

High-resolution Near-infrared Follow-up of K2 Microlensing Systems

Calen Henderson
Ohio State University

Background and Context:

K2's Campaign 9 (K2C9) will conduct a several square-degree microlensing survey toward the Galactic bulge to detect exoplanets simultaneously from the ground and from space.

The long spatial baseline between K2 and the Earth will facilitate parallax measurements for hundreds of microlensing events, some with planetary signatures, allowing for the determination of the mass of and distance to the lens systems.

By constraining the flux of the lens host star it is possible to measure these quantities via a method independent from parallax. However, this second channel for characterizing lenses has been applied to fewer than ten lens systems. Further developing this technique is important to confirm the parallax-derived values as well as establish an additional methodology for characterizing lenses, particularly since the majority of microlensing events that will be detected over the next decade will not have parallax measurements.

Methodology:

In order to employ the flux characterization method en masse it is necessary to measure the near-infrared (NIR) flux of the background source star.

High-resolution follow-up measurements of the microlensing target are taken in H-band, which balances the sky brightness, the wavelength-dependent diffraction limit of the observational facility, and the contrast between the lens and the source.

Moreover, determining the NIR source flux requires measurements at several epochs spanning a range of magnification.

Thus, it is crucial to obtain H-band source flux measurements for events in the K2C9 field with a cadence of at least twice weekly.

Strategic Plan:

Ohio State is an institutional member in the SMARTS consortium, providing access to ANDICAM, a dual-channel optical+NIR imager on the CTIO 1.3m.

We can thus use ANDICAM to carry out targeted observations, measuring NIR source fluxes for a significant fraction of events alerted by the ground-based OGLE-IV survey that K2C9 will detect as well.

We will also work with the Kepler team to advocate for a semester of time on UKIRT, a facility with a sufficiently large etendue in the NIR to obtain NIR source fluxes via survey-mode operations.

Finally, we will explore options for high-resolution follow-up.

In particular, we will propose for 1 night of Keck NIRC2 observing, which will allow for the observation of ~20 high-profile targets, including those planetary in nature.

Personnel Justification:

I am currently leading and selecting events for a targeted NIR effort using ANDICAM.

This campaign complements a Spitzer microlensing campaign June-July/2015 (Gould, PI).

The Spitzer microlensing team has initiated a parallel H-band survey using the UKIRT telescope (C. Beichman, PI) to obtain hourly NIR data for a specific subset of Spitzer targets.

I furthermore have a recent single-author paper in which I explore three different techniques, which operate on three different time scales, by which the flux characterization method can be employed.

In September/2015 I will begin an NPP fellowship at JPL, positioning us well to obtain access to NASA and Caltech resources, including UKIRT and Keck.

Ancillary Science:

For free-floating planet candidates, parallax will confirm that the cause of the short time scale of the event is a low-mass object.

However, high-resolution NIR follow-up is required to rule out the presence of a host lens star and distinguish between a planet that is free-floating planet and one that is bound but widely separated.

NIR source flux measurements also significantly reduce the systematic uncertainties involved in determining

the Einstein ring, the angular scale in microlensing phenomena whose value is necessary to measure the mass of and distance to the lens.

Lastly, our proposal will serve as path finding for the NASA WFIRST mission, as it is unknown how an optimal microlensing survey toward the Galactic bulge in the NIR should be conducted.