

AO - Adaptive Optics

The currently operational AO, - called "AO-76" was installed on the NST in 2010. AO-76 incorporates a 97 actuator deformable mirror (DM), a Shack-Hartmann wave front sensor with 76 subapertures, and a digital signal processor system. Diffraction limited resolution is attained in the visible after speckle reconstruction. Without speckle reconstruction, and under good atmospheric conditions, the resolution approaches the diffraction limit in the infrared (IR). We are upgrading the AO-76 to AO-308 (357 actuator DM), which will be sufficient to perform diffraction limited photometry and polarimetry over the isoplanatic patch at all visible (and IR) wavelengths on the NST under nominal BBSO seeing conditions. AO-308 is undergoing bench testing in Spring 2012 and will be in regular operation in Summer 2012. Traditional AO systems, such as AO-76 and AO-308 confine diffraction limited observations to the isoplanatic patch (6" at 500 nm on average in summer) with a gradual roll-off away from the patch. The next generation multi-conjugate AO (MCAO) is being developed at BBSO, which will enable diffraction limited observations over an extended field. MCAO will employ two DMs to correct the turbulence in the ground layer (< 500 m), and the boundary layer (3-6 km) respectively. First light of the NST MCAO system is expected in Summer 2013 with regular operation in Summer 2014.

NST-AOs	AO-76	AO-308	MCAO
Wavefront sensor	Shack-Hartmann WFS with 76 subapertures	Shack-Hartmann WFS with 308 subapertures	Two Shack-Hartmann WFSs for narrow and wide field measurement
Deformable mirror	97 actuator DM	357 actuator DM	Two DMs
Control system	DSP and FPGA	DSP and FPGA	Multi-CPU parallel computation