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# Timing and spectral Properties of PSR B1509−58 observed with BeppoSAX

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**Abstract.** We present some preliminary results of a BeppoSAX observation of the pulsar PSR B1509−58. We discuss in detail the spectrum energy distribution and show that the high energy data can be explained by a steepening continuum spectrum.

## 1. Timing and spectral analysis

PSR B1509−58 was observed on February 1998 by the Narrow Field Instruments onboard BeppoSAX satellite. Standard procedures and selection criteria have been applied to observation data; LECS and MECS (Boella et al. 1997) events have been selected within a circular region centered at the source of $4'$ and $3'$ radius respectively.

The UTC arrival times of all selected events were converted to the Solar System Barycenter. Since at the BeppoSAX observation epoch no source ephemeris were available, we searched for the pulse period using the folding technique on MECS data that present the best signal–to–noise ratio. The period, evaluated through a $\chi^2$ maximization, has been searched within a trial period interval centered at the extrapolation of the ephemeris reported in Rots et al 1998. The value obtained is $P = 0.150989037 \pm 0.000000005$ s. Fig. 1 (left) shows the folded light curve in the energy bands 2-10 keV (MECS). The profile has the asymmetric single pulse shape observed since the first detection. No evident variations with energy have been observed within the 0.1-200 keV BeppoSAX band.

The pulsed spectrum has been accumulated assuming as on–pulse emission the signal in the phase interval 0.18–0.70 and subtracting the off–pulse contribution extracted in the interval 0.7–1.1 (see Fig. 1 left). The whole BeppoSAX spectrum (0.1-200 keV) fitted with a single power–law corrected for the low en-

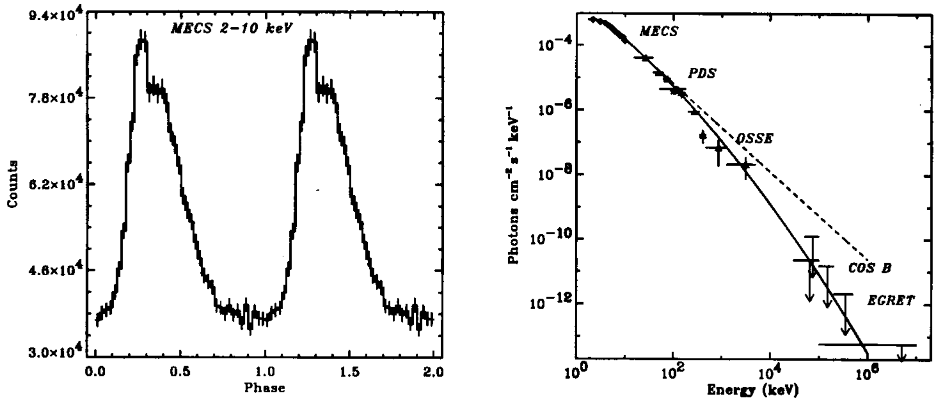


Figure 1. **Left**: The pulse profile of PSR B1509−58 in 2-10 keV band. Two cycles are shown for clarity. **Right**: PSR B1509−58 deconvolved spectrum of the pulsed component. Data are relative to BeppoSAX, OSSE, EGRET and COS B observations. The two lines represent respectively the power–law (dashed line) and energy–dependent power–law (continuum line) used to fit BeppoSAX data

ergy absorption gives as best parameters a photon index of 1.36±0.05 and a $N_H$ of 1.74±0.22 × $10^{22}$ cm$^{-2}$ with a $\chi^2$ of 82.8 for 92 dof. The flux measured in the 2–10 keV energy range is 2.14 × $10^{-11}$ erg cm$^{-2}$ s$^{-1}$ and that measured in the 20–200 keV band is 1.42 × $10^{-10}$ erg cm$^{-2}$ s$^{-1}$.
Although this model well describes BeppoSAX data, its extrapolation at higher energies predicts fluxes significantly higher than the values measured by OSSE and BATSE (Mats et al 1994) and than the EGRET and COS B upper limits (Brazier et al. 1993, Hartman et al. 1994) as shown in Fig. 1 (right) by the dashed line.

We fitted our data with a model including an additional curvature term. In particular, we used a power-law with a slope that varies linearly with log(E): $f(E) = A\ E^{\alpha(E)}$ where $\alpha(E) = \alpha_0 + \beta\, log(E)$. The results are: $\alpha_0$=1.09±0.15; $\beta$=0.11±0.06 and $N_H$=1.33±0.28 × $10^{22}$ cm$^{-2}$ with $\chi^2$=79.2 for 91 dof. We obtained a slightly better $\chi^2$ and a 2 $\sigma$ detection for the spectral curvature. The high energy extrapolation is now in agreement with the other experiment results presented in Fig.1 (right).

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