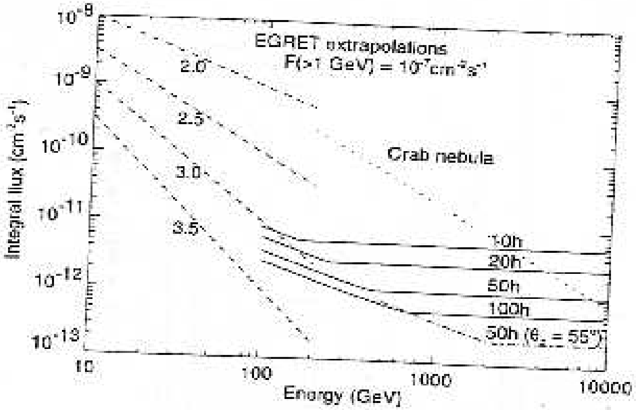

Figure 1 Minimum detectable flux (5σ) estimated from a simulation. Detection at EGRET sensitivity is extrapolated for reference, by power law spectra of different indices.

zenith angle less than 30°. VHE detectin from ten of pulsars will greatly proceed the systematic study of pulsar driven nebulae and emission mechanisms.

4. CANGAROO III - *Jumps!*

With addtional three more telescopes to the 7-m (10-m) CANGAROO II telescope, an array of four Cherenkov telescopes of a 10-m dish has recently been proposed. Further study for another leap of CANGAROO is now under way.

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*Beppo*SAX observations of the binary pulsar PSR B1259−63

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1. Observations and Data Analysis

*Beppo*SAX observed for the first time PSR B1259−63 on March 22 for a total exposure time of 28.6 ks in the MECS. It was T −68 days before periastron and the true anomaly was ~ 135°. The source was found in an unexpected low flux level; more than an order of magnitude fainter than the flux-measured by ASCA 40 days after the 1994 periastron (true anomaly ~ 127°) (Hirayama et al. 1996).

From these results and because BSAX could not perform the planned periastron monitoring of PSR B1259−63 for solar angle constraints and gyroscopes failures, we decided to perform two 50 ks observations instead of the five 20 ksec planned and to perform the second 25 ks one soon after.

The first observation was scheduled for September 2, corresponding to T +96, but a pointing failure resulted in a short, ~ 17 ks exposure. The "proper" observations where then performed on September 8, 17, 25 (T +102, 111, 118) with MECS exposure times of 53.4, 51.1, 28.7 ks. In all these observations the source flux level was about half that observed by ASCA (see Table 1 and Fig. 1.). Flux variations were quite evident on both intra- and inter-observations time scales (see Table 1). In particular on September 8 there was a sudden drop of a

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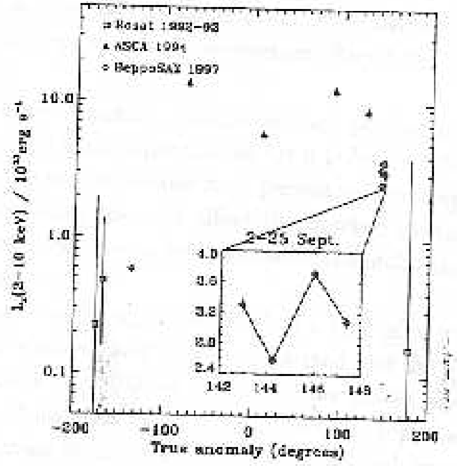

Figure 1 Luminosity history of PSR B1259−63 versus true anomaly.

factor two in the flux level on 10 ks time scale.

The results of the power law spectral fits, together with the observations parameters, are shown in Table 1. Figures 1. and 1. show X-ray luminosity and spectral index as function of the true anomaly together with the ROSAT and ASCA results. We were also able to detect a flux of ∼ 1 mCrab (6σ) in the 13–40 keV band of the PDS for the 8 and 17 September observations. This flux is the sum of that from PSR B1259−63 plus that from a serendipitous field object (FO), 9.5 arcmin away, that in the ROSAT PSPC is resolved in two components. Accurate data analysis to disentangle the genuine pulsar flux is ongoing.

2. Results and Discussion

The power law spectral fit of the March observation showed that while the spectral index was compatible with the ASCA results the column density was significantly lower than the typical 6×10^{21} cm^{-2}. The second ROSAT observation, even though at a low confidence level, gave a similar result (Cominsky et al., 1994).

In the September observations the N_H was compatible with the canonical value, but with some indication of decreasing with time. On the other hand, the spectra were harder with $\alpha = 1.4\div1.5$ and with some indication of anticorrelation with the flux level (see Fig. 1.).

The BSAX results are in agreement with the trend of variable X-ray emission from the PSR B1259−63 system determined by previous ROSAT and ASCA

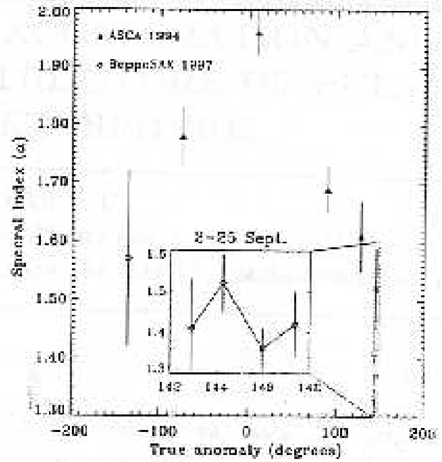

Figure 2 Power law spectral index of PSR B1259−63 versus true anomaly.

measurements. In general the level of X-ray intensity and the non-thermal spectrum agree with the theoretical expectation of a *non-accreting* and shock-powered pulsar system (Tavani, 1997). We also note that the low flux measured in March "before" periastron, is in some way specular to what was found around apastron when the pre-apastron observation had a flux twice weaker than that in the past-apastron observations (Greiner et al., 1995). This contradicts any hypothesis of asymmetry in flux emission for negative and positive true anomaly, in favor of a non-constant Be-star outflow rate leading to a non-constant value of X-ray flux and N_H also near apastron. BSAX observations show that:
(1) the level of X-ray intensity falls in between the previously detected X-ray

Table 1 PSR B1259−63: Observation and fit (Power Law + absorption model) parameters.

