
PAPYRUS : A pathfinder for ELT-PCS on GTC

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Abstract

The Provence Adaptive optics Pyramid Run System (PAPYRUS) is a pyramid-based Adaptive Optics (AO) system installed at the Coude focus of the 1.52m telescope (T152) at the Observatoire de Haute Provence (OHP).

Imaging exoplanets and exoEarth with the ELT is a scientific grail, but also an instrumental challenge. Detecting the dimm light reflected by the planet among the huge flux coming from its host star, scrambled by the residual aberrations from the atmospheric turbulence, is the main challenge for the ELT second generation. It will require instrumental ingredients optimized toward this specific task, among which an high-contrast arm able to cancel the star light, a science instrument able to characterize spectrally the planet light, and an extreme AO system able to feed both previous systems with a well corrected wavefront. These ingredients must be facing the challenge of the ELT itself : a promising extreme angular resolution hidden in a complex environment (segmentation, non-kolmogorov aberrations and discontinuities, vibrations and windshake...).

We propose in this paper to explore the interest of building a prototype of PCS on the large segmented Gran Telescopio Canarias (GTC) based on the PAPYRUS system recently installed at OHP. We explore the XAO scheme able to provide the best performance : optimised pyramid WFS, second stage AO, optimized control laws, and analyse its capabilities wrt the telescope environment. We base our analysis on the PAPYRUS performance measured on-sky. We analyse the science potential of such a system on a 10m telescope, in term of exoplanet spetral characterization and disk imaging.

Keywords: adaptive optics, pyramid wave, front sensing, exoplanets

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