Jordan B. S. Van Beeck

Work Address (until December 22, 2023)
Institute of Astronomy
Department of Physics & Astronomy ● KU Leuven
Celestijnenlaan 200D ● B-3001 Leuven, Belgium

Online Presence Personal Webpage · ResearchGate page · LinkedIn page
Google Scholar page · Github page (JVB11) · ArXiv records · ADS library
Researcher ID · 0000-0002-5082-3887 · Zenodo records

Research Interests

My work is related to waves propagating inside stars (i.e. asteroseismology), where I mainly characterize wave coupling to understand the process of wave amplitude limitation, and its implications for the modeling of stellar structure (and evolution). Formerly trained as a chemist, I am also interested in analytical, computational or theoretical chemistry-related research; for example, the simulation of dust nucleation processes in winds of evolved stars.

Scientific Education

09/2019 - 09/2023	Astronomy & Astrophysics, Ph.D. KU Leuven, Belgium Thesis title: Asteroseismology of Kepler B stars: internal magnetism and nonlinear mode coupling FWO long research stay at TAPIR, Caltech, CA, USA. *Promoters: Prof. Dr. C. Aerts, Prof. Dr. T. Van Hoolst, Dr. Prof. D. M. Bowman*
09/2017 - 07/2019	Astronomy & Astrophysics, M.Sc. *Magna Cum Laude* KU Leuven, Belgium Thesis title: The influence of an interior magnetic field on gravity-mode oscillations of intermediate-mass stars *Promoters: Prof. Dr. C. Aerts, Dr. T. Van Reeth, Prof. Dr. D. M. Bowman*
09/2015 - 09/2017	Chemie / Chemistry, M.Sc. *Magna Cum Laude* University of Antwerp (Universiteit Antwerpen), Belgium Thesis title: Characterization of radioactive particles Erasmus+ internship at CERAD, NMBU, Norway. *Promoters: Prof. Dr. K. Janssens, Prof. Dr. B. Salbu, Prof. Dr. O.-C. Lind, M.Sc. G. Nuyts*
09/2012 - 09/2015	Chemie / Chemistry, B.Sc. *Magna Cum Laude* University of Antwerp (Universiteit Antwerpen), Belgium Thesis title: Atomic scale reactive MD studies of DNA oxidation for plasma oncology: the role of H_2O_2 and HO_2 *Promoters: Prof. Dr. A. Bogaerts, Prof. Dr. E. Neyts, Dr. C. Verlackt*

Employment History

09/2023 - 12/2023 | Research Associate, Asteroseismology
Institute of Astronomy, KU Leuven, Celestijnenlaan 200D, B-3001 Leuven, Belgium
Project: non-linear asteroseismic modeling of slowly pulsating B stars

Funded by the European Union (ERC, 4D-STAR, N° 101071505). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Council Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

Awarded Grants and Fellowships

2021 - 2022 | FWO (Research Foundation Flanders) long research stay grant **(€12 738)** for a stay as a VSR at TAPIR, Caltech, CA, USA with Prof. Dr. J. Fuller.

2019 - 2023 | 4-year PhD Fellowship, Department of Physics & Astronomy, KU Leuven.

2016 | Erasmus+ M.Sc. internship, for a stay at CERAD, NMBU.

Seminars and Conference Presentations

March 2023 | GOOD VIBRATIONS SEMINAR (https://youtu.be/dWaEkri_s2I?feature=shared)
The Good Vibrations seminar series, S3E8.
Title: "Non-linear resonant gravito-inertial mode coupling and asteroseismology of Kepler slowly pulsating B stars"

February 2023 | AD-VALVAS SEMINAR (https://youtu.be/nTWZoLCMa_g?feature=shared)
Ad-valvas seminar of the Institute of Astronomy, KU Leuven, Belgium.
Title: "Non-linear gravito-inertial mode coupling in SPB stars"

July 2022 | POSTER PRESENTATION (additional info: doi:10.5281/zenodo.6814504)
TASC6 / KASC13 workshop/conference at KU Leuven, Belgium.
Title: "Resonant Amplitude Equations for Gravito-Inertial Modes: Mode Coupling in a Slowly Pulsating B star"

November 2021 | CONTRIBUTED TALK (doi:10.26081/K6VH15)
Transfer in Stellar Interiors conference (part of the Probes of Transport in Stars program), KITP, UC Santa Barbara, CA, USA.
Title: "Mode Coupling among gravito-inertial modes in Slowly Pulsating B Stars"

July 2020 | CONTRIBUTED TALK (doi:10.5281/zenodo.5525346)
MOBSTER-1 Virtual conference 2020: Stellar variability as a probe of magnetic fields in massive stars (online, hosted by University of Delaware, DE, USA)
Title: "Linking detected gravity modes to axisymmetric internal magnetic fields"

June 2019 | POSTER PRESENTATION (doi:10.5281/zenodo.3228857)
74th Dutch Astronomers Conference/Nederlandse Astronomenconferentie at the Kapteyn Astronomical Institute of the University of Groningen, Groningen/Paterswolde, the Netherlands.
Title: Constraining magnetic fields in intermediate-mass main-sequence stars with asteroseismology.

