Andreas W. Neitzel

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RESEARCH SUMMARY

Fifth-year PhD candidate at IA/CAUP, Porto, in machine learning for Galactic archaeology. **Funding won** through public calls: MSc, FCT doctoral and ArqueoGal PhD fellowships, and two **HPC allocations** on EuroHPC supercomputers as **principal investigator**. **First author** of an A&A paper on manifold learning; developer of JANUS and Starfold. **Co-Investigator** on the FCT project ArqueoGal. **International**: INAF Bologna secondment, **ESO** visiting astronomer at the VLT, **ESA** Ariel Science Consortium, talks at TASC/KASC and IMAS. **Best Master's Student**, FCUP (2023).

EDUCATION

PhD in Astronomy, Faculdade de Ciências da Universidade do Porto and IA/CAUP *since Sep 2022*

- **Thesis** Machine Learning Applied to Galactic Archaeology. **Advisors** T. L. Campante, D. Bossini, A. Miglio.

MSc in Astronomy and Astrophysics, Faculdade de Ciências da Universidade do Porto *Sep 2020 to Dec 2022*

- **Thesis** Determination of Age and Mass for Seismic Stars in the Ariel Input Catalog.

BSc in Physics (Astrophysics branch), Faculdade de Ciências da Universidade do Porto *2017 to Nov 2020*

GRANTS, FELLOWSHIPS AND COMPUTING ALLOCATIONS

PhD research fellowship under the FCT project ArqueoGal (CIAAUP-17/2026-BI-D) *Sep 2026 to Aug 2027*

FCT Doctoral Fellowship (2025.01843.BD) *Sep 2025 to Aug 2026*

MSc research fellowship, BreakStarS project (CIAAUP-08/2021-BI-M) *Sep 2021 to Mar 2022*

FCT Advanced Computing Project 2026.08362.CPCA.A2, principal investigator *Nov 2026 to Nov 2027*

- **HPC** Allocation to run JANUS on the Gaia DR4 XP spectra of about 1.8 billion stars: 1,002,400 core-hours, 1,000 H100 GPU-hours and 25 TB for 12 months.

FCT Advanced Computing Project 2026.08382.CPCA.A1, principal investigator *Nov 2026 to Nov 2027*

- **HPC** Allocation to run JANUS on the Gaia DR3 XP spectra of about 220 million stars: 299,520 ARM core-hours (99,840 granted, tripled as a bonus), 1,500 A100 GPU-hours and 10 TB for 12 months.

Deucalion development access, University of Porto HPCvLAB *Dec 2025 to Sep 2026*

- **HPC** JANUS development and HAYDNsim runs for the HAYDN proposal: 94,001 core-hours in about 250 jobs.

FCT Exploratory Research Project ArqueoGal (2024.15303.PEX) *Feb 2026 to Aug 2027*

- **Project** Co-Investigator (team member) and developer of the project's machine-learning pipelines (Tasks 3, 5 and 6). PI T. L. Campante.

PLATO Guest Observer proposals, co-investigator on 3 *2026*

- **Targets** blue stragglers (PI L. Briganti), NGC 1851 red giants (PI A. Miglio), accreted halo stars (PI E. Leitinger).

RESEARCH POSITIONS

Visiting PhD Student, INAF-OAS Bologna *Sep 2025 to Mar 2026*
Six-month secondment in A. Miglio's group building the HAYDNsim simulation pipeline for the proposed HAYDN mission, with regular visits to INAF Osservatorio Astronomico di Padova.

- **Simulations** Built the noise-estimation and synthetic-catalogue tools (TRILEGAL, King-profile sampling) for globular and open clusters.

PhD Researcher, IA/CAUP *since Sep 2022*
Doctoral research on machine-learning methods for Galactic archaeology with Gaia, APOGEE and asteroseismic data.

- **Deep learning** Developing JANUS, a neural network that predicts APOGEE-like stellar parameters and abundances from Gaia XP spectra, with a reliability score for each star.

MSc Research Fellow, IA/CAUP *Sep 2021 to Mar 2022*

- **Stellar modelling** Implemented the small-frequency-separation routine in the stellar characterisation code PARAM.

