

Variability Studies of Seyfert Galaxies Using Sloan Digital Sky Survey and Wide-Field Infrared Survey Explorer Observations

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Abstract : Active Galactic Nuclei (AGN) are the actively accreting centers of the galaxies that host supermassive black holes. AGN emits radiation in all wavelengths and also shows variability across all the wavelength bands. The analysis of flux variability tells us about the morphology of the site of emission radiation. Some of the major classifications of AGN are (a) Blazars, with featureless spectra. They are subclassified as BLLacertae objects, Flat Spectrum Radio Quasars (FSRQs), and others; (b) Seyferts with prominent emission line features are classified into Broad Line, Narrow Line Seyferts of Type 1 and Type 2 (c) quasars, and other types. Sloan Digital Sky Survey (SDSS) is an optical telescope based in Mexico that has observed and classified billions of objects based on automated photometric and spectroscopic methods. A sample of blazars is obtained from the third Fermi catalog. For variability analysis, we searched for light curves for these objects in Wide-Field Infrared Survey Explorer (WISE) and Near Earth Orbit WISE (NEOWISE) in two bands: W1 (3.4 microns) and W2 (4.6 microns), reducing the final sample to 256 objects. These objects are also classified into 155 BLLacs, 99 FSRQs, and 2 Narrow Line Seyferts, namely, PMNJ0948+0022 and PKS1502+036. Mid-infrared variability studies of these objects would be a contribution to the literature. With this as motivation, the present work is focused on studying a final sample of 256 objects in general and the Seyferts in particular. Owing to the fact that the classification is automated, SDSS has misclassified these objects into quasars, galaxies, and stars. Reasons for the misclassification are explained in this work. The variability analysis of these objects is done using the method of flux amplitude variability and excess variance. The sample consists of observations in both W1 and W2 bands. PMN J0948+0022 is observed between MJD from 57154.79 to 58810.57. PKS 1502+036 is observed between MJD from 57232.42 to 58517.11, which amounts to a period of over six years. The data is divided into different epochs spanning not more than 1.2 days. In all the epochs, the sources are found to be variable in both W1 and W2 bands. This confirms that the object is variable in mid-infrared wavebands in both long and short timescales. Also, the sources are observed for color variability. Objects either show a bluer when brighter trend (BWB) or a redder when brighter trend (RWB). The possible claim for the object to be BWB (present objects) is that the longer wavelength radiation emitted by the source can be suppressed by the high-energy radiation from the central source. Another result is that the smallest radius of the emission source is one day since the epoch span used in this work is one day. The mass of the black holes at the centers of these sources is found to be less than or equal to 108 solar masses, respectively.

Keywords : active galaxies, variability, Seyfert galaxies, SDSS, WISE

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