy distribution of bursts is consistent with a power law of index 1.66, over 4 orders of magnitude. This scale-free distribution resembles the Gutenberg-Richter Law for earthquakes, and gives evidence for self-organized criticality in SGRs. The distribution of time intervals between successive bursts from SGR 1900+14 is consistent with a log-normal distribution. There is no correlation between burst intensity and the waiting times till the next burst, but there is some evidence for a correlation between burst intensity and the time elapsed since the previous burst. We also find a correlation between the duration and the energy of the bursts, but with significant scatter. In all these statistical properties, SGR bursts resemble earthquakes and solar flares more closely than they resemble any known accretion-powered or nuclear-powered phenomena. Thus our analysis lends support to the hypothesis that the energy source for SGR bursts is internal to the neutron star, and plausibly magnetic.

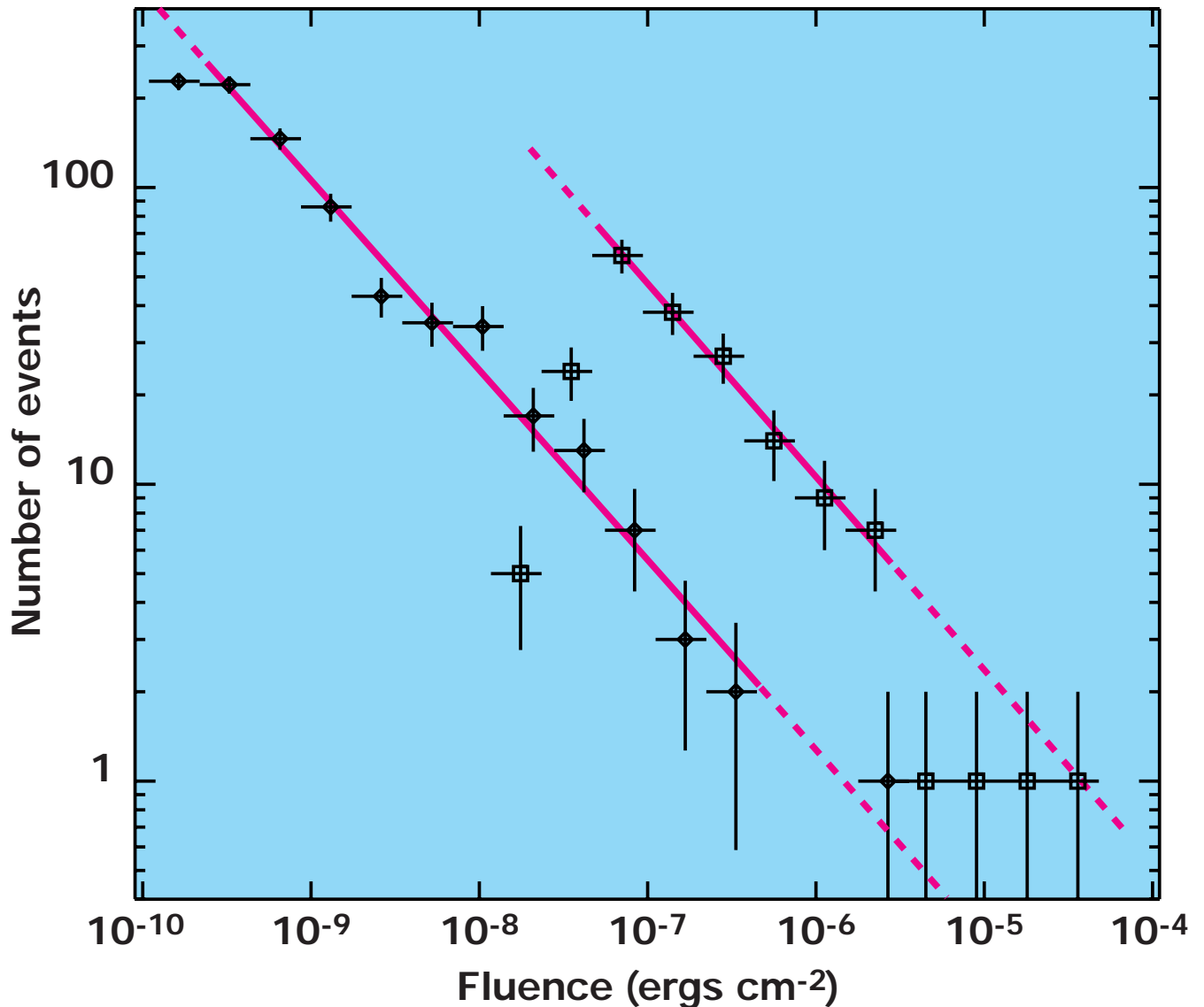


Fig. 1. Differential distribution of the fluences of bursts from SGR 1900+14 as measured with RXTE (diamonds) and BATSE (squares). The solid lines denote the interval where used in the fit and the dashed lines are the extrapolations of the model.

