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2° Forum della Ricerca Sperimentale e Tecnologica

MAST&R: Collaborations for Adaptive Optics Data Processing and the Development of Advanced Astronomical Technologies

Carmelo Arcidiacono - INAF for the whole MAST&R team

Abstract:

The MAST&R (Math, ASTronomy & Research) project is an INAF initiative that involves several institutes (OAR, OAS, OAPd, OAA, OAAb, IAPS, OACN) and focuses on developing technologies and software for processing data from Adaptive Optics (AO) instruments. Through collaborations with international research institutions and technology companies, MAST&R aims to enhance the effectiveness of AO data post-processing techniques for flagship projects like MAORY, MICADO, MAVIS, ERIS, and SHARKs. These instruments require advanced computational capabilities and sophisticated models for Point Spread Function (PSF) analysis, which are essential for achieving unprecedented precision in astronomical observations.

National and International Collaborations

MAST&R is a national initiative born within the INAF UTG1 OptNIR Division. Involved INAF institutes include OAR, OAS, OAPd, OAA, OAAb, IAPS and OACN. These centers work closely with universities and other national research facilities to develop PSF reconstruction software and image deconvolution techniques.

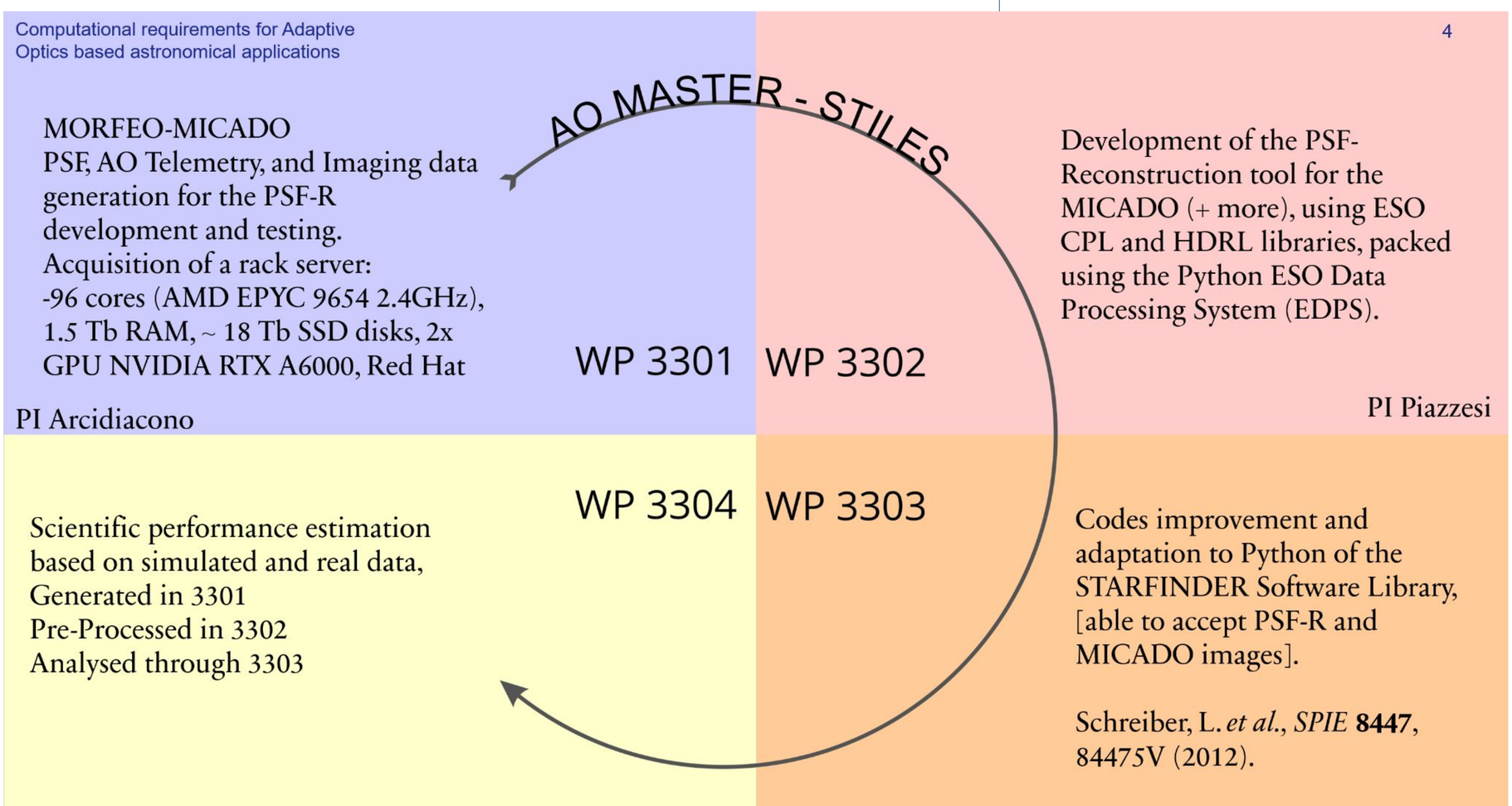
In a wider international collaborations scheme the project is integrated into international consortia for the ELT telescope, contributing to the development of the MORFEO (ex-MAORY) and MICADO instruments in collaboration with ESO and other European institutions. These collaborations are crucial for the design and development of advanced PSF reconstruction algorithms working closely with the ELT-working groups.

