KEPLER MONITORING OF RAPID OPTICAL VARIABILITY IN AGN - CYCLE 4

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The precision and sampling of Kepler AGN light curves are more than an order of magnitude superior to the best obtainable from the ground. Our observations of four AGN (Mushotzky et al. 2011) yields power spectral density functions (PSDs) that are well-described as power-laws which are much steeper than previously measured in both the optical and x-rays, and steeper than expected from AGN accretion disk models developed to explain previous data sets. These steep PSDs must show a break, most likely on time scales of months, or the total variability power would diverge. Our latest analysis yields a tantalizing indication of just such a break in the best-observed source, but this has not yet been detected in other, shorter light curves. This long time scale suggests that the observed optical variations are driven by viscous instabilities in the accretion disk. The only way to confirm and define this break is by lengthening the data train with continued Kepler observation. We propose continued and new Kepler monitoring of 85 AGN and AGN candidates spanning a wide range of luminosity and black hole mass. Measuring the break in such sources would allow a search for the expected correlation between black hole mass and time (and therefore size) scale. Such a correlation, which has already been seen in the x-rays, would yield further insights into the physical processes occurring in the disk. We will also use Kepler data to measure the temporal cross-correlation between optical and x-ray variations in individual AGN. This can provide a crucial observational link between the disk and the putative hot corona. If an interband lag is detected, it would yield a direct estimate of the size scale of the accretion disk. Also, correlations with ground-based emission-line light curves could permit improved reverberation mapping of the larger broad-line region. Determination of the first high-quality optical PSDs and x-ray/optical correlations will allow us to test the predictions of accretion disk theory and models of reprocessing and feedback between thermal (disk) and non-thermal (corona/jet) emission sites in the central engines of AGN. These proposed Kepler AGN light curves will leave a lasting legacy that will not be surpassed for many years to come.