PROCEEDINGS OF SCIENCE

Faint objects on INTEGRAL/IBIS mosaics in 15 - 80 keV energy range

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We discuss searches for positive detection of selected candidates (i.e. faint objects, mostly intermediate polars and blazars) in INTEGRAL IBIS data. We discuss various approaches with emphasis on detection and confirmation of faint objects with low signal to noise ratio.

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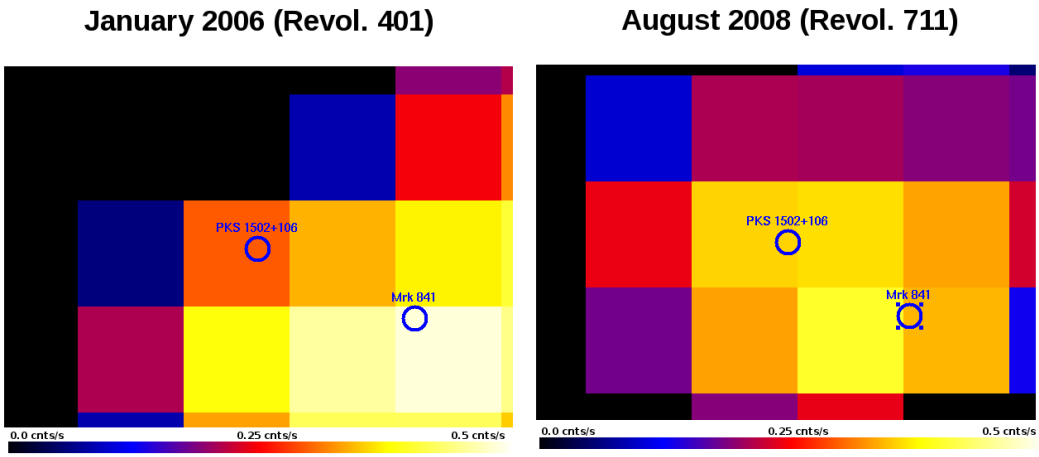

Figure 1: Virtual detection of PKS 1502+106 (BL Lac type object) due to nearby bright object Mrk 841 in 15-25 keV.

1. Introduction

Since it launch in October 2002 the ESA space mission, INTEGRAL [5], carried out plenty of valuable X-ray data both in galactic and extragalactic Universe. The onboard imagers (JEM-X and IBIS) are based on coded mask technique, which produces specific anomalies during the image spectral processing, i.e. 'ghosts'. The probability of their appearance grows with the existence of nearby bright sources. Therefore individual analysis of the results is always necessary as well as the assignement to the counterparts. For this research we used public data provided by Integral Science Data Center (ISDC)[1] and we focused on research of the X-ray objects in the table 1 within the spectral range 15-80 keV. Data analysis of the INTEGRAL pointings (Science Windows) has been done by using OSA 7.0 software.

2. Complications

Positive detection is often complicated by nearby bright sources, which can only rarely be seperated (i.e. with Profile Function fitting) as the angular resolution of IBIS detector is $\sim$ 12'. The blazar PKS 1502+106 is only at 7' from the Seyfert galaxy Mrk 841 (see IBIS images in Fig. 1). The confirmation of this detection can be made by using multiwavelength follow up observations. We recommend regular long-time monitoring with ground automatic optical telescopes to find out the state the faint X-ray objects (i.e. PKS 1502+106) and to compare those data with the IBIS ones [2].

The source detection on the mosaic images depends both on the significance level and exposure, which are indeed correlated each other. The value of 3 sigma should be sufficient assuming high exposure (above circa 500 ksec) and symmetrical profile of the detection. Afterall comparison with other instruments (optical, X-ray, ...) is necessary.