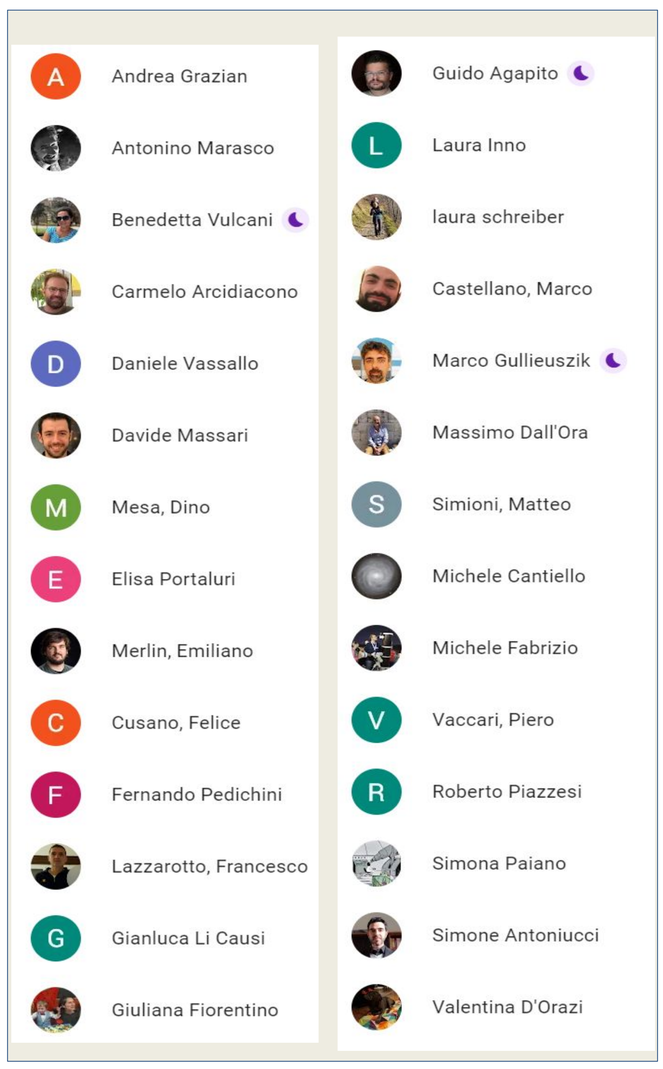
Key Activities:

- **Advanced Software Development**: Creation of new AO data processing tools, with a focus on PSF reconstruction techniques using WFS telemetry data. These tools will be implemented to enhance the scientific performance of MICADO and MAORY.
- **Numerical Simulations**: Use of powerful computational resources, including cloud infrastructures, for End2End numerical simulations of AO and MCAO (Multi-Conjugate Adaptive Optics) systems, essential for data calibration and reduction.
- **Big Data Management**: The use of advanced telescopes like the ELT will generate enormous amounts of data (TB per night), requiring new approaches to distributed and parallel computing. MAST&R aims coordinating the use of cloud computing resources to manage this data flow.

MAST&R and PNRR-STILES:

The INAF MAST&R initiative proposed for STILES the AOMaster software infrastructure for the exploitation of the data obtained with current AO facilities with the wider goal of being ready for the observations coming from the next generation of giant telescopes.
In the STILES WBS, it's composed by the WP
3301 Instrument performance through numerical simulations
3302 PSF-Reconstruction software development
3303 Starfinder computational improvement and Python portability
3304 Scientific verification of the results obtained above





Meetings:

- Giornata di presentazione del Centro HPC per il progetto STILES, April 14 2023, CNR, Rome
- MAST&R topical meeting on November 7 2023 [online]
- MAST&R progress meeting, November 24 2022, Padova https://indico.ict.inaf.it/event/2207/
- MAST&R progress meeting, May 25 2022, Teramo (@ADONI)

Related activties

- Machine Learning per Alta Risoluzione Spaziale ML4ARS alessio.turchi

Supported Grant - minigrant [2023]

- Machine Learning for Adaptive Optics guido.agapito
- NextSTEPS: Next Search for Thermal Emission of ProtoplanetS silvano.desidera
- Simulating spectral characterization of substellar objects atmospheres with the ELT/MICADO LSS observing mode, dino.mesa
- MICADO PSF-R: an insight on the telemetry data volume, matteo.simioni

Management: It's time for project coordinator turnover, consider to apply