Conference/Thematic Research School Attendance

July 2022	TASC6 / KASC13 workshop/conference at KU Leuven, Belgium.
Nov.-Dec. 2021	Transfer in Stellar Interiors conference (part of the Probes of Transport in Stars program), KITP, UC Santa Barbara, CA, USA.
August 2021	10th MESA summer school (online: http://cococubed.asu.edu/mesa_summer_school_2021/index.html)
July 2020	MOBSTER-1 Virtual conference 2020: Stellar variability as a probe of magnetic fields in massive stars (online: https://sites.google.com/view/mobster1vc/home).
July 2020	Let's Talk Science: 8th Summer School for Science Communication and Communicative Competences (online: https://www.letstalkscience.be/news/summer-school-2020-goes-digital)
June 2019	74th Dutch Astronomers Conference/Nederlandse Astronomenconferentie at the Kapteyn Astronomical Institute of the University of Groningen, Groningen/Paterswolde, the Netherlands.
April 2019	STFC/MAMSIE mini-workshop Workshop facilitating research among the KU Leuven MAMSIE group led by Prof. Dr. Conny Aerts, the research group at Newcastle University led by Prof. Dr. Tamara Rogers, and the research group at CEA led by Dr. Stéphane Mathis.
October 2018	STFC/MAMSIE mini-workshop Workshop facilitating research among the KU Leuven MAMSIE group led by Prof. Dr. Conny Aerts, the research group at Newcastle University led by Prof. Dr. Tamara Rogers, and the research group at CEA led by Dr. Stéphane Mathis.

Awards and Honors

July 2019	Paul Smeyers Prize, KU Leuven Awarded to the annual best master's thesis in Astronomy & Astrophysics at the June examination session.

Teaching Experience

University Courses

2022 - 2023	Teaching Assistant, Department of Physics & Astronomy, KU Leuven 'Natuurkunde met elementen van wiskunde' I (K01B4A; in Dutch), first year B.Sc. pharmaceutical sciences
2019 - 2021	Teaching Assistant, Department of Physics & Astronomy, KU Leuven 'Natuurkunde met elementen van wiskunde' I and II (K01B4A and K01B4B; in Dutch, English translation: 'Physics with elements of mathematics' I and II), first year B.Sc. pharmaceutical sciences

Research Positions

11/2021 - 06/2022	Visiting Student Researcher at TAPIR, Caltech, CA, USA Mentor: Prof. Dr. J. Fuller *Funding: FWO long research stay grant* Project Title: Nonlinear asteroseismology: a dynamic step forward. Topic: using nonlinear asteroseismic theory to develop computational tools that aid in explaining oscillation mode amplitude limitation in slowly pulsating B stars. *(Resulting in a submitted first-author publication.)*
11/2021 - 12/2021	Transport in Stellar Interiors Program Affiliate (workshop, conference) at KITP, UC Santa Barbara, CA, USA Mentor: Prof. Dr. L. Bildsten *Funding: FWO long research stay grant*
02/2018 - 05/2018	Student Researcher at the Institute of Astronomy, KU Leuven, Belgium Mentors: Dr. David Gobrecht and Prof. Dr. Leen Decin Topic: Dust cluster nucleation in (carbon-rich) winds of asymptotic giant branch stars. *(Resulting (indirectly) in a contribution to a (published) technical report.)*
04/2016	Visiting Student Researcher at the Deutsches Elektronen-Synchrotron (DESY), Hamburg, Germany. Mentors: Prof. Dr. Ole-Christian Lind, Prof. Dr. Koen Janssens, M.Sc. Gert Nuyts Topic: High spatial and spectral resolution X-ray analysis of environmental radioactive particles. *(Work undertaken for Master's thesis in Chemistry.)*
01/2016 - 06/2016	Erasmus+ internship/exchange at CERAD, NMBU, Norway Mentor: Prof. Dr. Ole-Christian Lind *Funding: Erasmus+ M.Sc. internship grant* Topic: Characterization of environmental radioactive particles. *(Work undertaken for Master's thesis in Chemistry.)*
05/2015	Visiting Student Researcher at the European Synchrotron Radiation Facility (ESRF), Grenoble, France. Mentor: Dr. Wout De Nolf, M.Sc. Gert Nuyts Topic: High spatial and spectral resolution X-ray analysis of art samples.

