

DEEP AO IMAGING VALIDATION OF KOI'S USING THE LARGE BINOCULAR TELESCOPE

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We propose to significantly enhance and expand Kepler's imaging follow-up program by using observations obtained with the world's premiere diffraction-limited facility: the new ("extreme") adaptive optics (AO) system at the Large Binocular Telescope (LBT). The LBT AO system offers several distinct advantages compared to other comparable large-aperture telescopes: (1) a pyramid wavefront sensor permits closed-loop (on-axis) correction for stars as faint as $R=17.2$ mag using the primary target as its own natural guide star; (2) use of a deformable secondary mirror results in lower thermal background levels; (3) a red-sensitive (I-band) wavefront sensor provides access to previously inaccessible K-dwarf and M-dwarf stars, increases the number of available off-axis guide stars, and increases the signal-to-noise ratio of starlight at the wavefront sensor, due to larger atmospheric r_0 and t_0 values. LBT AO measurements are significantly deeper than, yet complementary to, visible "lucky" imaging measurements, and can generate sufficient sensitivity to help reduce false-positive probabilities to essentially zero, particularly as a result of the ~ 2 mag "red advantage" obtained by observing in the JHK bands. Our proposed program will augment the overall number of KOIs targeted with AO and improve upon contrast levels achieved at the closest angular separations for high-priority stars of any apparent magnitude. These new capabilities translate directly into more robust validation of small (terrestrial) planets and will improve the overall statistical significance of Kepler's results, by accessing more stars, reducing false-positive probabilities for individual systems, and ultimately decreasing the uncertainty in Kepler's determination of the occurrence rate of rocky worlds.