Laboratory Activity Descriptions

The CfAO Summer School includes laboratory activities produced with support from the Laboratory for Adaptive Optics and the Center for Adaptive Optics Professional Development Program. The activities are staffed with instructors from several institutions associated with the Center for Adaptive Optics. The three activities are described below.

Adaptive Optics Demonstrator

The Adaptive Optics Demonstrator is a stand-alone, self-contained adaptive optics system that corrects a dynamic input laser at 30 Hz with a 37-actuator deformable mirror. Guided by an 8x8 Shack-Hartmann sensor, the AO Demonstrator is robust to misalignment and permits easy user interaction. In this activity, students will learn basic optical alignment techniques by realigning several of the AO Demonstrator's components. Following realignment, the students will interact with the graphical user interface (GUI) to calibrate the system and run it closed-loop.

Vision Science Activity

The quality of retinal imaging in the living eye can be greatly improved by the use of adaptive optics. This activity will provide participants with first-hand experience of the eye's imperfections that can be corrected by adaptive optics. The Zernike polynomial description of the wavefront aberrations and the corresponding point spread functions will be used to explore the relationships among Zernike order, pupil size, and image quality. We will also investigate the variability of ocular quality in people, some of whom may have had refractive surgery.

Optics for AO Systems

This activity is designed to enable students to observe and experiment with the diffraction of light, using a tabletop optical setup consisting of a computer-controlled detector illuminated by a laser source. You will work in small groups to investigate the relationships between the shape of the limiting aperture and the resulting far-field diffraction pattern. You will be able to directly examine how phase errors in the pupil affect the point spread function, as well has how they alter the signal received by a Shack-Hartmann sensor. The computer can be used to quantitatively examine the point-spread function, and software tools are provided for comparing your experimental results with simulations.