3.1 Mid-infrared quasar variability

The proposed forced photometry will provide six-epoch $W1/W2$ light curves for all $\sim$500,000 quasars spectroscopically confirmed by SDSS/BOSS. Quasar variability is well studied in the optical, while quasars are generally thought to be less variable in the infrared. Our proposed time-resolved *WISE* data products will for the first time provide a uniform mid-infrared view of quasar variability, for a very large sample and on long time scales of 6 months to 5.5 years. In particular, we will address the following questions:

- Are quasars sufficiently variable in the mid-infrared to enable their selection based on $W1/W2$ light curves? Applying the time-scale versus amplitude characterization of Palanque-Delabrouille et al. (2011), we will evaluate the extent to which *WISE* variability represents a new, full-sky mechanism for identifying quasar spectroscopy targets.
- Which quasars show the largest amplitude $W1/W2$ variations over 5.5 years? *WISE* may well represent an untapped, full-sky resource for discovering so-called 'changing-look' quasars.
- Do any SDSS spectroscopic galaxies show large increases in $W1/W2$ emission, consistent with being 'changing look galaxies' that have recently entered an AGN phase?

Given the data products we will create, these important questions can all be addressed via simple queries of our forced photometry catalogs. We will document the results in a publication, providing a first look at $W1/W2$ quasar variability as newly enabled by our proposed data products.

3.2 Faint, red motion objects

Gaia will soon revolutionize positional astronomy, but the most exotic, highly sought-after motion sources are too faint and red to be directly imaged by Gaia, which will detect very few free-floating brown dwarfs later than type $\sim$L4. Fortunately, these faint late L, T and Y dwarfs are precisely the objects whose motions will for the first time be detectable via our time-resolved coadds. Such objects will be strong candidates for JWST follow-up in the near future.

Thus far, motion searches based on the AllWISE catalog and single-exposure detections have been unable to push fainter than $W2{\approx}14.5$ (Luhman, 2014a; Kirkpatrick et al., 2014, 2016; Schneider et al., 2016). On the other hand, our time-resolved coadds allow us to probe motion sources $\sim$1.4 mag below the single-exposure limit