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Cygnus X-1 entered the soft state

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Cygnus X-1 entered the soft state

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on 31 Aug 2011; 13:12 UT

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Subjects: Radio, X-ray, Binary, Black Hole

Referred to by ATel #: [3636](#), [3802](#), [3880](#)

Radio and X-ray monitoring observations over the past few weeks - ATel #[3534](#) (MAXI/GSC), ATel #[3535](#) (AMI) and ATel #[3546](#) (RATAN) - indicated Cyg X-1 entering the soft state. A plot of the behaviour of Cyg X-1 as observed with AMI, MAXI and BAT can be found under: <http://www.mrao.cam.ac.uk/~guy/cx1/2011.ps>. Our bi-weekly RXTE monitoring campaign of Cyg X-1 shows that the source transited into a soft state between August 13 and August 26. Three groups of observations were conducted: on July 29 (ObsID 96121-01-16-00/01/02/03/04, overall exposure 10 ks), August 13 (96121-01-17-00, 16 ks) and August 26/27 (96121-01-18-00/01/02/03, 6 ks). We model the 3--40 keV RXTE/PCA spectra with a broken power law, an iron line, an absorption component and, where required, a disk black body.

July 29:

The soft photon index of ~ 1.9 -2.0 and the average 3.2-10 Hz time lag ranging between 3ms and 4ms point towards a softer mode of the hard state. The power spectra (PSDs) show a clear two-humped structure without a power law component and no black body component is required in the spectral fits.

August 13:

The spectra are similar to those of the July 29, with a slight softening of the photon index to 2.05-2.15 and an increase of the lag to 4-5 ms, while the PSDs remains two-humped with no or very small power law contribution and the black body is still not required. This behaviour is still indicative of a softer mode of the hard state or of the hard intermediate state.

August 26/27:

Related

- 11539** The 30-day monitoring of MAXI J1820+070 at 4.7 GHz
- 10459** Ongoing radio monitoring of Cyg X-1 with the RATAN-600 radio telescope
- 10446** Change in radio behaviour of Cygnus X-1
- 10322** Unusual soft X-ray activity of Cygnus X-1 detected with MAXI/GSC
- 9089** New RATAN-600 data for Cygnus X-1
- 9087** Detection of a bright radio flare of Cygnus X-1 at 7.2 GHz with the Sardinia Radio Telescope
- 7327** Fermi/LAT observations of Cygnus X-1
- 7322** The current RATAN-600 observations of Cygnus X-1
- 7316** Cyg X-1 transiting into the hard state
- 6344** Cygnus X-1 has returned to soft state
- 6244** Title: Cygnus X-1 - a (failed?) state transition
- 6119** Fermi GBM detection of a rise in Hard X-rays from Cyg X-1
- 6115** MAXI/GSC detection of a transition back into the hard state in Cygnus X-1
- 6021** Cygnus X-1 in the intermediate state
- 5995** Cygnus X-1 is entering its X-ray hard state
- 3880** Fermi GBM observes another decrease in hard x-rays from Cyg X-1
- 3803** Cygnus X-1 15-GHz radio flux increasing
- 3802** FERMI GBM Observes Increase in Hard X-rays from Cyg X-1
- 3636** Fermi GBM Observes Decrease in Hard X-rays from Cyg X-1
- 3616** Cygnus X-1 entered the soft

A multi-temperature black body component (diskbb) with a temperature of 0.35-0.50 keV is clearly required in the fits. The spectrum is steep, with a soft power law index between 2.7 and 2.9. The time lag is highly variable between 9 ms and -0.2 ms and the PSDs show a strong power law component as is typical for the soft state.

Taking into account the recent X-ray and radio monitoring data, we conclude from these three pointed observations that the source has transited into a soft state. This is especially interesting since the transition occurred so quickly after the end (ATel #3307) of the last prolonged soft state, which lasted from July 2010 to April 2011.

	state
3546	The RATAN observations of Cygnus X-1
3535	Cygnus X-1 radio observations
3534	MAXI/GSC detected a possible hard-to-soft state transition in Cygnus X-1
3307	Cyg X-1 entered a transitional state, may be on its way from the soft state back to the hard state
2906	EVN e-VLBI detections of MAXI J1659-152
2755	Radio observations of Cyg X-1 in the soft X-ray state
2751	RXTE Monitoring of Cyg X-1 in its current transitional state
2734	Radio and X-ray monitoring of Cygnus X-1 during the recent state change
2724	Swift/XRT observations of Cyg X-1 during state transition
2721	Fermi GBM detects a rapid hard X-ray decline in Cyg X-1
2715	AGILE gamma-ray detection of Cygnus X-1
2714	RXTE-ASM detects the start of a possible state transition in Cygnus X-1
2711	MAXI/GSC detected a rapid soft X-ray brightening in Cyg X-1
2512	AGILE detection of a gamma ray flare from the Cygnus X-1 region

[[Telegram Index](#)]

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