MATTO - The Multi-Conjugate Adaptive Techniques Test Optics

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Abstract

The Multi-Conjugate Adaptive Techniques Test Optics (MATTO) is an innovative wide-field adaptive optics (AO) test bench currently in development at the Astronomical Observatory of Padova. This facility is strategically designed to explore and advance Multi-Conjugate Adaptive Optics (MCAO) techniques under diverse conditions. With a forward-looking perspective, MATTO is engineered for flexibility, featuring independently configurable modules.

The first module reproduces reference sources, incorporating opto-mechanical groups to generate atmosphere-perturbed beams. This module can reproduce both natural and artificial references, encompassing distinct light spectra and asterisms. A second module combines light from these references, emulating the beam geometry in the lower atmosphere and the light collection from a telescope. The MCAO correction module implements a range of compensation schemes through the integration of three large deformable mirrors (DMs), enabling conjugation at various atmospheric altitudes. Lastly, a sensing module provides versatility by simulating a diverse array of wavefront sensors, encompassing both pupil plane and focal plane techniques, while also mimicking optical phase modifiers such as roof and pyramid configurations. The overall setup is

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highly flexible, facilitating the placement of sensing and perturbing elements in different optical positions and ensuring adaptability for future proof-of-concept studies and advancements in AO techniques. The latest opto-mechanical design of the bench is presented in this paper, providing details on the accessible parameter space and the simulation capabilities.

Keywords: AO, MCAO, Wavefronsensing