Astrophysics Seminar

Adaptive Optics: Paving the way to high-resolution astronomy from the ground

Dr. Jonathan Crass, University of Notre Dame

Tuesday

February 24

12:30 P.M.

Rm 184 NSH

All large ground-based optical telescopes have limited resolution due to the Earth's atmosphere distorting incoming starlight. In recent decades, astronomers have worked to develop techniques to overcome the effects of this distortion to achieve diffraction-limited imaging from the ground. In this talk, I present two techniques which are actively used for correcting the effects of the Earth's atmosphere: adaptive optics (AO) and lucky imaging.

AO and lucky imaging are both proven techniques used for different types of astronomical observations. I present the basics of each technique with their successes and limitations, and I discuss how the combination of both techniques opens up a new avenue for high-resolution imaging on large ground-based telescopes. The Adaptive Optics Lucky Imager (AOLI) combines these two techniques into a dedicated instrument for the first time and uses a novel type of wavefront sensor, the non-linear curvature wavefront sensor (nlCWFS) as part of its adaptive optics system. This instrument, designed initially for use on the 4.2m William Herschel Telescope, will provide some of the highest resolution visible-wavelength images ever taken on ground-based telescopes.

As well as imaging, AO systems can be used to provide a corrected beam to a spectrograph. I will present an update on the iLocater radial-velocity (RV) instrument being developed at the University of Notre Dame for the Large Binocular Telescope (LBT). This instrument couples light from each dish of the LBT into single-mode optical fibers, the first instrument in the world to do this, which mitigates significant systematic errors experienced by existing RV instruments. By feeding the light from these fibers into an ultra-stable spectrograph, iLocater will achieve a RV precision of 20cm/s, allowing the detection of Earth like planets around M-type stars.