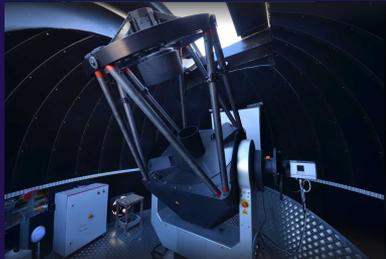




Development of the Cerro Murphy Observatory Software System



Mirośław Kicia,
Annual Meeting CAMK Warsaw 2026

Rolf Chini Cerro Murphy Observatory (OCM)



Is an international astrophysical project located in the Atacama Desert in Chile, hosted by the **ESO Paranal Observatory** and operated by the **CAMK PAN**.

The observatory was established in 2005, owned and operated jointly by the **Ruhr University Bochum (RUB)** and the **Catholic University of the North (UCN)** until 2020, when it was transferred to the CAMK, and is now run by the **Araucaria Project**.

The Araucaria Project is a collaboration between astronomers from institutions in Europe, Chile and the US.

From 2021, **OCM** has been undergoing a **major upgrade**. We are getting new telescopes, instruments, infrastructure, and **software system**.





Source: NATS library website.

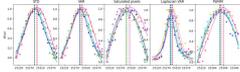


Figure 2.1b: ZBMZ focusing data curve fit.

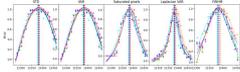


Figure 2.1c: ZBMZ focusing data curve fit.

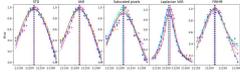
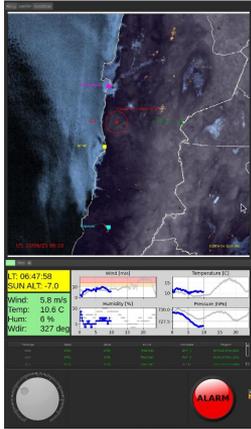
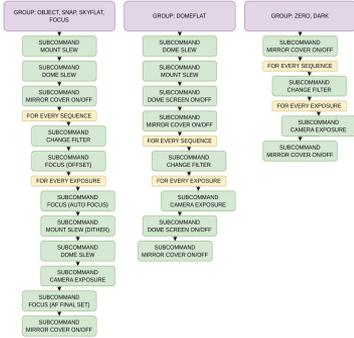
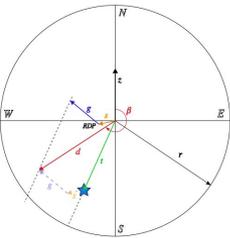
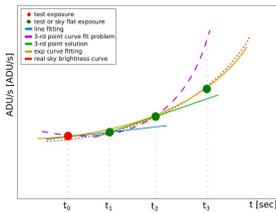
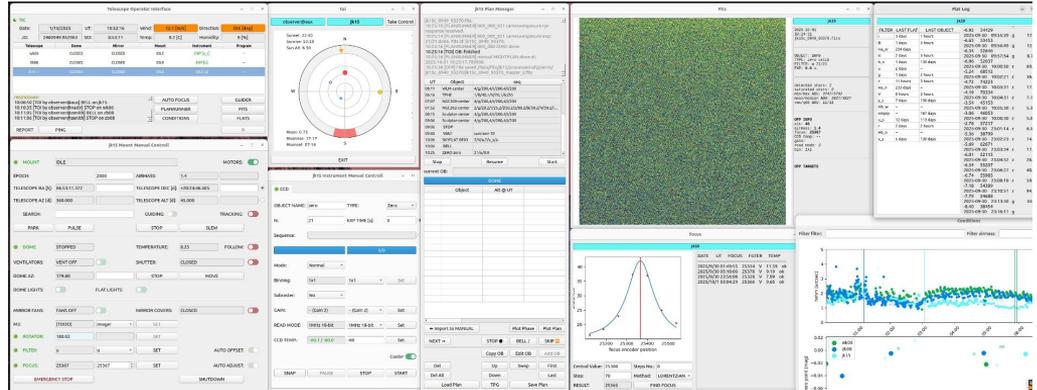
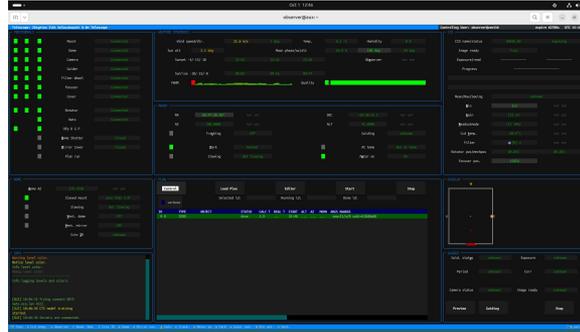


Figure 2.2b: ZBMZ focusing data curve fit.



