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Adaptive Optics at C2PU/Calern (AOC) : a stellar- and planetary-mode AO system on a 1-m telescope

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Abstract :
The Adaptive Optics at Calern (AOC) system aims to bring AO correction to 1-m class telescopes, which usually lack high-angular resolution capabilities. Installed on the 1-m Epsilon telescope at the Calern Observatory, and based on a 10x10 Shack-Hartmann wavefront sensor and a 97-actuator deformable mirror, AOC operates in both stellar (8.5 arcsec field of view) and planetary modes (30.5 and 80.5 arcsec). It enables wavefront sensing on either point sources or extended objects such as Jupiter or Saturn, with the particularity that the science target itself serves as the AO guide object.

We are developing and validating simulation tools aimed at optimising wavefront sensing strategies and improving command control. In parallel, we are implementing diagnostic and performance evaluation tools based on real-time telemetry. By continuously comparing simulations with telemetry, on-sky data, and on-site atmospheric monitoring when available, we can refine wavefront control strategies and command matrices. These efforts aim to improve the robustness and overall performance of the system for high-resolution stellar and planetary observations.

In its planetary mode, AOC was planned to be used together with the spectro-imager JOVIAL which aims to measure the jovian oscillations at 519nm, while in its stellar mode it feeds a near-infrared camera (from 900nm to 1700nm). Once the system will be sufficiently optimised, we plan to use the latter for the comparison of short-exposure and long-exposure imaging techniques, in function of the quality of the correction obtained, and also super-resolution by means of deconvolution (for which the need in AO correction is a priori crucial). But AOC is also planned to be used for on-sky testing of coronagraphic concepts, or spectroscopic or photonics components, thanks also to the ease of access of the optical bench at the Coudé focus of the telescope.

Keywords : *Adaptive optics, AO optimization, Wide-field AO, Small telescopes, Stellar imaging, Planetary imaging, System characterization, High-resolution imaging*