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# X-ray variability of ss 433: Effects of the supercritical accretion disc

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## Abstract

© 2014 The Authors Published by Oxford University Press on behalf of the Royal Astronomical Society. We study a stochastic variability of SS 433 in the 10-4-5 × 10-2 Hz frequency range based on RXTE data, and on simultaneous observations with RXTE and optical telescopes. We find that the cross-correlation functions and power spectra depend drastically on the precession phase of the supercritical accretion disc. When the wind funnel of the disc is maximally open to the observer, a flat part emerges in the power spectrum; a break is observed at the frequency 1.7 × 10-3 Hz, with a power-law index β ≈ 1.67 at higher frequencies. The soft emission forming mostly in the jets lags behind the hard and optical emission. When the observer does not see the funnel and jets (the 'edge-on' disc), the power spectrum is described by a single power-law with β ≈ 1.34 and no correlations between X-ray ranges are detected. We investigated two mechanisms to explain the observed variability at the open disc phase: (1) reflection of radiation at the funnel wall (X-rays and optical) and (2) the gas cooling in the jets (X-rays only). The X-ray variability is determined by the contribution of both mechanisms; however, the contribution of the jets is much higher. We found that the funnel size is (2-2.5) × 1012 cm, and the opening angle is θ{symbol}f ~ 50°. X-ray jets may consist of three fractions with different densities: 8 × 1013, 3 × 1013 and 5 × 1011 cm-3, with most of the jet's mass falling within the latter fraction. We suppose that revealed flat part in the power spectrum may be related to an abrupt change in the disc structure and viscous time-scale at the spherization radius, because the accretion disc becomes thick at this radius, h/r ~ 1. The extent of the flat spectrum depends on the variation of viscosity at the spherization radius.

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## Keywords

Accretion, accretion discs, Stars: individual: SS 433, X-rays: binaries