

Dwaipayan Debnath

PhD Candidate, Institute of Astronomy, KU Leuven, Belgium
dwaipayan.debnath@kuleuven.be
ORCID: 0000-0002-9571-2590
<https://ddebnathkul.github.io/>

Research Interests

Massive-star atmospheres and winds · Computational astrophysics · Stellar evolution and feedback · Binary interaction and evolution

Research Positions

- PhD in Astrophysics** KU Leuven, Belgium — Nov 2022 – present
- Thesis: *Multi-dimensional Modelling of Massive-Star Atmospheres*
- Observing Astronomer** Mercator Telescope, La Palma — 29 May – 10 Jun 2024
- Summer Intern (Visiting Students Program)** Raman Research Institute, Bangalore — May – Jul 2017
- Study of dispersion measure of pulsar PSR B0834+06

Academic Background

- MSc in Astronomy & Astrophysics** KU Leuven, Belgium
- Thesis: *Updating Atomic Database for Astrophysical Applications; First Effects on the Wind Dynamics of Wolf-Rayet Stars*
- B.Tech. in Electronics & Communication Engineering** NIT Agartala, India
- Thesis: *Return Loss, Bandwidth and Gain Improvement of Microstrip Antenna using Modified Inset Feeding*

(Co-)authored Papers

- **Debnath, D.**, Sundqvist, J. O., Moens, N., Van der Sijpt, C., Verhamme, O., & Poniatowski, L. G. (2024).
2D unified atmosphere and wind simulations of O-type stars.
Astronomy & Astrophysics, 684, A177.
DOI: [10.1051/0004-6361/202348206](https://doi.org/10.1051/0004-6361/202348206)
- Ud-Doula, A., Sundqvist, J. O., Narechania, N., **Debnath, D.**, Moens, N., & Keppens, R. (2025).
Suppression of photospheric turbulence in strongly magnetic O-stars in radiation-MHD simulations.
Astronomy & Astrophysics.
DOI: [10.1051/0004-6361/202452375](https://doi.org/10.1051/0004-6361/202452375)
- González-Torà, G., Sander, A. A. C., Sundqvist, J. O., **Debnath, D.**, Delbroek, L., Josiek, J., Lefever, R. R., Moens, N., Van der Sijpt, C., & Verhamme, O. (2025).
Improving 1D stellar atmosphere models with insights from multi-D simulations I: O-stars.
Astronomy & Astrophysics.
DOI: [10.1051/0004-6361/202452241](https://doi.org/10.1051/0004-6361/202452241)
- Van der Sijpt, C., Sundqvist, J. O., **Debnath, D.**, Driessens, F. A., & Moens, N. (2025).
Structure formation in O-type stars and Wolf-Rayet stars.

Astronomy & Astrophysics.
DOI: [10.1051/0004-6361/202452385](https://doi.org/10.1051/0004-6361/202452385)

- González-Torà, G., Sander, A. A. C., Moens, N., Sundqvist, J. O., **Debnath, D.**, Delbroek, L., Josiek, J., Lefever, R. R., Van der Sijpt, C., Verhamme, O., & Bernini-Peron, M. (2025).
Improving 1D stellar atmosphere models with insights from multi-D simulations II: 1D versus 3D model comparison for Wolf-Rayet stars.
Astronomy & Astrophysics.
DOI: [10.1051/0004-6361/202554125](https://doi.org/10.1051/0004-6361/202554125)
- Sundqvist, J. O., **Debnath, D.**, Backs, F., Verhamme, O., Moens, N., Delbroek, L., Dickson, D., Schillemans, P., Van der Sijpt, C., & Dirickx, M. (2025).
An on-the-fly line-driven-wind iterative mass-loss estimator (LIME) for hot, massive stars of arbitrary chemical compositions.
Astronomy & Astrophysics.
DOI: [10.48550/arXiv.2504.00936](https://arxiv.org/abs/2504.00936)
- Moens, N., **Debnath, D.**, Verhamme, O., Backs, F., Van der Sijpt, C., Sundqvist, J. O. & Sander, A. A. C. (2025).
2D unified atmosphere and wind simulations for a grid of O-type stars.
Astronomy & Astrophysics.
DOI: [10.1051/0004-6361/202556825](https://doi.org/10.1051/0004-6361/202556825)
- Delbroek, L., Sundqvist, J. O., **Debnath, D.**, Backs, F., Moens, N., Van der Sijpt, C., Verhamme, O., & Schillemans, P. (2025).
Spectral synthesis of 3D unified model atmospheres with winds for O-stars.
Astronomy & Astrophysics.
DOI: [10.1051/0004-6361/202556421](https://doi.org/10.1051/0004-6361/202556421)

Conference Contributions

- **The Wolf-Rayet Phenomenon**, Morelia, Mexico
First effects from 3D models on observations of Wolf-Rayet stars
- **EAS Meeting**, Kraków, Poland
2D unified atmosphere and wind models of O-stars
- **XshootU Workshop**, Prague
2D unified atmosphere and wind models of O-stars
- **POEMS**, Rio de Janeiro
Multi-D unified atmosphere and wind simulations of O-stars
- **Fundamentals of Stellar Outflows**, Leuven
Contributed talk: From multi-D stellar-wind models to spectral synthesis
- **XshootU Workshop**, Vienna
Contributed talk: Line-driven-wind iterative mass-loss calculator (LIME)

Seminars

- **IVS Seminar Series**, Leuven
Multi-D unified atmosphere and wind simulations of O-stars
- **Massive Star Seminar Series**
Wind accretion, tidal interaction, Roche-lobe overflow, and mass transfer in massive binary systems

Teaching and Outreach

- Teaching Assistant - Galaxies & Cosmology; Computational Astrophysics, Masters, A&A, KU Leuven
- Supervisor - Theoretical Research Project (Luis Antonio Bala), Masters A&A, KU Leuven
- Supervisor - Research Project (Anya Schmit, Luka Vranckx, Sara Heyvaert), Masters A&A, KU Leuven
- Co-supervisor - Research Project (Agung Prawira Negara, Lotte Van Marcke), Masters A&A, KU Leuven
- Co-supervisor - Master thesis (Cécile de Wassige):
Mass loss in evolution of massive stars in the early Universe: effects of chemical surface enrichment, KU Leuven
- Developed [LIME](#), an online tool to compute line-driven mass-loss rates for tunable stellar parameters and abundances

Technical Skills

Programming: Python, Fortran 90, C++, Matlab, Bash, \LaTeX

Tools: NumPy/SciPy, Astropy, Matplotlib, f2py, Git, Jupyter, Docker

Codes: MPI-AMRVAC, MFORCE, FASTWIND, MESA

HPC: VSC (Vlaams Supercomputer Centrum), KU Leuven clusters

References

Prof. Jon Sundqvist — Institute of Astronomy, KU Leuven

jon.sundqvist@kuleuven.be

Dr. Nicolas Moens — Institute of Plasma Astrophysics, KU Leuven

nicolas.moens@kuleuven.be