

Searching for Quasi-periodic Oscillations in Active Galactic Nuclei of the Chandra Deep Field South

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Recent X-ray observations have revealed growing evidence of quasi-periodic oscillation (QPO) in the light curve of active galactic nuclei (AGNs), which may serve as a useful probe of black hole physics. In this work, we present a systematic search for X-ray QPOs among ~ 1000 AGNs of the Chandra Deep Field South (CDF-S) in a homogeneous fashion. Dividing the 7-Ms Chandra observations into four epochs, we search for periodic signals that are persistent throughout any of these epochs, using two independent methods: Lomb-Scargle periodogram and Gregory-Loredo Algorithm. No statistically significant periodic signal is found with either method on any of the four epochs. Our extensive simulations of source light curves suggest that this non-detection is primarily due to a moderate sensitivity of the CDF-S data in QPO detection. Using the simulation-predicted detection efficiency, we are able to provide a meaningful constraint on the intrinsic occurrence rate of persistent QPOs, $< (15 - 20)\%$, provided that they share a similar power spectral density with a handful of currently known AGN QPOs. The true intrinsic occurrence rate might be significantly below this upper limit, however, given the non-detection among the CDF-S sources. Our additional search for short-lived QPOs that are only detected over a small subset of all observations results in two candidates, one in source XID 643 at a period of ~ 13273 s and the other in source XID 876 at a period of ~ 7065 s.

Topic

活动星系核与超大质量黑洞

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