



Bert Vandenbroucke

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Research

My research is focused on hydrodynamical integration methods, radiation transfer and the combination of both methods in the study of star formation, magnetic fields and stellar radiation feedback on star-forming and galactic scales. I am the (co-)author of a number of astrophysical simulation codes: SHADOWFAX, CMAcIONIZE and SWIFT.

Education and experience

2007
-
2012

Bachelor + Master in Physics and Astronomy
Ghent University (Belgium)

*awarded the Armand Pien prize for best master's thesis in Astronomy
award for best student in Physics and Astronomy*

2012
-
2016

PhD in Astronomy
Ghent University (Belgium)

Advanced models for simulating dwarf galaxy formation and evolution, with Sven De Rijcke (sven.derijcke@ugent.be)

2016
-
2019

Research Fellow
University of St Andrews (UK)

supervisor: Kenneth Wood (kw25@st-andrews.ac.uk)

2019
-
2021

Postdoctoral researcher
Ghent University (Belgium)

supervisor: Maarten Baes (maarten.baes@ugent.be)

2021
-
now

Research Software Engineer
Leiden University (Netherlands)

supervisor: Joop Schaye (schaye@strw.leidenuniv.nl)

Research output

Top publications¹

187 citations from 18 publications, H-index 8.

1. Vandenbroucke & Camps, 2020, A&A, 641, A66
2. Vandenbroucke, Baes & Camps, 2020, AJ, 160, 55
3. Vandenbroucke & Wood, 2019, MNRAS, 488, 1977
4. Vandenbroucke *et al.*, 2019, MNRAS, 485, 3771
5. Vandenbroucke *et al.*, 2018, MNRAS, 476, 4032

Top contributions²

20 presentations and 12 poster contributions to international events

1. 03/2020: Tübingen Spring Workshop 2020 on Modeling High-Mass Stellar Feedback, Tübingen, Germany
2. 06/2019: European Week of Astronomy and Space Sciences, Lyon, France
3. 04/2019: Turbulence & magnetic fields, Tuusula, Finland
4. 12/2017-8: Virgo consortium meetings in Garching (Germany) and Leiden (Netherlands)

Teaching

Co-lecturer for 2 courses at St Andrews, demonstrator for 1 course at Ghent and 1 course at St Andrews.³

Supervision

1. 2020-now: Yolan Uyttenhove, PhD project, Ghent University
2. 2020-now: Katie Angell, Master project, Cambridge University
3. 2019: Amy Suddards, Bachelor project, University of St Andrews
4. 2018: Yuyao Wang, Master summer project, University of St Andrews
5. 2018: Daniel Tootill, Master project, University of St Andrews
6. 2016: Yorick Van Den Bossche, Master project, Ghent University

Acquired funding

1. 03/2019: PI of a short DiRAC computing project worth ~ 0.5 M core hours
2. 11/2018: co-applicant for an FWO research project worth € 207,500.00
3. 09-10/2018: FAPESP Research Mobility Grant for UK researchers worth R\$ 28,409.57 (\approx € 6,470.00)
4. FWO travels grants worth € 442.63 (06/2016), € 985.08 (07/2016), and € 1823.19 (02/2020)

Various

1. Volunteer for the St Andrews mobile planetarium and the activities of the St Andrews Observatory
2. Organizer of the weekly lunch talk for the St Andrews astronomy group
3. Reviewer for Astronomy & Computing (2018) and Monthly Notices of the Royal Astronomical Society (2020)

