INTEGRAL OBSERVATION OF THE X-RAY BURSTER KS 1741-293

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ABSTRACT

KS 1741-293 was firstly detected in 1989 with the X-ray wide field camera TTM (3-10 keV) on board of the Rontgen-Kvant-Mir observatory. During these observations this source exhibited two X-ray bursts allowing to identify it as a neutron star in a Low mass X-ray Binary. During the BeppoSAX/WFC monitoring of the Galactic Centre Region, KS 1741-293 was also reported at a flux level of 6 mCrab in the 2-9 keV and 25 mCrab in the 9-25 keV energy range. Thanks to the deep and regular INTEGRAL observation of the Galactic Centre region, KS 1741-293 has been observed by the X-ray monitor JEM-X and the imager IBIS in a wide energy range, giving for the first time relevant information on its high energy behaviour. Furthermore, two X-ray bursts have been detected by JEM-X. We report on IBIS and JEM-X data analysis in terms of flux monitoring, spectral proprieties and bursts detection. The data reduction has been done with the most recent release of the standard analysis software (OSA 5.0).

Key words: X-rays binaries, INTEGRAL.

1. INTRODUCTION

The first bursting sources were discovered already in 1975 with SAS 3 and OSO-8. All X-ray sources showing type I burst are low mass X-ray binaries (LMXBs). Woosley and Taam (1976) and Maraschi and Cavaliere (1976) independently discussed the origin of the phenomenon: X-ray bursts are explained by thermonuclear flashes of the material accreting from the companion star on the surface of the neutron star.

The X-ray burster KS 1741-293 was firstly reported by in't Zand et al. (1991) as one of the 2 new transient sources near the galactic centre during observation with the X-ray wide-field camera TTM on board the Rontgen-Kvant-Mir observatory, in 1989. The source was detected on 3 consecutive days and two type I X-ray burst were detected in the energy range $5.7-27.2$ keV. The source was inside the error box of MXB1743-29, a bursting source detected in 1976 with SAS-3. More recently, in the BeppoSAX era (1996-2002), this source was detected, together to a large sample of galactic sources, during the WFC monitoring of the Galactic Center Region (in't Zand et al., 2004) at a peak flux of the order of 30 mCrab in the WFC energy band. KS 1741-293 was also detected by ASCA during the 107 pointing observation on a 5x5 deg region around the Galactic Center showing an apparent variability by a factor of 50 while no burst have been reported by Sakano et al. (2002). No hard X-ray detection has been reported by the first gamma-ray imager, SIGMA, and indeed the source is not in the hard X-Ray SIGMA survey, covering the 40-100 keV range (Revnivstev et al., 2004). KS1741-293 is listed in the BATSE/CGRO instrument deep sample as one of the 179 sources monitored along the CGRO operative life (Harmon et al., 2004) even though it is not a firm detection.

We show here for the first time the high energy spectrum of KS 1741-293 obtained with INTEGRAL. In section §2 we report the INTEGRAL observations and data analysis, in section §3 we briefly discuss the main results of this analysis.

2. OBSERVATION AND DATA ANALYSIS

The hard X- and gamma-ray observatory INTEGRAL was launched on October 17, 2002 by the a Russian PROTON launcher. The satellite makes revolution around the Earth in three days, along a highly eccentric orbit and the observing time is optimized by this choice. The wide-field Gamma-ray imaging and wide-band spectral capabilities of INTEGRAL coupled with the Core program strategy, are a powerful tool to further investigate the high energy behavior of X-ray bursters as firstly reported by Bazzano et al. (2004).The scientific instruments on board are the hard X- and gamma-ray imager IBIS (Ubertini et al., 2003) covering the energy band 20 keV$-$10

Table 1. KS1741-293 IBIS data set. The visibility periods 1, 2, 3 include all the public data and the core program data. The last periods 4 and 5 include the core program data only.

Period	Rev.	Start (MJD)	End (MJD)	exp. (ks)
1	46-63	52698	52792	306
2	103-120	52871	52921	1333
3	164-185	53052	53115	921
4	229-249	53246	53306	159
5	291-307	53431	53479	43

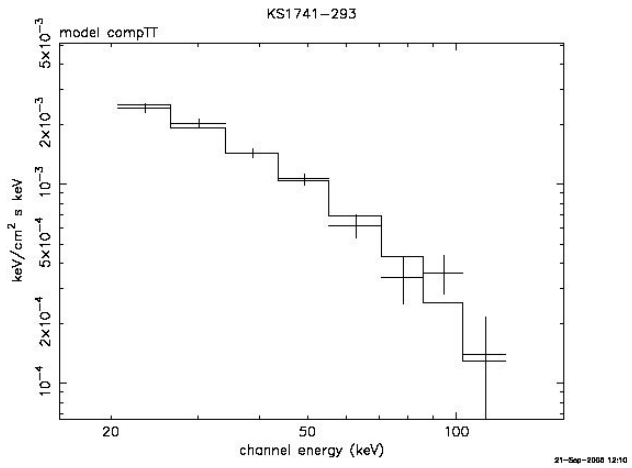

Figure 1. IBIS/ISGRI KS 1741-293 spectrum obtained in the 3th visibility period

MeV, the gamma-ray spectrometer SPI (Vedrenne et al., 2003) in the same energy band but devoted to fine spectroscopy, the X-ray monitor JEM-X (3−35 keV) (Lund et al., 2003) and the optical camera OMC (Mas-Hesse et al., 2003). We report here on the IBIS and JEM-X data analysis, performed with the last Off-line Science Analysis (OSA) software (release 5.0). Since IBIS is a coded mask telescope, the maximum of sensitivity corresponds to the fully coded field of view (FCFV) and for this analysis, we have selected the IBIS pointing in which KS 1741-293 is in the FCFV, including all the public data from revolution 46 (2003-02-28) to revolution 185 (2004-04-19), and the Core Program data (Winkler et al., 2003) from the revolution 46 to the revolution 307 (2005-05-19). The details of the observations are listed in table 1.

3. RESULTS

We have monitored KS 1741-293 during a period of more then two year, from the end of February 2003 to end of May 2005, including in our analysis all the public and core program data until April 2004 (periods 1, 2, 3). The source has been clearly detected in the periods 1 and 3. The signal in the period 2 is of order of 10 sigma, but, a more refined analysis of the image has shown that this effect could be due to the 1A 1742-294 tail (21 arcmin far from KS 1741-293). The one second resolved light curves obtained from JEM-X data in the revolution 53 (science window 58) and 63 (science window 92) exhibit two X- ray bust in the energy range 315 keV. The burst morphology confirms previous observations with no double peaked time profile unlike to the profile reported for MXB1743-29 as discussed by in't Zand et al. (1991).

The spectra of LMXB bursters show, on average, similarities with the ones from Black Hole binary systems and consist of a soft, disk component with temperatures of the order of a few keV and a low energy gamma-ray tail. Sometimes a cut-off at around 50 kev is present in the spectra and 2 different states have been detected for some of them (for a comprehensive review see Barret (2001)). The KS 1741-293 spectrum (fig. 1) has been extracted from the period 3 data. It is well fitted with a comptonized model (comptt) with an estimated plasma temperature of about 20 keV.

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