Joey S.G. **Mombarg**

Born: 09-12-1993, Arnhem, The Netherlands
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Current

Postdoctoral researcher *Leuven, Belgium*
Institute of Astronomy, KU Leuven. *Mar 2022 - Present*

- I am working on modelling gravity mode pulsations in A/F-type pulsators in the group of Prof. Dr. Conny Aerts.

Education

PhD Astronomy and Astrophysics *Leuven, Belgium*
Institute of Astronomy, KU Leuven. *Mar 2018 - Feb 2022*

- Thesis title: *"Asteroseismic Modelling of Intermediate-mass Stars"*.
- Supervisors: Prof. Dr. C. Aerts and Dr. Timothy Van Reeth.
- Research stay at Université Toulouse III Paul Sabatier, Toulouse, France from April 12 2021 - Nov 1 2021 under the supervision of Prof. Dr. Michel Rieutord. Awarded FWO (Flanders Research Foundation) long-stay travel grant.
- Topic: My PhD focused on modelling gravity mode pulsations in A/F-type pulsators to derive masses, ages, and mixing efficiencies with the goal of improving our understanding of the mechanism(s) behind the transport of angular momentum and chemical elements. My PhD thesis can be found here.

MSc Physics and Astronomy *Nijmegen, The Netherlands*
Radboud University. Specialization in Particle and Astrophysics. *Aug 2015 - Feb 2018*

- Graduated Bene Meritum.
- Thesis title: *"Detection and characterization of Jovian S-bursts"* (see awards).
  Supervisors: Dr. M. Klein-Wolt and C. Brinkerink.
- Attended a planetary science collaboration meeting organized by L'Observatoire de Paris - LESIA, Paris.
- Summer project (6 ECTS) with the asteroseismology group of KU Leuven.

BSc Physics and Astronomy *Nijmegen, The Netherlands*
Radboud University. Minor Astrophysics. *Sep 2012 - Jul 2015*

- Graduated Bene Meritum.
- Thesis title: *"Simulating the variable sky for BlackGEM"*.
  Supervisor: Dr. E Körding.

Conference and Workshop Participations

TA MESA summer school 2022 *UCSB, California, USA*
5-day workshop on the stellar evolution code Modules for Experiments in Stellar Astrophysics (MESA). *8-12 Aug 2022*

TASC6/KASC13 conference *Leuven, Belgium*

- 90-min tutorial (invited): *'Forward seismic modelling of gravity modes'*
- Poster contribution: *'Improved stellar evolution models with radiative levitation and rotational mixing'* Online version can be found here. *11-15 Jul 2022*

Workshop stellar physics group Institut de Recherche en Astrophysique et Planétologie — *Villalier, France*
Oral contribution: *'Improving the theory of chemical mixing inside intermediate-mass stars with asteroseismology'* — *18-19 Oct 2021*

European Astronomical Society (EAS) 2020 — *Online*
Poster contribution: *'Predicting stellar gravity-mode pulsations and evolution tracks with neural networks'* — *29 Jun -3 Jul 2020*

Stars and their Variability: Observed from Space — *Vienna, Austria*
Oral contribution: *'Improving stellar evolution models with atomic diffusion from asteroseismology of intermediate-mass stars'* — *19-23 Aug 2019*

Tess Sci Con I — *Cambridge, USA*
Poster contribution: *'High-precision mass and age estimates of F-type stars from asteroseismology'* — *29 July - 2 Aug 2019*

TASC5/KASC12 — *Cambridge, USA*
Oral contribution: *'Improving stellar evolution models with atomic diffusion from asteroseismology of intermediate-mass stars'* — *22-26 July 2019*

Nederlandse Astronomen Conferentie 2019 — *Groningen, The Netherlands*
Oral contribution: ''*Masses, Ages, and Core Properties of Intermediate-mass Stars from Asteroseismology and Spectroscopy'* — *27-29 May 2019*

Lorentz workshop: 'Weighting stars from birth to death' — *Leiden, The Netherlands*
Oral contribution: *'Probing the fundamental parameters and core properties of γ Dor stars'* — *19-23 Nov 2018*

PHOST 2018 — *Banyuls-sur-mer, France*
Oral contribution: *'The effect of atomic diffusion on gravity modes of young stars with a convective core'* — *2-7 Sep 2018*

MESA Summer School 2018 — *UCSB, California, USA*
5-day workshop on the stellar evolution code MESA. — *13-17 Aug 2018*

Nederlandse Astronomen Conferentie 2018 — *Groningen, Netherlands*
Poster contribution: *'Atomic diffusion in young stars with a convective core'* — *16-18 May 2018*

Seminars

Good vibrations seminar — *Online*
"*Asteroseismic modelling of gravito-inertial modes in γ Doradus pulsators*" — *July 2021*
Link to video here.

