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FIRST OBSERVATIONS IN THE PRO-AM PROJECT OF TARGETS WITHIN 10 PC

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Abstract. This pro-am project investigates stellar objects within 10 pc of the Sun using TOPCAT for catalog exploration and analysis. Initial results include astrometry of double stars, spectroscopy of RS CVn systems, and photometry of flare stars. Bibliographic research and Gaia data revealed 48 off-sequence objects and added photometric and kinematic data for exoplanets and low-mass stars. The project is structured around three axes: (1) bibliographic research on exoplanets (post-June 2023), low-mass stars, and off-sequence objects; (2) multi-technique observations combining astrometry, photometry, and spectroscopy; and (3) collaborative analysis by amateur and professional participants.

Keywords: nearby stars, amateur-professional collaboration, stellar variability, double stars, astrometry

1 Bibliographic Research and Catalog - Identification of Off-Sequence Objects

Using Gaia data, we constructed a Hertzsprung-Russell diagram (G vs. $G-G_{\rm RP}$) and identified 48 off-sequence objects (22 North, 26 South), revealing a 40 percent classification error at DEC = 0°. An infrared (J, K_s) diagram yielded 27 objects but proved less reliable. The catalog was enriched with ∼40 off-sequence and 40 low-mass stars across UBVRIJHK bands, and the exoplanet section added 500 entries (220 unconfirmed) with proper motions, cross-identifications, and Gaia photometry to characterize stellar properties and interstellar effects.

2 Observations and Results

2.1 Astrometry

The Double Star Commission of the Société Astronomique de France utilized the SADR observatory to conduct detailed studies of double star pairs within our sample. One notable example is the DUN 5 AB pair, which is an orbital pair previously studied by Scardia in 2018, Izmailov in 2019, and Knapp in 2020. Our measurements, based on 10 images, yielded a position angle of $\theta = 184.45 \pm 0.39$ degrees and a separation of $\rho = 11.39 \pm 0.07$ arcsec, contributing to the ongoing monitoring of the orbital motion of this system.

2.2 Spectroscopy

Xi Ursae Majoris (ξ UMa, Alula Australis) is a nearby (28.5 ly) RS CVn binary with a combined apparent magnitude of 3.79. The system shows strong chromospheric activity, including Ca II H and K emission, as well as radio and X-ray signatures. Its light curve exhibits sinusoidal variability up to 0.5 mag, attributed to large starspots on the active component.

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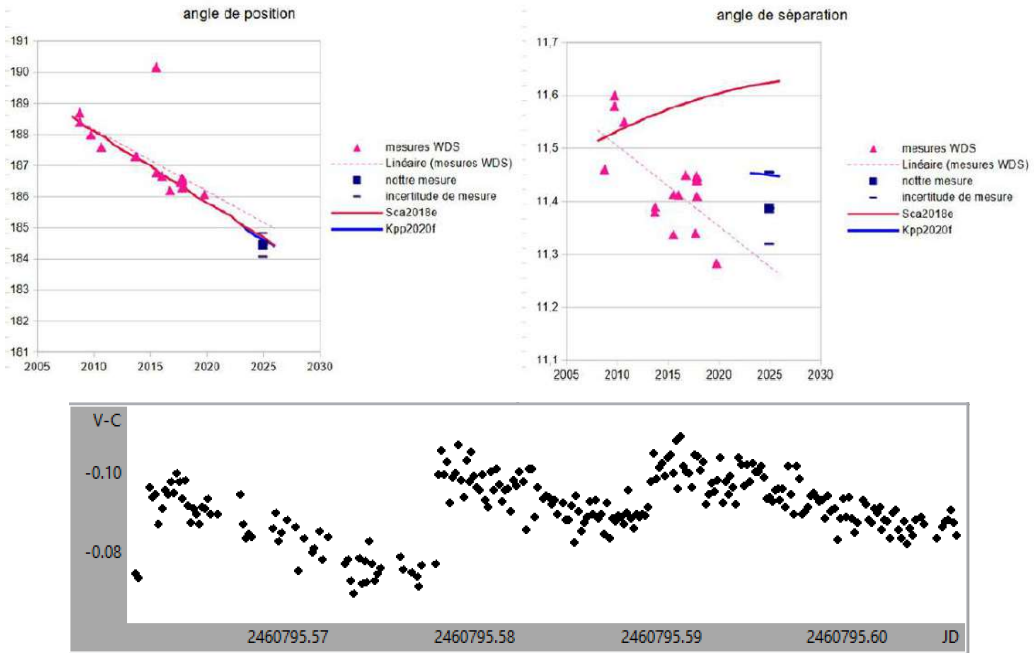

Fig. 1. Above: Data from P. Wullaert and Double Stars Commission from SAF **Bellow:** Lightcurve with B Cousins filter of CE Bootis obtained at the 120 cm telescope at Observatoire de Haute Provence

2.3 Photometry

We monitored BD +16 2708 (CE Bootis, Gl 569A), a triple M3V system ($m = 10.35$), using the T120 telescope with Cousins R, V, and B filters. Classified as both BY Draconis and UV Ceti, it exhibits rotational spot-driven variability and magnetic flares, most prominent in the B band. Additional targets included YZ CMi, which showed 2-3 flares, and V547 Cas, which showed no flare activity despite its cataloged classification.

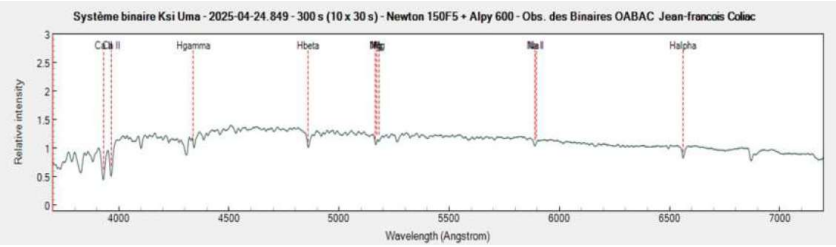

Fig. 2. Spectrum by J.F. Coliac from SAF and treatment by J.B. Desrosiers

3 Conclusions and Perspectives for 2025-2026

Future developments of the project target post-2023 exoplanets, low-mass stars, and off-sequence objects, including RAPAS photometry and systematic astrometry for double stars. A key goal is a 10 pc database providing spectra, light curves, astrometry, and bibliographic references. The pro-am collaboration has already yielded astrometric, spectroscopic, and photometric data, identified 48 off-sequence objects, and enriched the catalog, with 2025-2026 efforts set to further advance the study of nearby stellar systems.

We warmly thank Jean-François Coliac, Patrick Wullaert, Augustin Laouisset, and Jean-Bruno Desrosiers for their contributions to spectra, images, light curves, and spectral processing. The project team is coordinated by Yannic Delisle (amateur coordinator, CPS) and Céline Reylé (professional scientific coordinator, Observatoire de Besançon), with contributions from the IPSA Vega Association members. For more informations see `https://gemini.obspm.fr/20240616-catalogue-10pc/`