TOON DE PRINS

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EDUCATION

KU Leuven, Belgium:

PhD in science: Astronomy and Astrophysics — *September 2023 - now*
(Thesis defence expected before November 2027)

MSc in Astronomy and Astrophysics — *September 2021 - July 2023*
Summa Cum Laude

BSc in Physics — *September 2018 - June 2021*
(Minor in astrophysics & informatics) — Magna Cum Laude

KNOWLEDGE AND SKILLS

Astrophysics	Binary stars, Circumbinary disks, Jet formation, Stellar atmospheres & winds, Stellar structure & evolution, Planetary systems, etc.
Observing techniques & data analysis	Optical interferometry, Spectral energy distributions, Spectroscopic time-series, Photometric time-series, Bayesian analysis, Markov-Chain-Monte-Carlo, etc.
Programming	Python, GitHub, Object-oriented programming, Multiprocessing, High-performance computing, etc.
Planning & writing	Observing time proposal writing, Telescope operating, Grant proposal writing, etc.
Languages	Dutch (native), English (fluent), French (advanced), German (basic)

WORK EXPERIENCE

Exercise session assistant at KU Leuven (as a Master's student): *October 2022 - December 2022*
Newtonian dynamics

PUBLICATIONS

- Jet formation in post-AGB binaries: First author
Confronting cold MHD disk wind models with observations In press at A&A
(Article link) *February 2024*

- Magnetically driven winds from accretion disks Co-author
in post-asymptotic giant branch binaries Accepted by A&A
(Article link) *December 2023*

Legend: A&A = Astronomy & Astrophysics (journal); SJR 1.999, Quartile 1, as of 2022

HONOURS & AWARDS

PhD fellowship fundamental research *Awarded October 2023*
By the Research Foundation - Flanders (FWO)

Paul Smeyers Prize *Awarded July 2023*
Annual thesis prize of the MSc in A&A (KU Leuven)

RESEARCH PROFILE

Mass-loss rates and expansion velocities of AGB winds *September 2020 - December 2020*
Constrained the wind mass-loss rates and terminal expansion velocities of a small sample of dusty, wind-driving AGB stars observed with the IRAS space telescope. These quantities were inferred from observed infrared CO spectral line profiles, which were compared to simulations using the MCP radiative transfer code (Schoïer & Olofsson 2001). Supervised by Dr. Sofia Wallström of the Institute of Astronomy (IoA, KU Leuven), in the context of a bachelor thesis and the Nearby Evolved Stars Survey.

Magnetism of cobalt clusters *January 2021 - June 2021*
Researched the experimental production and magnetic properties of cobalt clusters, with sizes on the order of ~ 10 atoms, via the combination of laser ablation and Stern-Gerlach magnetic deflection. Performed in the context of a bachelor thesis. Experiment conducted in the magnetic deflection lab of the research group Quantum Solid State physics (QSP) at KU Leuven. Supervised by Prof. Ewald Janssens and PhD student Kobe De Knijf (QSP, KU Leuven).

Stellar and wind parameters of massive OB-type stars *September 2021 - December 2021*
Performed analysis of optical spectra of massive OB-type stars ($> 10\,\mathrm{M}_\odot$), in the context of a masters research project course and the XShootU collaboration. In a team of two, we derived fundamental stellar and wind parameters for a sample of 7 stars by comparing the spectra to synthetic NLTE spectra generated with the FASTWIND code (Santolaya-Rey et al. 1997). Data were acquired using the European VLT/X-Shooter spectrograph. Project supervised by professor Hugues Sana (IoA, KU Leuven).

Abundance analysis of IRAS 22272+5435 *February 2022 - December 2022*
Derived the atmospheric parameters and chemical abundances of the galactic post-AGB star IRAS 22272+5435, in the context of a two-semester spanning observational school organized by the IoA. To this end, optical spectra taken with the HERMES echelle spectrograph (Raskin et al. 2011) were analyzed using the LTE line-analysis code MOOG (Sneden et al. 2012). Data were obtained during a 5-night observing run at the IoA-operated Mercator telescope (Roque de los Muchachos observatory, La Palma, Spain). In a team of two, we wrote an observational proposal for Mercator, with which we intended to obtain stronger constraints on the s-process heavy element abundances in IRAS 22272+5435, with an emphasis on lead (Pb). Pb-abundances are heavily overestimated by model predictions, marking one of the greatest shortcomings of s-process nucleosynthesis theory. We derived a more reliable Pb-abundance estimate for the target. Supervised by Dr. Andrew Tkachenko (IoA) and Prof. Hans Van Winckel (IoA).

Jet-formation in post-AGB binaries *September 2022 - June 2023*
Master thesis research on the formation of jets in post-AGB binary systems. HERMES time-series from a more than a decade long monitoring programme provide unprecedented coverage of this intriguing phenomenon. The presence of a jet can be noticed via a P-Cygni like absorption profile in the H_α line at superior conjunction, when the post-AGB primary passes behind and is obscured by the jet. I developed a fitting routine that uses physically self-consistent magneto-hydrodynamic models (Jacquemin-Ide et al. 2019) to describe the jets, fitting the predicted H_α spectra to the observed time-series. This routine was applied to five target stars, simultaneously constraining the detailed structure of their jets and the underlying accretion disks. Supervised by Prof. Hans Van Winckel, Dr. Jacques Kluska (IoA) and Dr. Devika Kamath from Macquarie University (MQ, Australia).

Interferometry of post-AGB circumbinary disks *September 2023 - now*

Current PhD research on the structure and morphology of dusty post-AGB circumbinary disks. The aim is to further develop a neural-network based interferometric image reconstruction framework (ORGANIC, Claes et al. 2020) to resolve the inner structure of the disks. This framework will be applied to a representative sample of about 16 targets, using near-infrared interferometric data from VLTI/PIONIER, VLTI/GRAVITY, VLTI/MATISSE and CHARA/MIRC-X/MYSTIC. Subsequent modelling will quantify processes like dust grain growth, gas-dust separation and structure formation in a physical regime unique to post-AGB circumbinary disks (short timescales, high luminosities, etc.), providing precious constraints on disk physics in general. In addition, the origin of sub-structures observed in the images, possibly linked to the presence/formation of giant planets in the disks, will be investigated. Research to be carried out in close collarboration with MQ. Supervised by Prof. Hans Van Winckel, Prof. Denis Defrère (IoA) and Dr. Devika Kamath. Further collarborations are also foreseen with Prof. Orsola De Marco (MQ).