PUBLICATIONS

- **First author A. W. Neitzel**, T. L. Campante, D. Bossini, A. Miglio (2025). *Dissecting stellar populations with manifold learning. I. Validation of the method on a synthetic Milky Way-like galaxy*. A&A, 695, A243. doi:10.1051/0004-6361/202451718

- **Co-author** T. L. Campante, Y. Zhou, Y. Li, H. Kjeldsen, R. R. Costa, **A. W. Neitzel** et al. (2026). *EPRV asteroseismology of the K dwarfs GJ 570 A and GJ 783 A with ESPRESSO. Empirical mode-amplitude scaling in tension with 3D convection simulations*. A&A (published online, volume pending). doi:10.1051/0004-6361/202660350 **Contribution:** Carried out the GJ 570 A ESPRESSO observations at Paranal (visitor mode, May 2024).
- **Co-author** T. L. Campante, H. Kjeldsen, Y. Li, M. N. Lund et al., incl. **A. W. Neitzel** (2024). *Expanding the frontiers of cool-dwarf asteroseismology with ESPRESSO: detection of solar-like oscillations in the K5 dwarf epsilon Indi*. A&A, 683, L16. doi:10.1051/0004-6361/202449197 **Contribution:** Bayes-factor test for the presence of a power excess against a model without one (Appendix D).
- **Co-author** L. Magrini, C. Danielski, D. Bossini et al., incl. **A. W. Neitzel** (2022). *Ariel stellar characterisation. I. Homogeneous stellar parameters of 187 FGK planet host stars: description and validation of the method*. A&A, 663, A161. doi:10.1051/0004-6361/202243405 **Contribution:** Bayesian PARAM runs for a subset of the sample.
- **In preparation** First-author papers on JANUS (Gaia XP chemistry) and on HAYDNsim (crowded-field noise).

OBSERVING

Visiting astronomer, ESPRESSO at the VLT, ESO Paranal Observatory, Paranal, Chile *May 2024*

- **Observing** Visitor-mode run 113.26FX.002 on GJ 570 A for PI T. L. Campante: six nights allocated, five usable.

INTERNATIONAL TALKS AND POSTERS

- **Invited** *JANUS: a neural network for APOGEE-like chemistry of the TESS asteroseismic red giants from Gaia XP spectra, with per-star reliability*. IMAS13, Cádiar (Granada), Spain, Oct 2026.
- **Poster** *HAYDNsim: Forecasting photometric noise in the crowded fields that defeat current missions*. TASC10/KASC17, Aarhus, Denmark, Jul 2026.
- **Oral** *Contrastive deep learning for structure-preserving chemistry of TESS asteroseismic red giants from Gaia XP spectra*. TASC10/KASC17, Aarhus, Denmark, Jul 2026.
- **Oral** *Intelligent Identification of Stellar Populations with Manifold Learning*. IMAS11, Lluc, Balearic Islands, Spain, Nov 2024.
- **Oral** *Identification of stellar populations through latent space projection*. TASC8/KASC15, Porto, Portugal, Jul 2024.
- **National** Talks at IA Stars Day (2026), DFA Week (2026), ENAA XXXV (2025), ENAA XXXIV (2024), ENAA XXXIII (2023), FÍSICA 2022, DFA Week (2022). Posters at ENAA XXXVI (2026), ENAA XXXII (2022).

SOFTWARE

Starfold (andreaswneitzel.github.io/Starfold) *v0.2.0, MIT*

- **Unsupervised ML** Python package that finds groups in a table of measurements without labels, using UMAP, HDBSCAN and Optuna. It extends Neitzel et al. 2025.
- **Benchmark** Matched or beat the library defaults on 8 of 10 benchmark tables, but on only 2 of 4 held-out tables.
- **Also** Stellar Explorer, a browser app on a MESA and GYRE track of a one-solar-mass star. Tellurion (tellurion.dev), nearly 400 interactive physics and astronomy simulations.

TEACHING, MENTORING AND SERVICE

- **Supervision** Supervisor, IA Summer Programme (2024, 2025). Three-week supervision of university students on Galactic archaeology and machine learning with synthetic data.
- **Organisation** LOC member, TASC8/KASC15 international workshop (Porto, 2024). Chair, IA Stars Day LOC (2023). LOC member, IA Stars Day (2022).

MEMBERSHIPS

- **Consortia** ESA Ariel Science Consortium, Stellar Characterisation WG (since 2021). TASOC (since 2022). KASOC, Red-Giant Oscillations WG (since 2022).

AWARDS

- **Award** Best Master's Student in Astronomy and Astrophysics, FCUP (2023).

TECHNICAL SKILLS

Machine learning: Normalising-flow ensembles in PyTorch, gradient boosting, UMAP, HDBSCAN and Optuna search.
Uncertainty: Isotonic calibration, coverage and selection tests, nearest-neighbour novelty, covariance propagation.
Data at scale: Whole-release Gaia ingestion into Parquet, manifest-resolved datasets, provenance on every product.
HPC: Slurm on ARM, x86 and GPU partitions (Deucalion, University of Bologna clusters), CUDA and RAPIDS.
Software: Typed, tested Python packages with continuous integration, locked environments and Sphinx manuals.
Astronomy: Gaia, APOGEE, GALAH, LAMOST, TESS and Kepler with PARAM, MESA, GYRE, TRILEGAL, galpy, astropy.
Visualisation: matplotlib and Plotly, and interactive browser applications in WebGL, Canvas2D and SVG.
Languages: Portuguese (native), English (C2), German (A2), Spanish (A2).