Performance of the Fresnel Wavefront Sensor as a Function of Scintillation Strength

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Abstract

Local amplitude aberrations caused by scintillation can impact the reconstruction process of a wavefront sensor (WFS) by causing a spatially non-uniform signal at the pupil plane. The nonlinear curvature wavefront sensor (nlCWFS), also referred to as the Fresnel wavefront sensor (FWFS), has demonstrated the ability to precisely reconstruct wavefronts in the presence of scintillation, using amplitude aberrations to help inform the reconstruction process. The FWFS has been shown in previous work to also achieve better sensitivity compared to the Shack-Hartmann WFS (SHWFS) under low light levels. Building upon previous laboratory experiments and simulations, we present the results of laboratory testing to quantify the wavefront reconstruction performance of the FWFS compared to an equivalent SHWFS as a function of scintillation strength and relative input flux. Preliminary results and implications of the experiment are described.

Keywords: wavefront sensing, adaptive optics, scintillation

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