INTRODUCTION

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IMAGING ANALYSIS

We have combined data from CGRO viewing periods 15, 221, 335, 427 and 726-740 and binned the measured γ-ray arrival directions in a galactic 225 x 225 grid after applying "standard" EGRET event selection criteria. The measured distribution is compared with an expected model distribution, composed of galactic and extragalactic diffuse model components and established high-energy γ-ray sources within.

TIMING ANALYSIS

For the timing analysis we have selected events in a circular aperture around the PSR J0218+4232 position with an energy dependent extraction radius. This radius has been determined from polarization studies. A detection significance of 3.6σ is reached. The contour starts at 1σ in steps of 1σ for 1 degree of freedom. PSR J0218+4232 is indicated by a star symbol and J0534 by a bullet.

In a recent observation at harder X-rays (1-10 keV) with the BeSSX MMEC instruments the double peaked nature with phase separation ~ 0.47 of the X-ray profile was confirmed [4]. Spectral analysis showed that the pulsar emission has a very hard spectrum with a power-law photon index of ~ -0.6, the hardest pulsar X-ray spectrum reported so far.

At high energy (100 MeV - 10 GeV) γ-rays the positional coincidence of the CORDO EGRET source 2EG J0218-4222 [7] with PSR J0218+4232 was noted by Verbont et al. [8]. These authors found also indications for pulsed emission energies above 100 MeV. Since then, PSR J0218+4232 was again seen in the field of view of EGRET. In this work all available EGRET observations of PSR J0218+4232 between April 1991 and November 1996 with off-axis angles < 30 deg have been used to obtain maximum statistics. In addition, for the timing analysis we used the single very accurate event sets (an error $3\sigma$), with a validity interval of about 2 years, allowing clear phase locking of all selected events.
We folded the barycentric arrival times of 100-1000 MeV events with the pulse timing parameters from one single observation taking into account the binary nature of the system. We obtained a 3.5σ signal in a Z test and the lightcurve showed a prominent pulse between phases 0.6 and 0.7 following a broader best-guess prominent pulse between phases 0.1 and 0.4 (see Figure 30). Phase folding of events with energies above 1 GeV gives a statistically flat light curve. However, a phase-resolved imaging analysis shows that the 130-200 MeV spatial signal is concentrated in the phase intervals of the 2 pulses. This reinforces the conclusion drawn in the imaging analysis that 3C26A is the dominant component of the high-energy EGRET sources above 1 GeV, and PSR J0218+4232 below 300 MeV.

A comparison with the X-ray ROSAT HRI [4] and ROSAT ERI [2] lightcurves shows that the phase separation of the pulses in the γ-ray lightcurve is similar to the separation of ≈ 0.47 found at X-rays. The large uncertainties in the absolute timing of the X-ray profiles do not allow conclusions on the absolute phases of the X-ray and γ-ray pulses.

However, we can compare in absolute phase the 100-1000 MeV lightcurve with the 610 MHz radio profile. Figure 3a and find that the 2 γ-ray pulses coincide with 2 of the 3 radio-pulses within the absolute timing uncertainty of the radio Jodrell Bank observations and of CORO (the latter ≤ 100 μs).

**SUMMARY**

This study shows that we obtained good circumstantial evidence for the first detection of high-energy γ-rays from a millisecond pulsar, PSR J0218+4232.

- A count-rate-detected γ-ray event in the 100-1000 MeV energy range is consistent with the 610 MHz radio profile, and the γ-ray lightcurve shows a close alignment of the 2 high-energy peaks with 2 of the 3 radio-pulses.

- Between 100 and 1000 MeV the EGRET source was consistent with PSR J0218+4232 with the signal concentrated in the phase intervals of the 2 pulses.

- Above 1 GeV the 3C26A is in the sky map the evident counterpart, and, consistently, no pulsar signal is found in the timing analysis for energies above 1 GeV.

Finally, we confirm the earlier indications [5] that the energy loss in γ-rays corresponds to ~10% of the total pulsar spin-down luminosity.

The full analysis and implications of our findings will be presented in detail in a forthcoming paper [9].

**REFERENCES**