Performances of the integrated Mach-Zehnder wavefront sensor for extreme adaptive optics

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Abstract

We will present the integrated Mach-Zehnder (iMZ), a self referenced interferometric wavefront sensor developed for XAO and implemented on an XAO test bench at CRAL. The WFS concept consists of creating two opposite sets of interferences between the wavefront phase to be measured and the spatially filtered reference beam. We describe the implementation of this concept including the scheme to extend its dynamical range by using phase diversity. A new calibration method adapted to the iMZ which takes into account the non-linearities of the signal is developed to use the sensor for various types of phase measurements. We will compare the iMz sensitivity compared with other WFS. We will present the overall performances of the iMz in closed loop for different telescopes (Very Large Telescope (VLT) and ELT) in different turbulence regimes and including island effects, cophasing residuals or low wind effects. These performances were estimated from either end-to-end simulations or experimental measurements.

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