[1] http://www.isdc.unige.ch/

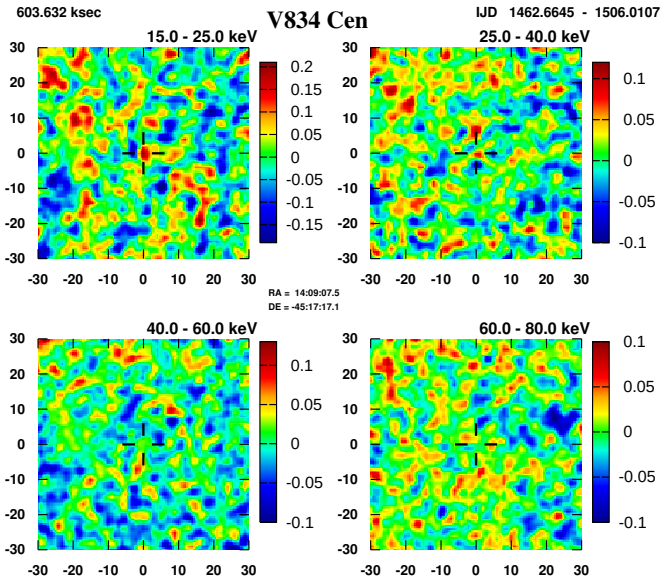

Figure 2: Intensity [cnts/s] mosaic of the cataclysmic variable star V834 Cen

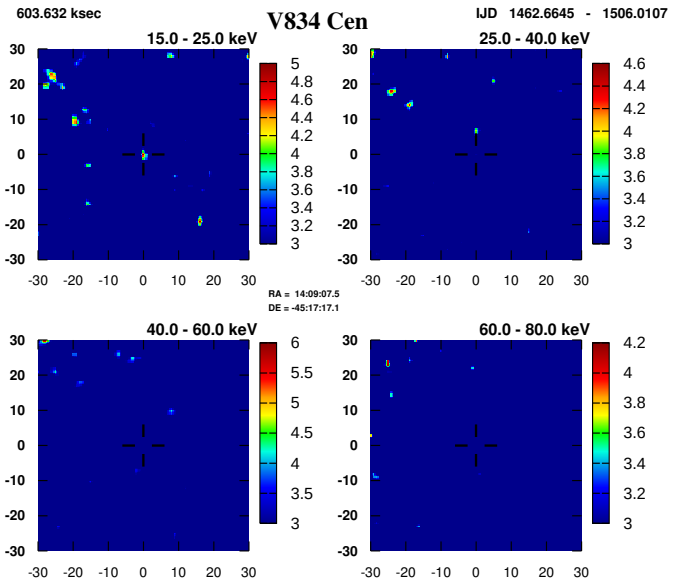

Figure 3: Significance [σ] mosaic of the cataclysmic variable star V834 Cen

3. Faint detections

3.1 V834 Cen

According to [4] V834 Cen was in a low state in 2002 and showed intensity variations on yearly timescales (measured with RXTE). The last high state was observed in 1998, while in 2002 only upper limit was measured. For the period 2004 - 2008 there is only one positive detection of the cataclysmic variable V834 Cen by INTEGRAL slightly above 3 sigma in the 15-25 keV range (Figures 2 and 3). This object was significantly detected on the Science Windows between

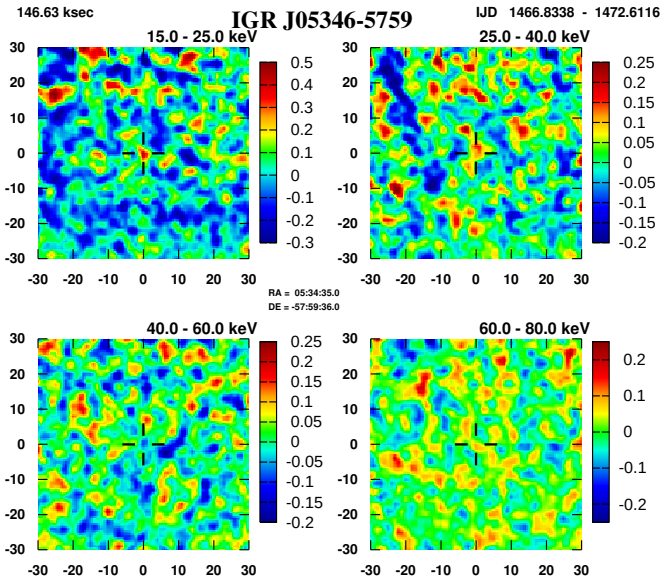

Figure 4: Intensity [cnts/s] mosaic of the cataclysmic variable star IGR J05346-5759

