پژوهشگاه دانش‌های بنیادی
IPM
INSTITUTE FOR RESEARCH IN FUNDAMENTAL SCIENCES

Instrumentation and Observational Astronomy

Astronomical techniques have evolved since introduction of modern detectors like CCDs in 80s and revolutionized by Active and Adaptive Optics in 90s. These and a dozen of other techniques turned astronomical telescopes into advanced laboratories with diverse high-level technologies including vacuum technology, laser comb, laser guide star, etc. In addition modern spectrographs use diverse configurations to record spectra of hundreds of objects at once. Stellar occulting disks allowed us to *see* exoplanets for the first time.

The aim of this course is to provide an introduction to the observational astronomy techniques. Our objective is to familiarize students in the field of astronomy and cosmology with the key knowledge and expertise one needs to handle professional telescopes. In particular we will discuss geometric and wave optics, optics of telescopes, aberrations and optical quality, signal to noise and sensitivity, sampling and the Nyquist theorem, detectors, astronomical seeing and the earth atmosphere, adaptive optics, photometry, spectroscopy, spectropolarimetry, and interferometry. In particular we will discuss in detail concept of the modulation Transfer Function (MTF) and study aberrations and seeing through their MTFs. Students will present well-known papers in the filed like Lucy deconvolution, Zeeman-Doppler Imaging, etc.

Lectures will be at 16:30 to 18:00 on Saturdays and Mondays at the SoA. The course also involves homeworks which are partially computer programing in Python. A few additional sessions will be arranged to practically work with telescopes at night.

The course is too new to be covered by a single textbook. Beside introducing three main textbooks, I will present slide handouts for each lecture. Hundreds of additional references are given in slides. A Lecture note (in Persian) will also be provided to the attendees. The lecture note will complement the course slides.

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