Institut de Recherche en Astrophysique et Planétology — *Toulouse, France*
"*Constraining stellar evolution theory with asteroseismology of γ Doradus stars using deep learning*" — *May 2021*
Journal club / seminar hybrid

Institute of Astronomy — *KU Leuven, Belgium*
"*Pulse fiction: Gravito-inertial asteroseismology of intermediate-mass stars*" — *Dec 2019*

Scientific Awards and Grants

2021 — **IRAP PhD day Best poster award** — *Toulouse, France*
Title: *"Asteroseismic modelling of A- and F-type pulsators"*.
Authors: J.S.G Mombarg

2020 — **Long-stay travel grant Research Foundation - Flanders (FWO)** — *Leuven, Belgium*
9-month travel grant (14850EUR) for research stay at Institut de Recherche en Astrophysique et Planétology (IRAP), Toulouse, France. (Shortened to 6.5 month due to COVID pandemic.)

2018 — **Netherlands Astronomy Conference 2018 Best poster award** — *Groningen, The Netherlands*
Title: *"Atomic diffusion and pulsations in young stars with a convective core"*.
Authors: J.S.G Mombarg, M. Michielsen, M.G. Pedersen and C. Aerts.

2018 — **De Zeeuw-Van Dishoeck 2018 award** — *Haarlem, The Netherlands*
Award (3000EUR) for best astronomy Master thesis in The Netherlands awarded by the "Koninklijke Hollandse Maatschappij der Wetenschappen".

Publications

4 first-author, 7 co-author, 255 citations, h-index 8
Link to ADS Library

Mombarg, J. S. G.; Dotter, A.; Rieutord, M.; Michielsen, M.; Van Reeth, T.; Aerts, C, "Predictions for gravity-mode periods and surface abundances in intermediate-mass dwarfs from shear mixing and radiative levitation", 2022, The Astrophysical Journal, Volume 925, Issue 1, id.154, Impact factor: 5.874

Pavlovski, K.; Hummel, C. A.; Tkachenko, A.; Dervisoglu, A.; Kayhan, C.; Zavala, R. T.; Hutter, D. J.; Tycner, C.; Sahin, T.; Audenaert, J.; Baeyens, R.; Bodensteiner, J.; Bowman, D. M.; Gebruers, S.; Jannsen, N. E.; **Mombarg, J. S. G.**, "Dynamical parallax, physical parameters and evolutionary status of the components of the bright eclipsing binary α Draconis", 2022, Astronomy & Astrophysics, Volume 658, id.A92, Impact factor: 5.802

Aerts C.; Augustson K.; Mathis S.; Pedersen M. G.; **Mombarg J. S. G.**; Vanlaer V.; Van Beeck J.; Van Reeth T, "Rossby numbers and stiffness values inferred from gravity-mode asteroseismology of rotating F- and B-type dwarfs", 2021, Astronomy & Astrophysics, Volume 656, id.A121, Impact factor: 5.802

Serenelli, Aldo; Weiss, Achim; Aerts, Conny; Angelou, George C.; Baroch, David; Bastian, Nate; Bergemann, Maria; Bestenlehner, Joachim M.; Czekala, Ian; Elias-Rosa, Nancy; Escorza, Ana; Van Eylen, Vincent; Feuillet, Diane K.; Gandolfi, Davide; Gieles, Mark; Girardi, Leo; Lodieu, Nicolas; Martig, Marie; Miller Bertolami, Marcelo M.; **Mombarg, Joey S. G.**; Morales, Juan Carlos; Moya, Andres; Nsamba, Benard; Pavlovski, Kresimir; Pedersen, May G.; Ribas, Ignasi; Schneider, Fabian R. N.; Silva Aguirre, Victor; Stassun, Keivan; Tolstoy, Eline; Tremblay, Pier-Emmanuel; Zwintz, Konstanze, "Weighing stars from birth to death: mass determination methods across the HRD", 2021, *The Astronomy and Astrophysics Review*, Volume 29, Impact factor: 25.357

Gebruers, Sarah; Straumit, Ilya; Tkachenko, Andrew; **Mombarg, Joey S. G.**; Pedersen, May G.; Van Reeth, Timothy; Li, Gang; Lampens, Patricia; Escorza, Ana; Bowman, Dominic M.; De Cat, Peter; Vermeylen, Lore; Bodensteiner, Julia; Rix, Hans-Walter; Aerts, Conny, "A homogeneous spectroscopic analysis of a Kepler legacy sample of dwarfs for gravity-mode asteroseismology", 2021, *Astronomy & Astrophysics*, Volume 650, id.A58, 23 pp, Impact factor: 5.802

Mombarg J. S. G., Van Reeth T., and Aerts C., "Constraining stellar evolution theory with asteroseismology of γ Doradus stars using deep learning", 2021, *Astronomy & Astrophysics*, Volume 650, id.A58, 23 pp, Impact factor: 5.802

Henneco, Jan; Van Reeth, Timothy; Prat, Vincent; Mathis, Stéphane; **Mombarg, Joey S. G.**; Aerts, Conny, "The effect of the centrifugal acceleration on period spacings of gravito-inertial modes in intermediate-mass stars", 2021, *Astronomy & Astrophysics*, Volume 648, id.A97, Impact factor: 5.802

