

Implementing the crossed-sine wavefront sensor for astronomy application with a single natural guide star

François Hénault (a), Yan Feng (a), Alain Spang (b), Laura Schreiber (c)

- (a) Institut de Planétologie et d'Astrophysique de Grenoble, Université Grenoble-Alpes, CNRS, B.P. 53, 38041 Grenoble, France
- (b) Université Côte d'Azur, Observatoire de la Côte d'Azur, CNRS, Laboratoire Lagrange, France
- (c) INAF, Osservatorio di Astrofisica e ScienzadelloSpazio di Bologna, Via Gobetti 93/3, 40129 Bologna, Italy ;

Abstract: The crossed-sine Wavefront sensor (WFS) is based on a gradient transmission filter and a 2 x 2 mini-lens array, enabling simultaneous achromatic imaging at a high spatial resolution and measurement accuracy comparable to those of laser-interferometers [1-2]. The imaging system is very compact and can serve a large range of high throughput applications in astronomy, biomedicine and metrology. The performance of the system has been demonstrated recently in the optic laboratory [3].

However the principle of the crossed-sine WFS is based on simultaneous acquisitions of four off-axis light sources, which may be a limitation when dealing with Adaptive optics (AO) systems for astronomy. This communication presents an alternative design allowing the system to operate with a single, on-axis natural guide star. The new design is described, and numerical simulations confirm that the achieved performance is similar as in the original design.

Keywords: Adaptive Optics, Wavefront sensor; SCAO

References

- [1] F. Hénault, A. Spang, Y. Feng, and L. Schreiber, "Crossed-sine wavefront sensor for adaptive optics, metrology and ophthalmology applications," *Engineering Research Express*, vol. 2, no. 015042, 2020.
- [2] Y. Feng, F. Hénault, L. Schreiber, A. Spang, "Development and implementation of crossed-sine wavefront sensor for simultaneous high spatial resolution imaging ," Proceedings of the SPIE vol. 10379, n° 103790N (2020).
- [3] L. Schreiber, Y. Feng, A. Spang, F. Hénault, J.-J. Correia, E. Stadler, D. Mouillet, "The crossed-sine wavefront sensor: first tests and results," Proceedings of the SPIE vol. 12188, n° 121883I (2022).