¹Full bibliography

Articles in Refereed Journals

1. Sartorio N., **Vandenbroucke B.**, Falceta-Gonçalves D., Wood K., *Photoionization feedback in turbulent molecular clouds*, 2021, Monthly Notices of the Royal Astronomical Society, 500, 1833
2. **Vandenbroucke B.**, Camps P., *CMacIonize 2.0: a novel task-based approach to Monte Carlo radiation transfer*, 2020, Astronomy & Astrophysics, 641, A66
3. **Vandenbroucke B.**, Baes M., Camps P., *CosTuum: Polarized Thermal Dust Emission by Magnetically Oriented Spheroidal Grains*, 2020, The Astronomical Journal, 160, 55
4. Baes M., Trčka A., Camps P., Trayford J., Katsianis A., Marchetti L., Theuns T., Vaccari M., **Vandenbroucke B.**, *Infrared luminosity functions and dust mass functions in the EAGLE simulation*, 2020, Monthly Notices of the Royal Astronomical Society, 494, 2912
5. **Vandenbroucke B.**, Wood K., *Radiation hydrodynamics simulations of the evolution of the diffuse ionized gas in disc galaxies*, 2019, Monthly Notices of the Royal Astronomical Society, 488, 1977
6. Sartorio N. S., **Vandenbroucke B.**, Falceta-Gonçalves D., Wood K., Keto E., 2019, *Massive star formation via torus accretion: the effect of photoionization feedback*, 2019, Monthly Notices of the Royal Astronomical Society, 486, 5171
7. Lund K., Wood K., Falceta-Gonçalves D., **Vandenbroucke B.**, Sartorio N. S., Bonnell I. A., Johnston K. G., Keto E., 2019, *Radiation hydrodynamics simulations of massive star formation via gravitationally trapped HII regions – Spherically symmetric ionized accretion flows*, Monthly Notices of the Royal Astronomical Society, 485, 3761
8. **Vandenbroucke B.**, Sartorio N. S., Wood K., Lund K., Falceta-Gonçalves D., Haworth T. J., Bonnell I. A., Keto E., Tootill D., 2019, *Testing the stability of supersonic ionized Bondi accretion flows with radiation hydrodynamics*, Monthly Notices of the Royal Astronomical Society, 485, 3771
9. **Vandenbroucke B.**, Wood K., Girichidis P., Hill A., Peters T., 2018, *Radiative transfer calculations of the diffuse ionized gas in disc galaxies with cosmic ray feedback*, Monthly Notices of the Royal Astronomical Society, 476, 4032
10. **Vandenbroucke B.**, Wood K., 2018, *The Monte Carlo photoionization and moving-mesh radiation hydrodynamics code CMACIONIZE*, Astronomy & Computing, 23, 40
11. **Vandenbroucke B.**, De Rijcke S., 2016, *The moving mesh code SHADOWFAX*, Astronomy & Computing, 16, 109
12. **Vandenbroucke B.**, Verbeke R., De Rijcke S., 2016, *Constraining the subgrid physics in simulations of isolated dwarf galaxies*, Monthly Notices of the Royal Astronomical Society, 458, 912

13. Verbeke R., **Vandenbroucke B.**, De Rijcke S., 2015, *How the first stars shaped the faintest gas-dominated dwarf galaxies*, The Astrophysical Journal, 815, 85
14. Cloet-Osselaer A., De Rijcke S., **Vandenbroucke B.**, Schroyen J., Koleva M., Verbeke R., 2014, *Numerical simulations of dwarf galaxy merger trees*, Monthly Notices of the Royal Astronomical Society, 442, 2909
15. Verbeke R., De Rijcke S., Koleva M., Cloet-Osselaer A., **Vandenbroucke B.**, Schroyen J., 2014, *Gaseous infall triggering starbursts in simulated dwarf galaxies*, Monthly Notices of the Royal Astronomical Society, 442, 1830
16. Schroyen J., De Rijcke S., Koleva M., Cloet-Osselaer A., **Vandenbroucke B.**, 2013, *Stellar orbits and the survival of metallicity gradients in simulated dwarf galaxies*, Monthly Notices of the Royal Astronomical Society, 434, 888
17. De Rijcke S., Schroyen J., **Vandenbroucke B.**, Jachowicz N., Decroos J., Cloet-Osselaer A., Koleva M., 2013, *New composition-dependent cooling and heating curves for galaxy evolution simulations*, Monthly Notices of the Royal Astronomical Society, 433, 3005
18. **Vandenbroucke B.**, De Rijcke S., Schroyen J., Jachowicz N., 2013, *Physics of a Partially Ionized Gas Relevant to Galaxy Formation Simulations – The Ionization Potential Energy Reservoir*, The Astrophysical Journal, 771, 36

