IGR J17252−3616: AN ECLIPSING PULSAR OBSERVED BY *INTEGRAL* AND *XMM-NEWTON*

J.A. Zurita Heras[1,2], G. De Cesare[3], R. Walter[1,2], A. Bodaghee[1,2], G. Bélanger[4], T.J.-L. Courvoisier[1,2], S.E. Shaw[5,1], and J.B. Stephen[6]

[1]INTEGRAL Science Data Centre, Versoix, Switzerland
[2]Observatoire de Genève, Sauverny, Switzerland
[3]IASF-INAF, Via Fosso del Cavaliere 100, 00133 Roma, Italy
[4]Service d'Astrophysique, DAPNIA/DSM/CEA, 91191 Gif-sur-Yvette, France
[5]School of Physics and Astronomy, University of Southampton, Highfield, SO171BJ, UK
[6]IASF/CNR, Via Piero Gobetti 101, 40129 Bologna, Italy

ABSTRACT

We report here the analysis of the *INTEGRAL* and *XMM-Newton* observations on IGR J17252−3616. The source is located at R.A. (2000.0) = $17^h25^m11.4^s$ and Dec. = $-36^\circ16'58.6''$ ($4''$). We found one infrared counterpart, 2MASS J17251139−3616575, located $1''$ away. The source is a binary X-ray pulsar with a spin period of 413.7±0.3 s and an orbital period of 9.72±0.09 d. IGR J17252−3616 is a persistent source with an average 20–60 keV flux of ∼6.4 mCrab. The spectrum can be fitted with a flat power law plus an energy cutoff, typical of accreting pulsars. A large hydrogen column density ($N_{\rm H} \sim 15\,10^{22}\,{\rm atoms\,cm^{-2}}$), suggesting an intrinsic absorption, and the Fe Kα line at 6.4 keV are clearly detected. Phase-resolved spectroscopy does not show any variation in the continuum except the total emitted flux. The absorption is constant along the pulse phase. This source is the hard X-ray counterpart of EXO 1722−363 as they both show common timing and spectral features. The observations suggest that the source is a wind-fed accreting pulsar accompanied by a supergiant star.

Key words: X-rays: binaries, X-rays: individual: IGR J17252−3616=EXO 1722−363.

1. INTRODUCTION

The imager IBIS/ISGRI on board the X-ray and γ-ray observatory *INTEGRAL* allowed the (re)discovery of several hard X-ray sources due to its unique sensitivity in the 20–200 keV energy range. Many of those objects show common features in their spectra, such as a high intrinsic low-energy absorption, and they are believed to be high mass X-ray binaries (HMXB) (Walter et al., 2005).

The discovery of IGR J17252−3616 was reported on February 9, 2004 (Walter et al., 2004). A follow-up with *XMM-Newton* was performed in order to investigate its nature in a wide high energy band.

2. OBSERVATIONS

IGR J17252−3616 is located close to the galactic centre which has been regularly observed with *INTEGRAL* as part of the core programme (CP). The CP strategy consists of pointings lasting ∼30 minutes and distributed in various grids around the galactic centre and plane. A total exposure of 6.5 Ms was accumulated with public and CP data (MJD 52671–53294). The source was observed by *XMM-Newton* on March 21, 2004, from 13:02:45 to 16:04:45 UTC for a total exposure of 11 ks.

3. IMAGING, TIMING AND SPECTRAL ANALYSIS

A single X-ray source corresponds to the *INTEGRAL* position in the EPIC/MOS1 image (see Fig. 1). Its position is R.A. (2000.0) = $17^h25^m11.4^s$ and Dec. = $-36^\circ16'58.6''$ ($4''$). There is one infrared counterpart, 2MASS J17251139−3616575, located $1''$ away with a magnitude in the Ks-band of 10.7.

The source is persistent and variable in the 20–60 keV energy range with an average flux of ∼6.4 mCrab. A significant peak at 9.72±0.09 d is visible in a Lamb-Scargle periodogram and the folded light curve is shown in Fig. 2. A minimum flux consistent with an eclipse is visible at phase 0.

Moreover, a pulsation has been detected in EPIC/pn and confirmed in IBIS/ISGRI data ($P_{\rm s} = 413.7 \pm 0.3$ s, see

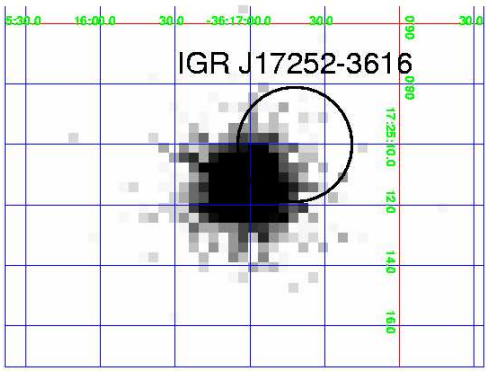

Figure 1. EPIC/MOS1, 0.8–10 keV extracted image. ISGRI position and uncertainty are reported.