Professional Activities

Conference Organization

July 2022	Member of the LOC, TASC6 / KASC13 workshop/conference at Leuven, Belgium

Associations

2022	Fellow (Graduate Student) Royal Astronomical Society (RAS)
2020 - 2022	Graduate Student Member American Astronomical Society (AAS)
2020 - 2022	Graduate Student Member Royal Netherlands Astronomical Society (KNA)
2019 - 2023	Graduate Student Member International Research Network for Nuclear Astrophysics (IReNA)

Languages

Spoken

Dutch (mother tongue)
English (fully proficient)
French (basic)

Programming

Expert:

Proficient:

Scientific Software Proficiency

Scientific Software Creator

First-Authored Peer-reviewed Publications

1. **J. Van Beeck**, T. Van Hoolst, C. Aerts, and J. Fuller. Non-linear Three-mode Coupling of Gravity Modes in Rotating Slowly Pulsating B Stars: Stationary Solutions and Modeling Potential. Submitted to *A & A*, pre-print on ArXiv (https://arxiv.org/abs/2311.02972).
   Uses the AE Solver framework and light curve models generated by NTSA.
2. **J. Van Beeck**, D. M. Bowman, M. G. Pedersen, T. Van Reeth, T. Van Hoolst, and C. Aerts. Detection of non-linear resonances among gravity modes of slowly pulsating B stars: Results from five iterative pre-whitening strategies. *A & A*, volume 655, article id. A59, November 2021. Uses the NTSA framework to generate the light curve models and resonance signatures. (DOI: 10.1051/0004-6361/202141572)
3. **J. Van Beeck**, V. Prat, T. Van Reeth, S. Mathis, D. M. Bowman, C. Neiner, and C. Aerts. Detecting axisymmetric magnetic fields using gravity modes in intermediate-mass stars. *A & A*, volume 638, article id. A149, June 2020. (DOI: 10.1051/0004-6361/201937363; Inlists: DOI: 10.5281/zenodo.3818245)

Other Peer-reviewed Publications

1. D.J. Fritzewski, T. Van Reeth, C. Aerts, **J. Van Beeck**, S. Gossage, G. Li. Age-dating the young open cluster UBC1 with g-mode asteroseismology, gyrochronology, and isochrone fitting. *A & A*, Forthcoming Article, pre-print on ArXiv. (https://arxiv.org/abs/2310.18426; DOI: 10.1051/0004-6361/202347618)
My Contributions: make NTSA available for the lead author, provide guidance in using the automated NTSA framework used to generate the light curve models, provide feedback on entire manuscript.
2. T. Van Reeth, C. Johnston, J. Southworth, J. Fuller, D. M. Bowman, L. Poniatowski, and **J. Van Beeck**. Tidally perturbed gravity-mode pulsations in a sample of close eclipsing binaries. *A & A*, volume 671, article id. A121, March 2023. (DOI: 10.1051/0004-6361/202245460)
My Contributions: provide the automated NTSA framework used to generate the light curve model, check derivations for formalism, provide feedback on entire manuscript.
3. T. Van Reeth, P. De Cat, **J. Van Beeck**, V. Prat, D. J. Wright, H. Lehmann, A.-N. Chené, E. Kambe, S. L. S. Yang, G. Gentile and M. Joos. The near-core rotation of HD 112429. A γ Doradus star with TESS photometry and legacy spectroscopy. *A & A*, volume 662, article id. A58, June 2022. (DOI: 10.1051/0004-6361/202142921)
My Contributions: provide the automated NTSA framework used to generate the light curve and LSD profile variations model, check derivations for formalism, provide feedback on entire manuscript.
4. T. Van Reeth, J. Southworth, **J. Van Beeck**, and D. M. Bowman. V456 Cyg: An eclipsing binary with tidally perturbed g-mode pulsations. *A & A*, volume 659, article id. A177, March 2022. (DOI: 10.1051/0004-6361/202142833)
My Contributions: make NTSA available for the lead author, provide guidance in using the automated NTSA framework used to generate the pulsation light curve model, provide feedback on entire manuscript.
5. C. Aerts, K. Augustson, S. Mathis, M. G. Pedersen, J. S. G. Mombarg, V. Vanlaer, **J. Van Beeck**., and T. Van Reeth. Rossby numbers and stiffness values inferred from gravity-mode asteroseismology of rotating F- and B-type dwarfs. Consequences for mixing, transport, magnetism, and convective penetration. *A & A*, volume 656, article id. A121, December 2021. (DOI: 10.1051/0004-6361/202142151)
My Contributions: provide residual light curves based on NTSA light curve models for 26 SPB stars, compute residual-to-coherent amplitude ratios for 17 SPB stars, provide feedback on entire manuscript.
6. V. Prat, S. Mathis, C. Neiner, **J. Van Beeck**, D. M. Bowman, and C. Aerts. Period spacing of gravity modes in rapidly rotating magnetic stars. II. The case of an oblique dipolar fossil magnetic field. *A & A*, volume 636, article id. A100, April 2020. (DOI: 10.1051/0004-6361/201937398)
My Contributions: check derivations and code for formalism, provide feedback on entire manuscript (this article used the stellar evolution and oscillation/pulsation models computed for Prat et al. 2019).
7. V. Prat, S. Mathis, B. Buysschaert, **J. Van Beeck**, D. M. Bowman, C. Aerts, and C. Neiner. Period spacings of gravity modes in rapidly rotating magnetic stars I. Axisymmetric fossil field with poloidal and toroidal components. *A & A*, Volume 627, article id. A64, July 2019. (DOI: 10.1051/0004-6361/201935462)
My Contributions: compute stellar evolution and pulsation/oscillation models for the frequency perturbation calculations, check derivations and code for formalism, provide feedback on entire manuscript.

