
Lab demonstration of wavefront reconstruction for the fragmented aperture of the ELT

Arielle Bertrou-Cantou^{*†1}, Eric Gendron , Gérard Rousset , Fabrice Vidal , Arnaud Sevin , Jordan Raffard , and Florian Ferreira

¹Caltech Department of Astronomy [Pasadena] – United States

Abstract

The fragmentation of the ELT pupil in six petals by the spider which supports its secondary mirror comes with a new challenge in the implementation of the instruments AO systems. With tens of centimeters thickness, i.e. several times the turbulence coherence length, the spider arms break the continuity of the incoming wavefront. In visible light, the pyramid wavefront sensor (WFS) was shown to be a poor candidate to reconstruct these differential pistons but their values can be inferred from Kolmogorov's theory based algorithms. The SESAME testbed at LESIA enables to reproduce the relevant characteristics of the ELT (pupil fragmentation, high order DM, pyramid WFS prototype) and to carry experiments to validate these reconstruction methods. We demonstrate, in-the-lab, that the proposed algorithmic solutions effectively reduce the differential pistons errors and enable to recover the imaging capability of the ELT, provided that the wavefront to be reconstructed is continuous.

Keywords: ELT, fragmented pupil, wavefront reconstruction, high order AO

^{*}Speaker

[†]Corresponding author: abertrou@caltech.edu