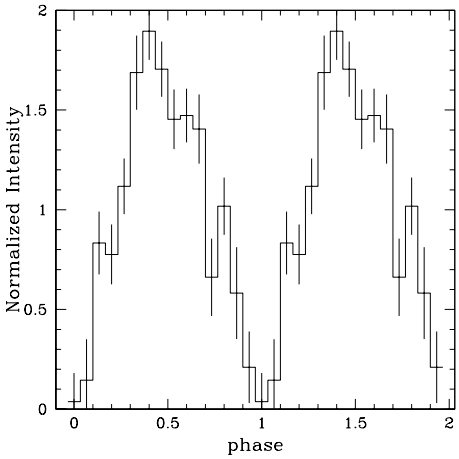

Figure 2. Orbital folded light curve with the best period of 9.72±0.09 d

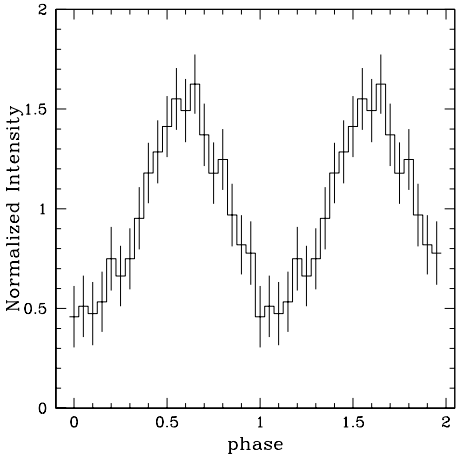

Figure 3. 20–40 keV folded light curve with the pulse period of $P_s = 413.7 \pm 0.3$ s

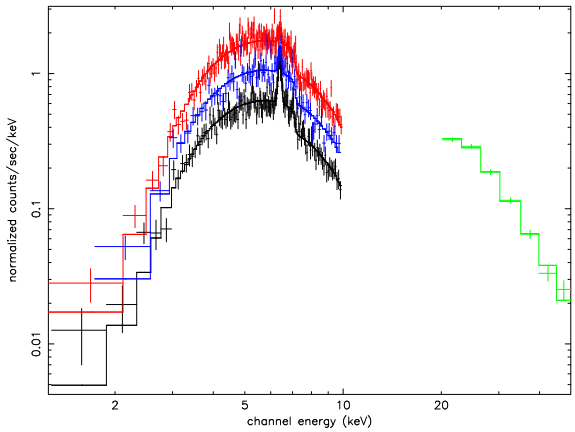

Figure 4. Combined spectral analysis. X-ray band: EPIC/pn phase-resolved spectra. Hard X-ray band: ISGRI average spectrum.

Fig. 3). There is no evidence of spin period variation in ISGRI data.

The EPIC and ISGRI spectra were fitted together. A cutoff powerlaw model gives typical values of an accreting pulsar ($\Gamma = 0.0 \pm 0.1$, $E_{\rm cut} = 8.2 \pm 0.4$ keV, χ^2/d.o.f.=401/376). The Fe Kα line at 6.4 keV and a large hydrogen column density ($N_{\rm H} \sim 15\,10^{22}\,{\rm atoms\,cm^{-2}}$) are also observed. Phase-resolved spectroscopy did not show any significant variation of the spectral shape with the phase excepting the change in the normalisation (see Fig. 4).

IGR J17252−3616 can be associated with EXO 1722−363. From Ginga observations in 1987 and 1988, Tawara et al. (1989) and Takeuchi et al. (1990) detected a pulsation of 413.9 s, important variations of the intensity in X-rays, a hard spectrum with important low-energy absorption and an emission line at 6.2 keV. Using RXTE data, Corbet et al. (2005) resolved the orbital period of 9.741 days and detected a varying high column density. These investigations conclude that the system is a wind-fed accreting pulsar.

REFERENCES

Corbet, R. H. D., Markwardt, C. B., & Swank, J. H. 2005, ApJ, in press

Takeuchi, Y., Koyama, K., & Warwick, R. S. 1990, PASJ, 42, 287

Tawara, Y., Yamauchi, S., Awaki, H., et al. 1989, PASJ, 41, 473

Walter, R., Bodaghee, A., Barlow, E. J., et al. 2004, The Astronomer's Telegram, 229, 1

Walter, R., Zurita Heras, J. A., Bassani, L., et al. 2005, submitted to A&A