Conference Proceedings / Abstracts

1. **J. Van Beeck**, V. Prat, T. Van Reeth, S. Mathis, D. M. Bowman, C. Neiner, and C. Aerts. Linking detected gravity modes to axisymmetric internal magnetic fields. *MOBSTER-1 virtual conference: Stellar variability as a probe of magnetic fields in massive stars*, Proceedings of the MOBSTER-1 virtual conference held 12-17 July 2020, id.13. (https://ui.adsabs.harvard.edu/abs/2021mobs.confE..13V/abstract, DOI: 10.5281/zenodo.5525345
2. V. Prat, S. Mathis, B. Buysschaert, **J. Van Beeck**, D. M. Bowman, C. Aerts, and C. Neiner. Effect of the magnetic field on period spacings of gravity modes in rapidly rotating stars. *Proceedings of the conference Stars and their Variability Observed from Space*, held in Vienna on August 19-23, 2019. Eds.: C. Neiner, W. W. Weiss, D. Baade, R. E. Griffin, C. C. Lovekin, A. F. J. Moffat. University of Vienna, 2020, pp.105-106. (https://ui.adsabs.harvard.edu/abs/2020svos.conf..105P/abstract)

Technical Reports

1. D. Gobrecht, S. T. Bromley, and **J. Van Beeck**. Structural crossover of small $(SiC)_n$ clusters. HPC-Europe-3 report, August 2019.

Posters

1. **Van Beeck Jordan**, Prat Vincent, Mathis Stéphane, Aerts Conny, Bowman Dominic, and Van Reeth Timothy. (2019). "Constraining magnetic fields in intermediate-mass main-sequence stars with asteroseismology." Presented at the 74th Dutch Astronomy Conference/Nederlandse Astronomenconferentie, Groningen/Paterswolde, the Netherlands. (DOI: 10.5281/zenodo.3228857)
2. **Jordan Van Beeck**, Tim Van Hoolst, Jim Fuller, and Conny Aerts. (July 2022). "Resonant Amplitude Equations for Gravito-Inertial Modes: Mode Coupling in a Slowly Pulsating B star." Presented at the TASC6/KASC13 workshop/conference at Leuven, Belgium. (additional information DOI: 10.5281/zenodo.6814504, https://fys.kuleuven.be/ster/events/conferences/2020/tasc6/posters/jordan-van-beeck-poster-1.pdf)

Software

1. **Jordan Van Beeck**. AE Solver – Amplitude Equation Solver: a toolkit to obtain AE solutions for non-linear asteroseismology. Derives observables of non-linear mode coupling based on stellar and oscillation models. (2021 -)
   In active development; currently on a private GitHub repository, and in preparation for a public release. Available upon reasonable request to the author.
2. **Jordan Van Beeck**. NTSA – Non-Linear Time Series Analysis: a toolkit for the analysis of variability in stellar light curves. Derives signatures of non-linear oscillation mode coupling. (2020 -)
   In active development; currently on a private GitHub repository, and in preparation for a public release. Available upon reasonable request to the author.
3. **Jordan Van Beeck** and Sven Nys. (December 24, 2018). RR-Lyr-Method-Comparison: Period-Metallicity-Luminosity relation validation for RR Lyrae stars (Version 1.1). (DOI: 10.5281/zenodo.2525594)