Articles in Non-Refereed Journals

1. Verbeke R., **Vandenbroucke B.**, De Rijcke S., Koleva M., 2015, *The influence of the merger history of dwarf galaxies in a reionized universe*, IAU General Assembly, Meeting #29, #2232938

Other publications

1. **Vandenbroucke B.**, 20202, *HydroCode1D: 1D finite volume code*, Astrophysics Source Code Library, ascl:2012.009
2. **Vandenbroucke B.**, Wood K., 2018, *CMAcIONIZE: Monte Carlo photoionisation and moving-mesh radiation hydrodynamics*, Astrophysics Source Code Library, ascl:1802.003
3. **Vandenbroucke B.**, 2016, *Advanced models for simulating dwarf galaxy formation and evolution*, PhD thesis, Ghent University
4. **Vandenbroucke B.**, 2016, *SHADOWFAX: Moving mesh hydrodynamical integration code*, Astrophysics Source Code Library, ascl:1605.003

²Full list of conference and workshop contributions

Contributions to (inter)national conferences

1. 03/2020: Tübingen Spring Workshop 2020 on Modeling High-Mass Stellar Feedback (Tübingen, Germany). *Modelling photoionisation feedback with MCRT/MCRHD*. Invited talk.

2. 01/2020: RAS Specialist Discussion Meeting: Radiation hydrodynamics: Implementation and application (London, UK). *RHD simulations of diffuse ionised gas*. Oral contribution.
3. 11/2019: UK Fluids Network SPH SIG Meeting: SPH - Greatest Hits (so far) (Durham, UK). *Meshless finite volume schemes: greatest hits for the future?*. Oral contribution.
4. 11/2019: SWIFTcon 2019 (Durham, UK). *Why GIZMO-MFM could be fundamentally flawed*. Oral contribution.
5. 06/2019: EWASS symposium S10 – The feedback in the star formation process (Lyon, France). *Photoionization feedback in massive star formation*. Oral contribution.
6. 06/2019: EWASS symposium SS9 – Dwarf galaxies near and far: bridging numerical simulations with observations (Lyon, France). *Predictions for H α emission from dIrr galaxies from the MoRIA simulations*. Oral contribution.
7. 06/2019: EWASS symposium S8 – Resolving the Ionized ISM (Lyon, France). *Radiation hydrodynamics simulations of the evolution of the diffuse ionized gas in disc galaxies*. ePoster contribution.
8. 06/2019: Zooming in on star formation (Nafplio, Greece). *The Monte-Carlo radiation hydrodynamics code CMacIonize: summary and recent developments*. Oral contribution.
9. 04/2019: Turbulence & Magnetic fields – from the early Universe to late-type stars (Tuusula, Finland). *Impact of cloud turbulence on radiation escaping from leaky HII regions*. Oral contribution.
10. 12/2018: Lorentz Centre Workshop on Computational Cosmology (Leiden, Netherlands). *RHD simulations of outflows in the Ursa Minor dSph*. Oral contribution.
11. 07/2018: Tracing the Flow: Galactic Environments and the Formation of Massive stars (Lake District, UK). *Photoionising the DIG in the Milky Way: an interesting fine-tuning problem*. Poster contribution.
12. 10/2017: The Role of Gas in Galaxy Dynamics (Valetta, Malta). *CMacIonize: towards radiation hydrodynamics simulations of dwarf galaxy formation*. Poster contribution.
13. 09/2017: Frontiers of Astrophysical Modeling (Leuven, Belgium). *CMacIonize: towards radiation hydrodynamics simulations of dwarf galaxy formation*. Oral contribution.
14. 07/2017: National Astronomy Meeting (Hull, UK). *CMacIonize: Moving Mesh Monte Carlo Radiation Hydrodynamics (MMMC RHD)*. Poster contribution.
15. 02/2017: The Physics of the ISM (Cologne, Germany). *CMacIonize: a public ISM ionization code*. Poster contribution.
16. 01/2017: DEX XIII workshop (Edinburgh, UK). *The ionization structure of forming dwarf galaxies*. Oral contribution.

