Analysis of Astrometry in the JWST North Ecliptic Pole (NEP) Time Domain Field (TDF)

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• Located within JWST’s northern Continuous Viewing Zone centered on the NEP

• Void of bright foreground stars and low galactic foreground extinction

• Community field for time domain science

Image Credit: Desiree Stover/NASA
Background

What is astrometry?

Filter Profiles

Image Credit: Kiso Observatory, University of Tokyo

Image Credit: (Top) NAOJ (Bottom) livephysics
Project Outline

• Create artificial images of Subaru data

• Match the Subaru and LBT catalogs by Right Ascension and Declination

• Astrometrically cross-register the Subaru and LBT images with milli-arcsec precision and identify moving objects (comets, galactic stars, brown dwarfs)
Large Binocular Telescope Data

• Large Binocular Camera Filters \((U, g, r, z)\)

• Observed July 2016 for half a night
  – Equivalent to full night on 8.4 m telescope
  – Median seeing ~ 0.95” with depth ~ 26 AB magnitude
  – Observations part of the field selection

Image Credit: Large Binocular Telescope Observatory Website
Subaru Observations and Data

• Hyper Suprime-Cam Filters \((g, i, z, NB816, NB921)\)

• Observed June 2017 over five nights
  – Seeing between \(~ 0.5\)" and \(~ 1.0\)" with depth \(~ 24-26\) AB magnitude
  – Observations part of larger HEROES survey
  – Almost 1 year after LBT data

Image Credit: Cameron White
Results: Artificial Images

- Aid in the visual validation of moving objects
- Red and magenta objects correspond to bright sources that saturated the relatively long Subaru exposures in both $g$ and $i_2$, and just $g$, respectively
Results: LBT Astrometry

- LBT: four separate chips in each camera
  - Must mosaic the images together to get the full picture
Future Work

• Improve the LBT astrometry

• Identify objects that move significantly with respect to instrumental resolution

• Repeat this analysis with the photometry

• Incorporate data taken by *Hubble Space Telescope*
  – Better resolution than either LBT or Subaru

• Publish paper in Astrophysical Journal
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