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Two Years of Monitoring of Blazars with the OVRO 40 m Telescope at 15 GHz in Support of Fermi-GST

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Abstract. We have continued our monitoring program of $\sim$ 1200 sources with the Owens Valley Radio Observatory 40 m Telescope. Most of the sources are part of the Candidate Gamma-Ray Blazar Survey (CGRaBS). We have also been observing Targets Of Opportunity triggered by gamma-ray detections and participating in multiwalength campaigns lead by Fermi-GST. Regular program sources are observed twice a week and have been observed for $\sim$ 24 months at 15 GHz. We use these light curves to study the radio variability and its relation with optical properties. A significant fraction of the bright AGNs detected by Fermi-GST are in our program, which will allow for correlations between the radio and gamma-ray behavior for a number of sources. Here we present some example light curves, describe the tools used to study the variability and present some preliminary variability statistics for the sample.

1. The Program

Blazars are a subclass of AGN characterized by rapid variability, strong linear polarization at visible wavelengths, apparent superluminal motions, flat radio spectra and double-peaked spectral energy distributions. They are further subdivided into BL Lacs and FSRQs, the main difference being the presence of emission lines on the latter type. According to the standard picture of AGN (Urry & Padovani 1995) blazars are objects with the jet oriented close to the line of sight. Given the broad-band SEDs of these objects a complete understanding requires multiwavelength and multi-epoch data. Monitoring of a large sample of blazars in the radio band is a very useful complement to the gamma-ray data that will be available from Fermi-GST. Using the radio data we can study the time scales for the variability and its variation among different classes, for example, as defined by optical band properties. In combination with the Fermi-GST

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data these observations can help us understand the relation between these very different wavelengths.

Observations of all the sources with $\delta > -20^{\circ}$ from CRGaBS (Healey et al. 2008) have been carried out using the OVRO 40 m Telescope at 15 GHz. The sources have been observed about twice a week since mid 2007. Observations are made using a dual-beam Dicke-switch system. The individual beams are 2.5' and are separated by 13" (Readhead et al. 1989). The cryogenic HEMT receiver has a noise temperature of ~ 30 K and covers the band from 13.5 to 16.5 GHz. To protect from spillover the dish is under illuminated and the aperture efficiency is $\sim 25\%$.

2. Analysis and Preliminary Results

From our observations, we have radio light curves with a thermal noise of ~ 5 mJy and a few percent error derived from the scatter on the calibrators. The absolute flux scale is derived from 3C 286 using the results of Baars et al. (1977). The amplitude of variability in the light curves can be characterized using the modulation index, defined as the ratio of the flux rms to the mean flux density. The variability can be tested using a χ^2 test. The minimum significant variability can be estimated from calibration sources that are known to be constant. Typical time scales for the variability can be obtained using special techniques developed for unevenly sampled data, such as the discrete auto correlation function (Edelson & Krolik 1988; Paltani 1999) and the structure function (Simonetti et al. 1985). Examples of the application of these techniques can be found in Fuhrmann et al. (2008) in the context of intraday variability studies and Hovatta et al. (2007) for radio light curves of blazars. Using these techniques we can extract variability time scales from the radio light curves. Cross correlation with gamma-ray data (e.g. Abdo et al. (2009)) can be used to investigate the radio/gamma-ray relations. Development of methods to incorporate the different measurement uncertainties, properly account for outliers in the light curves and estimate the significance of the results is underway.

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