A Holographic Dispersed Fringe Sensor to Disambiguate Segment Piston for GMT

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Abstract

Diffraction-limited observing modes of the Giant Magellan Telescope will require ensuring that its doubly segmented optical design remains phased over the duration of a scientific exposure. The natural guide star wavefront sensor (NGWS) for the GMT will consist of two channels: a highly-sensitive pyramid wavefront sensor and a holographic dispersed fringe sensor (HDFS) designed to disambiguate phase wrapping that can occur in a pyramid wavefront sensor. The HDFS uses a phase mask in the pupil plane to selectively interfere GMT segment pairs in the subsequent focal plane. Multiplexed diffraction gratings over each segment are oriented so that the spectra of segment pairs are superimposed and interfere with each other. This results in a series of dispersed interference fringes that encode the segment piston differences. The dynamic range of the HDFS is ± 12 waves wavefront. This paper will present the design of the HDFS channel of the NGWS and give an update on the development and testing of a lab prototype.

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