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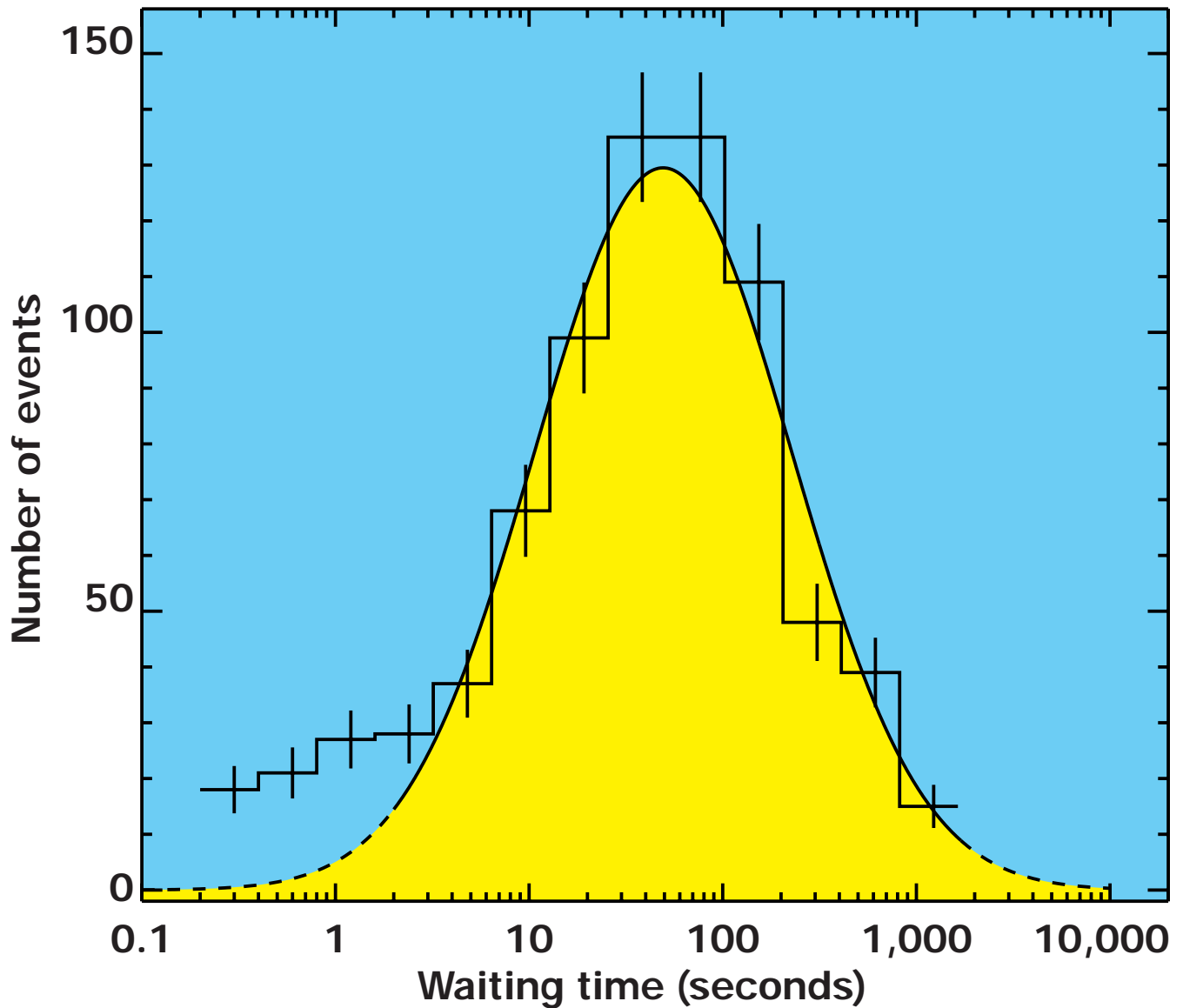


Fig. 2. Distribution of the waiting times between successive RXTE PCA bursts from SGR 1900+14. The line shows the best fit log-normal function. The solid portion of the line indicates the data used in the fit. The excess of short intervals above the model is due to the double peaked events explained in the text.

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