An analytical approach to model the second-stage Adaptive Optics correction for SPHERE

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Abstract

SAXO+(1) is the name of the proposed second-stage adaptive optics module to increase the performance of the Spectro-Polarimetric High-contrast Exoplanet REsearch instrument (SPHERE(2)) at the Very Large Telescope (Chile). This upgrade aims at improving the raw contrast (up to 10-5, goal 10-6) close to the optical axis, enabling the observation of fainter and redder targets. In order to define the main requirements for the second-stage module design, a few trade-offs need to be carried out. We propose in this paper the use of an analytical

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approach, based on spatial PSD analysis, to study some error terms affecting the SAXO+ system and to directly compute the AO residual phase screens. For this purpose, a second-stage correction filter in the spatial frequency domain has been implemented in PAOLA(3), a software tool for the analytical modeling of AO systems. The results are then validated by comparing them to the output of a full end-to-end simulation tool, COMPASS(4), running with the same input parameters.
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