Optical Time Variability of Fermi Blazars, Part 2: K2 Field 1

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This proposal has two goals:

1) Characterize the optical variability of synchrotron emission from the relativistic jets in γ-ray blazars, which informs us about the nature of turbulence in these jets.

2) Determine if the accretion disks of γ-ray -emitting, radio-loud quasars produce different optical emission from those of non-γ-ray-emitting, radio-quiet quasars, which implies that the accretion disks play an integral role in the process that makes radio-loud quasars different from radio-quiet quasars.

In March 2014, we will begin observing the two Fermi γ-ray blazars in K2 Field 0 (approved program GO0074). Starting in May 2014, we propose to obtain the optical light curve of the only Fermi γ-ray blazar in K2 Field 1, PKS B1130+008, with 30-minute integrations obtained continuously for ~ 80 days. Blazars vary 2-5 magnitudes. γ-ray blazars are the most extreme members of the blazar class, including flat spectrum radio quasars (FSRQs) and BL Lac objects. We will measure the power spectral densities (PSDs) of the light curves, which are characterized by power law slopes; characteristic timescales can be identified where breaks are seen. We will evaluate the γ-ray variability using Fermi LAT data (Fermi proposal submitted). Target of Opportunity Swift data during the K2 Field 1 campaign will delineate the relative contributions of synchrotron jet and thermal accretion disk emission. The combined precision and frequent time-sampling of the optical light curves will be the best ever obtained for γ-ray blazars. We will compare the characteristics of γ-ray blazars to those of radio-quiet quasars and non- γ-ray blazars being obtained by other K2 programs. Our proposed target, PKS B1130+008 (z=1.223, V~17.5), *is ~100 times more luminous than our Field 0 target*, *Veritas-Fermi blazar J0648+152* (our other Field 0 target has no redshift yet).

Previous Kepler Studies of FSRQs and BL Lacs: We used Kepler to monitor 3 FSRQs nearly continuously over three years (Figure 1a, Wehrle et al. 2013; Revalski et al. 2014). The original Kepler field contained no γ-ray blazars. We found that the FSRQs' PSDs had power law slopes of -1.8 to -1.2 ("red noise") on long timescales, and white noise on short timescales, consistent with turbulence in the optical jet or in the accretion disks (Figure 2). Edelson et al. (2013) obtained Kepler observations of only one (non-γ-ray) BL Lac object (Figure 1b) whose PSD was bent from -2.3 to -1.1. We achieved 0.9% precision for a V=18.4 AGN in our previous observations. K2 should achieve similar precision on brighter V~17.5 AGN.

Edelson, R. et al. 2013, ApJ, 766, 16.
Revalski, M., Nowak, D., Wiita, P., Wehrle, A., & Unwin, S. 2014, ApJ , in press.
Wehrle, A., et al., 2013, ApJ, 773, 89.

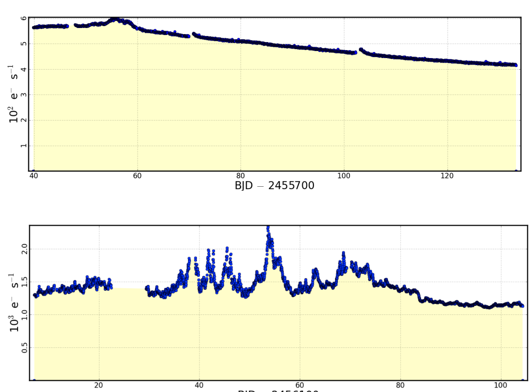

Figure 1a (top). 90-day Kepler light curve of FSRQ 1918+4937. **Figure 1b** (bottom). 90-day Kepler light curve of BL Lac object W2R 1926+42.

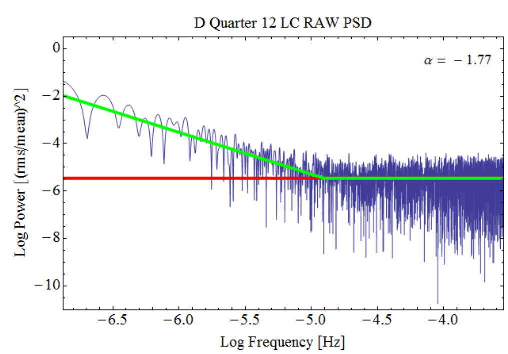

Figure 2. Power Spectral Density of 90-day Kepler observation of FSRQ 1924+507 has a "red noise" power law slope of -1.77 on long timescales and white noise on short timescales.