Mombarg J. S. G., Dotter A., Van Reeth T., Tkachenko A., Gebruers S. and Aerts C., "Asteroseismic modeling of gravity modes in slowly rotating A/F stars with radiative levitation", 2020, *The Astrophysical Journal*, Volume 895, Issue 1, id.51, Impact factor: 5.874

Mombarg J. S. G., Van Reeth T., Pedersen M. G., Molenberghs G., Bowman D. M., Johnston C., Tkachenko A. and Aerts C., "Asteroseismic masses, ages and core properties of gamma Doradus stars using gravity-inertial dipole modes and spectroscopy", 2019, *Monthly Notices of the Royal Astronomical Society*, Volume 485, Issue 3, Pages 3248-3263, Impact factor: 5.287

Aerts C. Molenberghs G., Michielsen M., Pedersen M. G., Björklund R., Johnston C., **Mombarg J. S. G.**, Bowman D. M., Buysschaert B., Pápics P. I., Sekaran S., Sundqvist J. O., Tkachenko A., Truyaert K., Van Reeth T. and Vermeyen E., 2018, "Forward Asteroseismic Modeling of Stars with a Convective Core from Gravity-mode Oscillations: Parameter Estimation and Stellar Model Selection", *The Astrophysical Journal Supplement Series*, 237, id15, Impact factor: 8.136

Van Reeth T., **Mombarg J. S. G.**, Mathis S., Tkachenko A., Fuller J., Bowman D. M., Buysschaert B., Johnston C., García Hernández A., Goldstein, J. Townsend, R. H. D. and Aerts, C., 2018, "On the sensitivity of gravito-inertial modes to differential rotation in intermediate-mass main-sequence stars", *Astronomy & Astrophysics*, 618:A24, Impact factor: 5.802

Teaching

Student project co-supervisor — *Leuven, Belgium*
KU Leuven — *May - July 2022*
- Co-supervisor of BSc student Rebecca Rehm.
  Project title: *'The impact of radiative levitation on mode excitation of B-type pulsators'*

MSc thesis co-supervisor — *Leuven, Belgium*
KU Leuven — *Sep 2019 - July 2020*
- Mentor of MSc student Jan Henneco (Supervisor: Dr. T. Van Reeth).
  Thesis title: *'The effect of the centrifugal deformation of stars on g-mode pulsations'*

Teaching Assistent — *Leuven, Belgium*
KU Leuven — *Mar 2018 - ongoing*
- TA for the BSc introductory courses to astronomy, and mechanics.
- TA for MSc course 'Asteroseismology.

Teaching Assistent — *Nijmegen, Netherlands*
Radboud University — *Sep 2015 - Jan 2016*
- TA of the BSc biology and physics courses 'Mathematics for Biologists', 'Biophysics' and 'Mechanics' (3h/week).

Scientific community work

Gaia DR3 PR event — *Brussels, Belgium*
ESA — *Jun 2022*
- In the context of pulsating stars observed with Gaia DR3, I made an animation demonstrating asteroseismology. Link to the article can be found here.

STEM University *Leuven, Belgium*
KU Leuven *Feb 2022*
- Workshop on stars and (exo)planets for primary and high school children, ∼15 participants, 1.5-hour workshop.

Member of the SOC for the EAS 2022 conference *Valencia, Spain*
Special session on Machine Learning in astronomy. *2022*

Lecture at high school *Online*
Berthoutsinstituut, Mechelen *May 2021*
- Online lectures for high school students on stellar evolution, black holes, exoplanets, and space travel. ∼50 participants, 2 times 45-min lecture.

Scientific reviewer
Monthly Notices of the Royal Astronomical Society *2020*

High School visit *Leuven, Belgium*
KU Leuven *March 2019*
- Departmental visit high school students, ∼20 participants, 1-hour workshop.

Ladies@Science *Leuven, Belgium*
KU Leuven *April 2019, April 2018*
- Exoplanet workshop for high school girls, ∼20 participants, 1-hour workshop.

Kids University *Leuven, Belgium*
KU Leuven *Oct 2018*
- Solar system workshop for primary school children, ∼30 participants, 1-hour workshop.

Observing Experience

Observer at the Mercator Telescope *La Palma, Spain*
4 × 10 nights on site, 1 × 5 nights remote *Sep 2019, Apr 2022*
- Service mode.

Co-observer at the Hale telescope *Palomar, USA*
3 nights *Jan 2017*
- As part of the MSc course “Telescope Observing”.

Programming

Advanced **Python, LaTeX, Fortran**
Basic **C++, Matlab**
SSE and pulsation codes **MESA, GYRE, ESTER, TOP**

Languages

Native **Dutch**
Fluent **English**
Proficient **French** level B1.
Basic **German, Russian** German: level A2. Russian: level A1.