Calibration and performances of the integrated Mach-Zehnder (iMZ) wavefront sensor for extreme adaptive optics

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Résumé

We describe our latest results obtained with the integrated Mach-Zehnder (iMZ), a wavefront sensor based on Fourier filtering of an interferometric arm. This kind of sensor meets extreme adaptive optics requirements, high speed (1 kHz) and high accuracy (< 10 nm at 5-10 cm spatial scale), as well as the reconstruction of phasing errors on segmented telescopes. Our contribution will present recent results on the calibration method we have developed and validated experimentally to extract the phase from the iMZ signal, using several phase patterns introduced by a deformable mirror. We present the phase modulation method and the unwrapping algorithm developed to increase the dynamical range of the sensor up to several microns, limited at ± lambda/4 without these new strategies. Numerical simulations of the iMZ performances for various turbulence phases will be presented to address the sensor accuracy in realistic conditions, with photon and read-out noise included. We will also report on our latest laboratory results of static phase correction using a 12x12 deformable mirror.

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