
First results from a bench demonstrator of a novel Wide Field of View Wavefront Sensor

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Abstract

Laser-enabled tomographic Wide field of view AO systems use several Laser Guide Stars to map the volume of turbulence above a telescope. The telescope infrastructure required to generate, launch and observe multi-LGS is expensive, and still result in AO system designs where residual wavefront errors remain one of the dominant error terms due to incomplete meta-pupil sampling of high altitude turbulent layers. This has motivated us to investigate the possibility of wide-field wavefront sensing using non-focused lasers which can provide better sampling of turbulence at high altitudes without increasing the number of launched guide stars. The technique uses a single multi-mode laser to create a high-contrast illumination pattern across the whole AO field-of-regard which can then be measured using a correlating Shack-Hartmann WFS over several sub-regions. We have assembled a laboratory demonstrator of a laser launch and wavefront sensing system that recreates realistic launch and return system geometries for an 8m-class telescope, including the impact of uplink turbulence on the illumination pattern. Here, the first results from wavefront sensing using this setup are presented as well as a discussion on the feasibility of employing such a system on a large aperture telescope using existing technologies.

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