Recent Trends in the Study of Compact Objects (RETCO-II): Theory and Observation
ASI Conference Series, 2015, Vol. 12, pp 135–136
Edited by Indranil Chattopadhyay, Anuj Nandi, Santabrata Das and Samir Mandal

Hard X-ray flux variations in AGN from NuSTAR

Priyanka Rani* and C. S. Stalin
Indian Institute of Astrophysics, Block II, Koramangala, Bangalore 560 034, India

Abstract. We present here our results on the hour like time scale X-ray flux variations in a sample of active galactic nuclei using data from the *Nuclear Spectroscopic Telescope Array (NuSTAR)*. We find that in the 3−79 keV band, BL Lacs are more variable than flat spectrum radio quasars and Seyfert galaxies. Among Seyferts, Seyfert 2s are more variable than Seyfert 1s. Also, radio-loud quasars are more variable in the hard (10−79 keV) band than the soft (3−10 keV) band while, Seyfert galaxies tend to show more variations in the soft band relative to the hard band.

Keywords : galaxies:active - galaxies:Seyfert - BL Lacertae objects:general

1. Introduction

A distinctive property of active galactic nuclei (AGN) is that they show flux variations over the entire electromagnetic spectrum over a wide range of timescales. Among the various wavelengths, hard X-rays are less affected by absorption, and thus, by exploring hard X-ray flux variability, one can put strong constraints on the physics in the innermost regions of AGN that are not resolvable using any existing imaging facilities. At hard X-ray wavelengths, until recently, we have knowledge only on the long term variability properties of AGN, that too for a limited number of sources mainly from Swift/BAT and RXTE/PCA observations. With the availability of the hard X-ray focusing telescope, NuSTAR (Harrison et al. 2013) since June 2012, it is now possible to probe the hard X-ray flux variations in AGN on a wide range of time scales. Here, we have carried out a systematic study on the hard X-ray variability properties of a sample of AGN on hour like time scales using observations from NuSTAR.

*email: priyanka@iiap.res.in

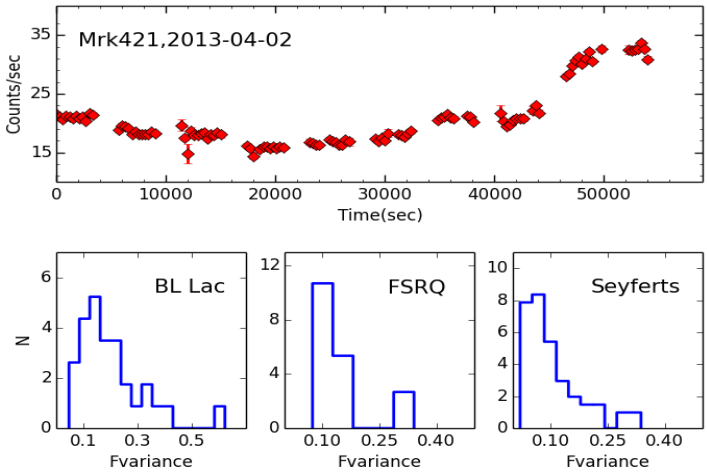

Figure 1. A sample light curve for Mrk 421 (top) and the distribution of F_{var} (bottom)

2. Sample, data reduction and analysis

Our sample consists of 71 AGN, which includes 4 BL Lac objects (BL Lacs), 3 flat spectrum radio quasars (FSRQs), 24 Seyfert 1 galaxies and 40 Seyfert 2 galaxies. Data have been processed using the *NuSTAR* Data Analysis Software (`NuSTARDAS`) v.1.4.1, following standard procedures and using the CALDB version 20141107. A circular region of 60″ was taken to extract the source and background counts on the same detector. Light curves were generated in the soft (3−10 keV), hard (10−79 keV) and total (3−79 keV) X-ray bands. A sample light curve is shown in Fig. 1. To characterize flux variations, we have used the normalized excess variance (F_{var}) following Vaughan et al. (2003). Distribution of F_{var} for the different types of sources in the 3−79 keV band is shown in Fig. 1.

3. Results

Our conclusions are (i) all source in our sample showed X-ray variations, (ii) radio loud sources are more variable in the hard band compared to the soft band while Seyfert galaxies vary more in the soft band, (iii) among radio-loud sources, BL Lacs are more variable than FSRQs both in soft and hard bands and (iv) among Seyferts, Seyfert 2s are more variable than Seyfert 1s in both soft and hard X-ray bands.

References

Harrison F. A., Craig W. W., Christensen F. E., et al., 2013, ApJ, 770, 103
Vaughan S., Edelson R., Warwick R. S., Uttley P., 2003, MNRAS, 345, 1271