OCM control software

- communication
- telescope operations
- plan runner
- scheduling
- guis
- visualisation
- automatic procedures
- auxiliary services
- and many other

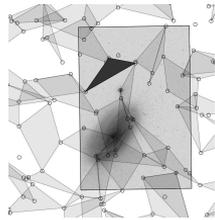


Source: Own work.

OCM data processing software

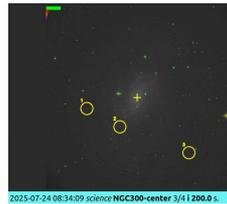
Astrometry

Astrometric solution preparation - using astrometry.net library local service.



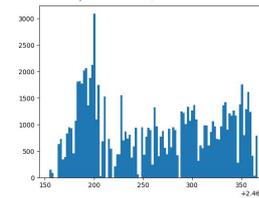
Thumbnails

Visualisation preparation using WCS, quality, stats and other data.



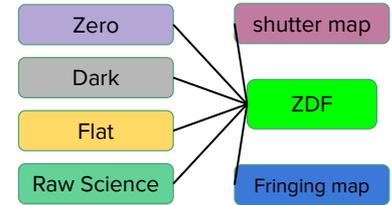
Stats

Basic stats, pointing error, FWHM, ML quality maps, targets stats, etc.



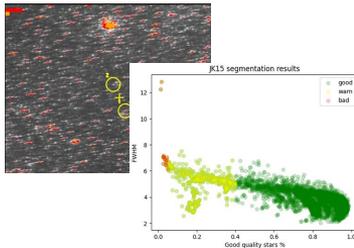
Stacker

Data calibration and stacking.



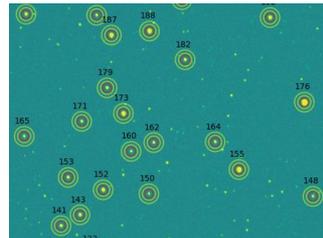
Quality

Data quality checks based on stats and ML models.



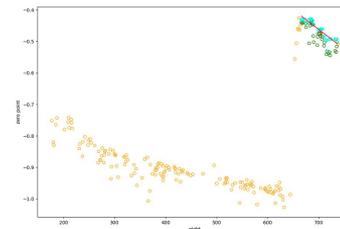
Photometry

Current: aperture photometry with Photutils. Future: implementation of PSF and DIA photometry methods.



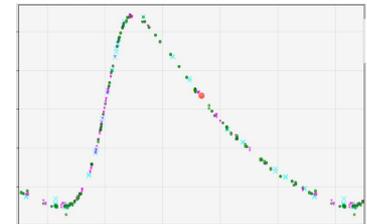
Standards

Computing filter coefficients. Data preparation for other modules to standardize the results. Clouds and mirror condition monitoring.



Light Curve

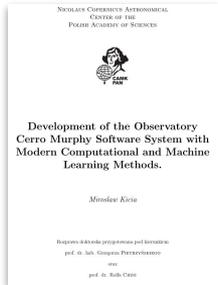
Creates a differential light curve with standard or instrumental magnitude. Supports scheduling.



Source: own work.



Source: ERC webpage.



Source: own work.

Achievements

ERC Proof of Concept Grant, „Toward Autonomous Observatories” (AutObs), PI: Pietrzyński, G., Personnel: Kałuszyński, M., Górski, M., Kicia, M.

Graczyk, D., Pietrzyński, G., Galan, C., Miller, N., Gieren, W., Zgirski, B., Hajdu, G., Kałuszyński, M., Chini, R., Gallenne, A., Górski, M., Karczmarek, P., Kervella, P., **Kicia, M.**, Maxted, P. F. L., Nardetto, N., Narloch, W., Pilecki, B., Pych, W., Rojas García, G., Smolec, R., Suchomska, K., Taormina, M., Wielgórski, P., A&A, Volume 694, id.A65, 22 pp., “*Surface brightness-colour relations of dwarf stars from detached eclipsing binaries - II. Extension of calibrating sample*”.

Kicia, M., Wednesday Colloquium CAMK Warsaw 22.10.2025, “*Toward Autonomous Observatories: Development of the Cerro Murphy Observatory Software System*”.

Kicia, M., PhD Thesis: “*Development of the Observatory Cerro Murphy Software System with Modern Computational and Machine Learning Methods.*”, Supervisors: prof. dr. hab. Grzegorz Pietrzyński and prof. dr. Rolf Chini.

Thank you for your attention

Mirostaw Kicia,

Nicolaus Copernicus Astronomical Centre
of the Polish Academy of Sciences

mkicia@camk.edu.pl



Ministry of Science
and Higher Education
Republic of Poland

Source: Nicolaus Copernicus Astronomical Centre of the Polish Academy of Sciences, ASA Wolfgang Promper