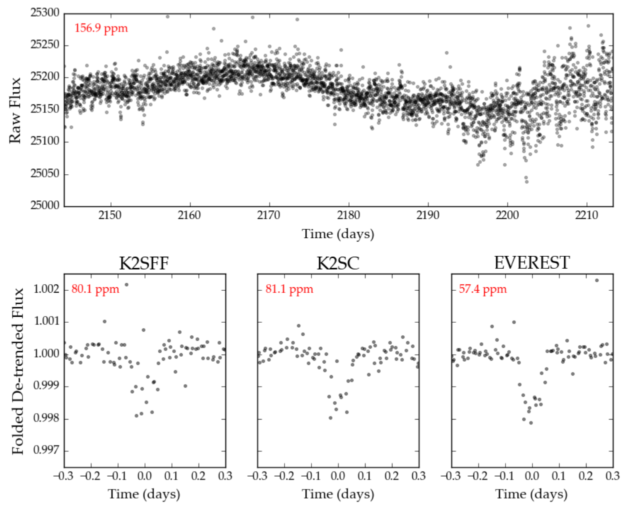
**HABITABLE ZONE PLANETS WITH K2.** R. Luger[1,2], E. Kruse[1], D. Foreman-Mackey[1], E. Agol[1,2], N. Saunders[1,2], R. Barnes[1,2], [1]Astronomy Department, University of Washington, Box 351580, Seattle, WA 98195, USA; rodluger@uw.edu, [2]Virtual Planetary Laboratory, Seattle, WA 98195, USA.

**Introduction:** The exquisite photometric precision of the original *Kepler* mission enabled the detection of thousands of transiting exoplanets, including on the order of one hundred small planets in or near the habitable zone [1]. However, the vast majority of *Kepler* targets are solar-like G dwarfs [2], which makes follow-up characterization of their potentially habitable planets difficult because of small transit depths, long orbital periods, and low signal-to-noise ratios given the large distances to most of the stars in the *Kepler* field. As of May 2014 the spacecraft has been operating in a new mode, known as *K2*, targeting a different patch of the sky every three months. Under this new observing strategy, the stars observed by *K2* are on average cooler and closer than those observed by *Kepler* [3]. *K2* thus offers an unprecedented opportunity to detect and characterize planets in the habitable zones of M dwarf stars, which are now known to be exceedingly common [1,4]. However, because of the failure of two out of four reaction wheels, *K2* delivers light curves with photometric precision nearly an order of magnitude lower than *Kepler* did, compromising its ability to detect small transiting planets.

**EVEREST:** We have developed the EVEREST (EPIC Variability Extraction and Removal for Exoplanet Science Targets) pipeline, which removes instrumental signals introduced by the uncontrolled motion of the spacecraft and delivers high quality light curves for all *K2* stars. In our first paper [5], we showed how EVEREST recovers the original *Kepler* photometric precision for bright (*Kepler* magnitude $K_p$ < 13) stars, yielding the highest precision light curves for unsaturated stars of any publicly available pipeline. Here we present an update to the EVEREST pipeline [6], in which we employ a regularized pixel level decorrelation scheme coupled to a Gaussian process to model and remove instrumental noise from light curves. The new version of EVEREST recovers the original *Kepler* precision to $K_p = 15$ and yields the highest precision of any pipeline for stars of all magnitudes, including saturated stars and stars observed in short cadence mode.

We are currently using the new EVEREST light curves to re-characterize all *K2* transiting exoplanets, including several dozen exoplanet candidates in or near the habitable zone. The higher photometric precision of our light curves relative to those in other catalogs allows for a higher confidence determination of the




planetary nature of these objects and more precise estimates of their radii, which are essential to assessing their habitability. In the figure above, we show the raw light curve of K2-72 (top), an M2 dwarf with four confirmed transiting planets, none of which can be seen by eye given the excessive instrumental noise. In the bottom three panels, we show the light curve de-trended with each of three pipelines: K2SFF [7] (left), K2SC [8] (center), and EVEREST (right). The light curve is folded on the period of K2-72e, a roughly Earth-sized planet in the star's habitable zone. The median 6-hr photometric scatter of each light curve is indicated in red. The EVEREST light curve has lower scatter than both the K2SFF and and K2SC light curves by ~40%, allowing for a commensurable increase in the precision of its radius measurement.

EVEREST has also facilitated the detection of ~200 previously unknown planets, ~10 of which are in or near the habitable zone [9]. We will discuss these new discoveries and efforts to further characterize them using transit timing variations (TTVs) and follow-up observations.

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