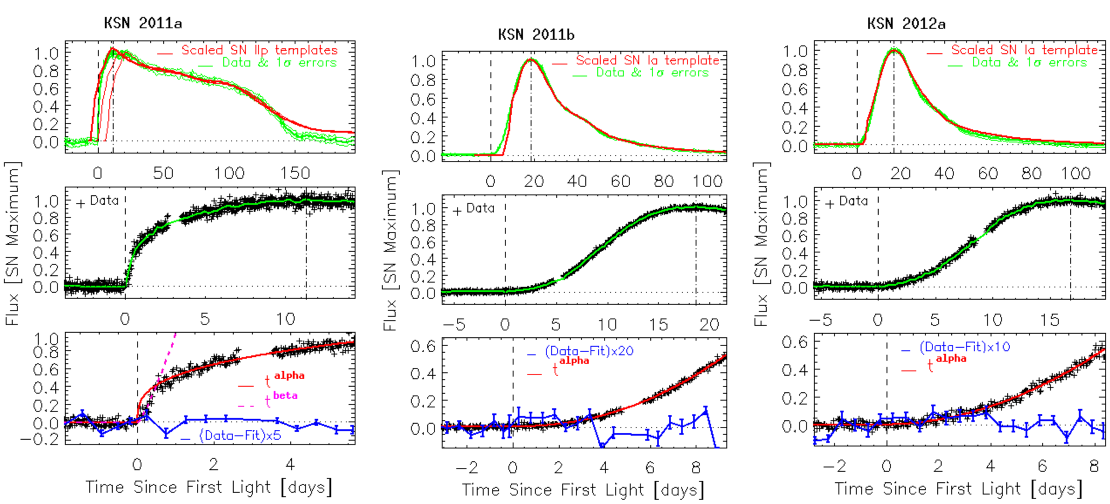
The Kepler Extra-Galactic Survey (KEGS) Transient Survey

Rob Olling[1], Ed Shaya[1], Armin Rest[2], Brad Tucker[3], Peter Garnavich[4], Dan Kasen[5], Richard Mushotzky[1], Alex Filippenko[5], David Thilker[6], Steven Margheim[7], John Tonry[8], Brian Schmidt[3], Stephen Smartt[9]

[1]University of Maryland, USA, [2]Space Telescope Science Institute, USA, [3]Australian National University, Australia, [4]University of Notre Dame, USA, [5]Departments of Physics and Astronomy, UC Berkeley, USA, [6]Johns Hopkins University, USA, [7]Gemini Observatory, USA, [8]Institute for Astronomy, University of Hawaii, USA, [9]Astrophysics Research Centre, Queens University, Belfast, UK

send email to: olling@astro.umd.edu



The Kepler Extra-Galactic Survey (KEGS) Transient Survey

Supernovae (SN) and Active Galactic Nuclei (AGN) vary on timescales of hours to months and are still shrouded in mysteries. We propose to monitor ∼10,000 bright ($g' \lesssim 18.8$) galaxies, which will yield ∼10 extremely well-sampled light curves of supernovae. No other present or planned project can match K2's cadence. We plan to: **A)** Determine the types of the companions to progenitors of SNe using features in the early (t $\lesssim$ 4 days) light-curves; **B)** Explore the explosion physics of SN Ia using subtle features during its rise (t$\lesssim$ 20 days); **C)** Improve the calibration of SN Ia for measuring distances and dark energy by creating a sample of well measured SN Ia light-curves with unprecedented detail. **D)** In nearby NGC galaxies, look for fast (t $\lesssim$ 10 day) and faint (M< -15) transients in a new range of parameter space provided only by K2; and **E)** In our previous Kepler GO work, we find that ∼ 3% of galaxies exhibit AGN-like variability at levels as low as 0.01%, and so we expect to discover about 300 AGN that are in the low-Eddington regime;

What triggers the white dwarf to explode as a SN Ia is unsolved: does it accrete material from a companion star or merge with another WD? If it accretes from a companion star, shock emission, as the explosion hits the star, would be observable (Kasen 2010). That emission will be short lived and strongest from certain viewing angles, requiring a rapid observing cadence and several SNe before strong conclusions can be reached. With two SN Ia discovered by our previous Kepler monitoring of a ∼ 500 galaxies (Olling et al. 2014a), tight constraints were placed on the systems. With a larger sample, we could determine what the progenitors of SN Ia are. Meanwhile, features due to the different explosion physics (detonation, deflagration, etc) of Ia and core collapse SNe will be revealed (Olling et al. 2014b).

Our program will improve the calibration of SN Ia's for cosmology by reducing uncertainties in distance measurements. By determining the key parameters needed for distance fitting (light-curve width, maximum, and the explosion time) on the scale of minutes rather than days, we can improve the precision of distances and dark energy as a function of redshift. *We will undertake a major, concurrent ground-based effort to observe the entire field every other day using SkyMapper and ATLAS Pathfinder.* We will also coordinate multi-color photometry and spectra to classify the transients using PESSTO, and existing programs at Siding Spring, Lick, Gemini, and Keck. These data, coupled with the Kepler high precision 30 min data will have great value for many years and for other K2 projects.

In particular in the nearby NGC galaxies, this program will also be sensitive to LBV- and nova-like eruptions, tidal shredding of stars or other material by super-massive black holes, and other still unknown types of faint, fast transients. TARGETS are extracted from the SDSS, 2MASS Extended Source Catalog, LEDA and NED catalogs. We have type and spectro- or photometric redshift for ∼10k galaxies and expect to find ∼10 SNe, split evenly between elliptical and spiral host galaxies. REFERENCES: Kasen, D. 2010, ApJ, 708, 1025; Olling etal. 2014a, submitted to *Nature*; Olling etal. 2014b, in preparation; Olling etal. 2013, K2 White Paper http://keplerscience.arc.nasa.gov/K2/docs/WhitePapers/Olling_WhitePaper.pdf