17. 06/2016: Great Lakes Cosmology and Galaxies 2016 (Hamilton, Canada). *Shadowfax: a public moving-mesh code*. Oral contribution.
18. 05/2016: Dutch Astronomy Conference (Nunspeet, Netherlands). *A solution for Too Big To Fail*. Poster contribution.
19. 06/2016: EWASS symposium S02 – The journey of dwarf galaxies (Tenerife, Spain). *The influence of feedback and the UVB on the early star formation histories of dwarf galaxies*. Poster contribution.
20. 05/2015: Dutch Astronomy Conference (Nunspeet, Netherlands). *Advanced methods in Nbody/hydrodynamical simulations*. Oral contribution.
21. 05/2015: Contact group meeting (Brussels, Belgium). *Advanced methods in Nbody/hydrodynamical simulations*. Oral contribution.
22. 09/2014: GESF2014: from Galactic to Extragalactic Star Formation (Marseille, France). *Reconstructing the low mass end of the baryonic Tully-Fischer relation with simulations*. Poster contribution.
23. 08/2014: 11th Potsdam Thinkshop, Satellite galaxies and dwarfs in the local group (Potsdam, Germany). *Reconstructing the low mass end of the baryonic Tully-Fischer relation with simulations*. Poster contribution.
24. 05/2014: Dutch Astronomy Conference (Noordwijkerhout, Netherlands). *The public moving-mesh code Shadowfax*. Poster contribution, honourable mention as “good poster about a simulation code” during poster prize award.
25. 07/2013: Mind The Gap (Cambridge, UK). *Simulations of the Multi-Phase ISM of Dwarf Galaxies*. Poster contribution.
26. 05/2013: Dutch Astronomy Conference (Lommel, Belgium). *Simulations of the multi-phase ISM of dwarf galaxies*. Poster contribution.

Contributions to international workshops

1. 02/2020: Invited lecture about photoionization and the ionized ISM during the *VIII Encontro de Física e Astronomia da UFSC* at the University of Santa Catarina in Florianópolis, Brazil.
2. 10/2019: Presentation about polarised dust emission by spheroidal grains during the SPICA collaboration meeting in Saclay, France.
3. 08/2019: Introductory lectures about numerical hydrodynamics and high performance computing during the St Andrews Monte Carlo Radiation Hydrodynamics Summer School 2019. Co-organizer of the school.
4. 12/2017: Invited talk about mesh-free hydrodynamics during the Virgo Consortium meeting in Garching, Germany.
5. 08/2017: Introductory lecture about numerical hydrodynamics during the St Andrews Monte Carlo Summer School 2017. Co-organizer of the school.
6. 09/2015: Lecture about mesh-free hydrodynamics during the CHARM Workshop on Computational Solar and Astrophysical Modeling, Juelich, Germany.

³Full list of teaching experience

1. 11-12/2018: Co-lecturer of the *Contemporary Astrophysics* module at St Andrews
2. 03/2017-02/2018: Guest lecturer for the *Fluids* module at St Andrews
3. 01-04/2017-2019: Demonstrator for the *Astronomy and Astrophysics* module at St Andrews
4. 04-05/2013-2016: Demonstrator/tutor for numerical exercises as part of the *Nuclear Astrophysics* course in Ghent