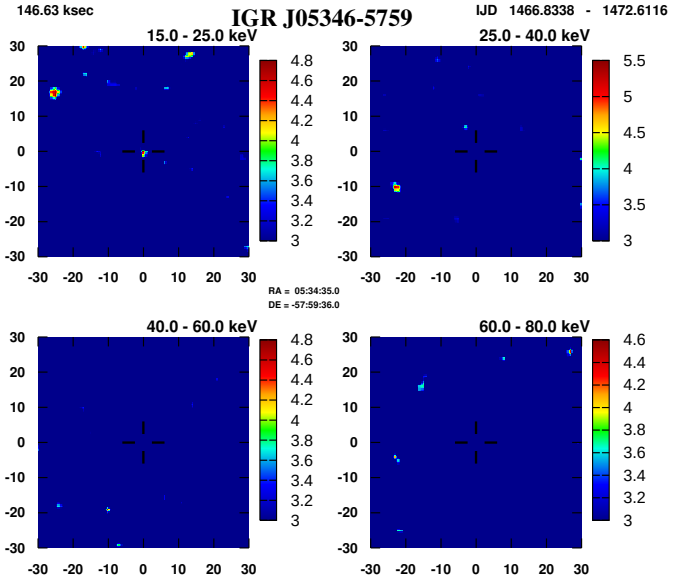

Figure 5: Significance [σ] mosaic of the cataclysmic variable star IGR J05346-5759

the revolutions 149 and 163 (January & February 2004). Mosaics from other SCWs (2400 ksec in total) show no detection above 3 sigma.

3.2 IGR J05346-5759

We found faint 4.5 sigma detection in 15-25 keV range of possible cataclysmic variable IGR J05346-5759 based on 146 ks exposure (on Figures 4 and 5). For such a low exposure is very important possible coincidence with other instruments to calibrate detection limits in dependence on exposure.

star	RA [hh:mm:ss]	DE [°:':"]
IGR J00234+6141	00:22:57.63	+61:41:07.8
V709 Cas	00:28:48.84	+59:17:22.3
XY Ari	02:56:08.10	+19:26:34.0
GK Per	03:31:12.01	+43:54:15.4
V1062 Tau	05:02:27.47	+24:45:23.4
TV Col	05:29:25.52	-32:49:04.0
IGR J05346-5759	05:34:50.60	-58:01:40.7
BY Cam	05:42:48.77	+60:51:31.5
MU Cam	06:25:16.18	+73:34:39.2
IGR J08390-4833	08:38:49.11	-48:31:24.7
XSS J12270-4859	12:27:58.90	-48:53:44.0
V834 Cen	14:09:07.30	-45:17:16.2
IGR J14536-5522	14:53:41.06	-55:21:38.7
IGR J15094-6649	15:09:26.01	-66:49:23.3
NY Lup	15:48:14.59	-45:28:40.5
IGR J16167-4957	16:16:37.20	-49:58:47.5
IGR J16500-3307	16:49:55.64	-33:07:02.0
V2400 Oph	17:12:36.43	-24:14:44.7

Table 1: List of already analysed cataclysmic variables (2003-2009)

4. Conclusions

So far we already processed 37 326 ksec of INTEGRAL / IBIS data in 98 Observation Groups containing 15 887 Science Windows belonging to the period 2003 - 2009 for the objects in the table 1. We plan to finish the deep survey of the 15-80 keV mosaics for all the cataclysmic variables [1] and blazars [3] detected by INTEGRAL with the focus on faint new detections and coincidences with optical data provided by robotic telescope D50 in Ondřejov observatory (CZ).

Acknowledgments

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References

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[5] C. Winkler et al., *The INTEGRAL mission*, *A&A*, **411**, p. L1-L6 (2003)