
Holographic Modal Wavefront Sensing for Active and Adaptive Optics

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Abstract

The SpacePhorm project, a collaboration between the University of Galway and TU Dublin, aims to develop novel wavefront sensing approaches for space application. As a part of this initiative, we are exploring using holographic modal wavefront sensors to detect and correct wavefront errors. One of the critical aspects of this research involves generating accurate and repeatable wavefronts to test these sensors. To achieve this, we have focused on using a Transmissive Spatial Light Modulator (SLM) to emulate wavefront discontinuities, common in segmented mirrors of large telescopes due to alignment errors. Our experiment with the SLM involves calibrating its phase response to different grey levels to ensure it produces phase modulation with minimal amplitude modulation. By setting up an optical system and varying the grey levels, we generated phase discontinuities and analyzed the resulting Point Spread Functions (PSFs). This study demonstrated that Transmissive SLMs could effectively generate and control phase discontinuities, providing valuable insight for improving wavefront sensors although the range of phase modulation is limited. These findings are valuable for advancing the imaging capabilities of large-segmented telescopes, contributing to enhanced astronomical observations and the broader goals of the SpacePhorm project.

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