Contribution ID: **13** Type: **Talk**

Testing the MICADO@ELT PSF Reconstruction tool on SOUL@LBT data

Wednesday 25 May 2022 10:20 (20 minutes)

A detailed knowledge of the point-spread function (PSF) is mandatory to fulfill most scientific requirements of the next generation adaptive optics (AO) instruments that will equip 30-meter class telescopes. Our blind PSF reconstructions (PSF-R) algorithm is currently being developed in the context of the MICADO@ELT consortium and it is aimed to reconstruct observation-specific PSFs without extracting information from the science data, relying only on telemetry and calibrations. After evaluating its reliability on end-to-end simulations, our PSF-R algorithm is mature enough to test it on real AO data. In this presentation we will discuss its performances and the uncertainties introduced in scientific measurements, for single-conjugated AO observations taken with the SOUL+LUCI instrument of the Large Binocular Telescope. In particular, the flexibility of our PSF-R software allowed the successful implementation of the pyramid wavefront-sensor. This is the first application of our algorithm to real data, demonstrating its readiness level and paving the way to further testing. For this reason, we focussed on observations of bright, on-axis point-like sources. By carefully calibrating the instrument response we were able to obtain a difference in Strehl ratio between the observed and the reconstructed PSFs of less than 2%. Furthermore, the full-width at half maximum of the reconstructed PSF differs less than 4.5% with respect to the observed PSF one. Finally, we will discuss a general method for performing the scientific evaluation of the reconstructed PSFs consisting of a dedicated set of simulated observations of an ideal science case. Specifically, the morphological characterization of a compact galaxy has been selected, being the typical case where a blind PSF-R approach is advantageous. The Sersic index results to be the only quantity affected by the use of the reconstructed PSF. Still, its measured deviation from the true value is small enough to allow the correct classification of the simulated galaxy.

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Session Classification: Sessione 3