Obs. date	LECS-MECS Exp. (ks)	Orbital Phase†	True anom. (degrees)	Photon index	N_H (10^{21} cm^{-2})	2–10 keV flux*
22/03/97	11.5–28.6	0.945	−134.93	1.57 ± 0.15	1.8 ± 1.6	1.23 ± 0.05
02/09/97	2.5–16.9	0.078	142.91	1.41 ± 0.12	5.0 ± 3.2	6.93 ± 0.21
08/09/97	9.9–53.4	0.083	144.27	1.52 ± 0.07	7.6 ± 1.5	5.42 ± 0.10
17/09/97	8.8–51.1	0.089	145.97	1.36 ± 0.05	4.2 ± 1.1	7.81 ± 0.12
25/09/97	3.4–28.7	0.096	147.38	1.42 ± 0.08	2.9 ± 1.6	6.48 ± 0.15

† periastron on 29 May 1997 (50597 MJD). * In units of 10^{-12} erg cm^{-2} s^{-1}.

fluxes for periastron and apastron passages in 1992–1994. These measurements agree qualitatively with expectations of a pulsar/Be star outflow interaction for a constant $\dot{M}$ and stable pulsar wind parameters. Rapid flux variations by a factor of ~ 2 are observed.

(2) The spectra are non-thermal, featureless, and particularly hard. They agree quantitatively very well with expectations for a pulsar/outflow shock interaction (Tavani, 1997). As the pulsar recedes from periastron, cooling by synchrotron and inverse Compton processes does not affect the shocked electron/positron pairs of the pulsar wind that radiate at a hydrodynamical shock with no appreciable radiative modifications.

(3) If the preliminary results from the PDS of a flux of $\simeq 1.3 \times 10^{-11}$ erg cm^{-2} s^{-1} in the 13–40 keV energy band will be confirmed and the FO flux and spectral parameters we measure in the 2–10 keV band are stable compared to the 1994 ASCA observations (Hirayama et al., 1996), then the reported OSSE flux in the 50–200 keV band (Tavani et al., 1996) needs to be revised downward by a factor of ~ 2. This will have relevant implications on the efficiency of high energy photons production by the shock interaction.

3. Conclusions

BSAX observed PSR B1259−63 in five occasions for a total of about 179 ks (MECS). The orbital phase covered by these observations gave invaluable information to constrain emission models. The preliminary results presented here are in agreement with the pulsar/Be, time-variable mass outflow, shock interaction leading to a time variation of the shock radius. If the PDS detection will be confirmed, it will fill the gap left by the ASCA and OSSE observations (Tavani et al., 1996) and will also allow to better evaluate the latter, taking into account the flux component from the FO. Timing analysis to search for pulsed emission hasn't revealed signs of pulsation, but this could be justified by a denser environment near periastron. Longer exposures by the LECS (0.1–2 keV) would be necessary to confirm the proposed detection (Becker, 1995).

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WIND ACCELERATION AND THE STRUCTURE OF PULSAR MAGNETOSPHERE

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1. Introduction

In the Crab nebula, bright knots, wisps and torus are observed in polar zone, high-latitude zone and equatorial zone of the pulsar magnetosphere, respectively (Hester et al. 1995). An association is proposed between the observed structure of the nebula and magnetized winds streaming in each latitude zones from the central pulsar. The highly accelerated winds streaming each zone shock at there. To construct such a latitudinal structure of magnetosphere, it is important to understand the latitudinal-dependence of pulsar wind.

We have investigated magnetohydrodymanical (MHD) wind properties (Takahashi and Shibata 1998); that is, wind acceleration, energy conversion from electromagnetic energy to kinetic energy. These properties depend on a magnetic field configuration. However, we do not have any observational informations about the magnetic structure between the pulsar and the nebula. We expect that the magnetic field line is dipole far inside the light cylinder, and is opened beyond the light cylinder because inertial effects of the plasma become so important. Here, we assume "dipole" – "paraboloidal" configuration. Under this field configuration, we investigate the condition for the trans-fast MHD wind. Then, we find that the trans-fast MHD wind is available for lower-latitude magnetic field lines while for middle-latitude magnetic field lines the wind remains sub-fast magnetosonic, and that when the Alfvén point locates very close to the light cylinder the trans-fast MHD wind solution tends to break.

2. Plasma Flow Streaming along a Magnetic Field Line

We assume a stationary and axisymmetric magnetosphere, where the plasma streams from the pair-creation region (see Sturrock 1971; Ruderman and Sutherland 1975) located close to the pulsar surface to the far distant shock front (see Kennel and Coroniti 1984a,b) along a magnetic flux tube. This MHD flow is

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