

Overcoming the Seeing Limitations at 2.4-m Thai National Telescope with Lucky Imaging Technique

Thursday, May 21, 2015 2:15 PM (15 minutes)

Resolving power of large telescopes is limited by seeing condition, the blurring due to the Earth's atmospheric turbulence. This limits the capability of large telescopes, including the 2.4-m diameter Thai National Observatory (TNO) in Chiang Mai, Thailand, from reaching its fullest resolving power. We present an effort to overcome this limitation through the 'Lucky Imaging' technique, which is done by taking large number of short (e.g., 0.01 second) exposures to "freeze" the atmospheric turbulence, and select the least atmospherically distorted images to combine into a final image with high signal-to-noise ratio. We obtain R-band images of Messier 15 and 79 (M15 and M79) from the TNO during December 2014. The objects are chosen to represent high-density star field suitable for determining the resolving power of the final image. We took 240 and 502 images of M15 and M79, respectively, and selected 1% of images with best quality to combine into final images. We measured the full width at half maximum flux (FWHM) of the final star images and found that we can obtain FWHM as low as 1.17 and 1.25 arcsec, for M15 and M79, respectively. This represents a ~20% improvement to the resolution from the original 1.66 and 1.48 arcsec FWHM for M15 and M79, despite the average seeing conditions and moderate airmass of 1.2 - 1.8. This experiment suggests that the TNO is capable of high-resolution imaging of relatively faint objects such as star clusters through lucky imaging technique if data is acquired at the best seeing and highest elevation possible.

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Session Classification: Astronomy, Astrophysics and Cosmology (Sponsored by NARIT)

Track Classification: Astronomy, Astrophysics, and Cosmology