AO Demonstrator – Mark Ammons

The AO demonstrator is an enclosed, standalone system that uses a deformable mirror to correct a distorted input beam. It was designed and built primarily for educational purposes, but could suffice as a simple research tool if the need arises. It has a small laser to serve as the input, a 37-actuator Intellite deformable mirror, a Shack-Hartmann wavefront sensor, a desktop computer (hopefully a laptop, soon) to control the mirror, several high-voltage drivers, and eventually a TV for viewing the focused laser point in real time. The components can be moved around together on a cart; moving it off-campus requires disassembly and roughly an hour or two. The system has a graphical user interface to simplify operation. There are several potential levels of interaction with the system, based on the user's familiarity with AO and computers:

1. Simple interaction: Users can start the system with the graphical user interface and simply observe results. Users can experiment with the beam's aberration by passing distorted glass through the beam or introducing turbulence (hair dryer). This is for groups or users who would like a quick demonstration of AO in operation – possibly a tour or group of students. A facilitator is necessary.

2. Complex interaction: The graphical user interface has several computational methods available for operation (image sharpening and Shack-Hartmann for now). Users can run these different methods and observe results in terms of the quickness of correction, quality of correction, error, etc. This requires a greater familiarity with (a) the optical layout, (b) standard reconstruction methods, and (c) wavefront sensing methods. This would be meant for classes or incoming CfAO members who would like to understand the engineering of AO.

3. Complete interaction: The modular source code is written in visual C++ and may be changed. Users can write new centroiding methods, reconstruction routines, and merit-figuring components, possibly to permanently add functionality to the entire system. Users can also change the optical layout of the system and experiment with different Hartmann spot sizes, input beams, lens relay configurations, etc. This type of interaction would be ideal for class projects or CfAO researchers (to test out ideas on a simple platform).

The parts and labor were funded by the Laboratory for Adaptive Optics (LAO) and the National Science Foundation (NSF).