Two-wavelength focal-plane piston sensing: first experimental results with LIFT

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Abstract

Adaptive optics systems for the future Extremely Large Telescopes will have to deal with large gaps in the pupil due to the spiders and/or the segmentation of one or several mirrors. These gaps are typically larger than the expected r0 at the sensing wavelength. They can thus create significant discontinuities in the wavefront, which might eventually lead to the so-called "island effect" or "petaling": the wavefront in each segment is well corrected, but differential pistons at a multiple of the sensing wavelength appear between the segments. In the context of prototyping the Natural Guide star Wavefront Sensor for the Giant Magellan Telescope, we have studied the Linearized Focal-plane Technique (LIFT) as a potential solution to correct the differential pistons generated while the adaptive optics system is running. LIFT originally uses a single image with a known phase offset to estimate wavefront modes. For this application, we derive the differential piston on a large range (several microns) from two LIFT estimations at different wavelengths. In this presentation, we show the results of the first tests of this "double wavelength LIFT" on a simplified bench.

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