

CURRICULUM VITAE – JORRYT MATTHEE

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RESEARCH INTERESTS

Galaxy formation in the early Universe – Cosmic reionization – Properties of the inter-stellar medium and stellar populations – Escape of ionizing radiation – Galaxy scaling relations – Galaxy-halo connection – Star formation histories – Chemical evolution – Supermassive black holes.

RESEARCH IMPACT

· Pioneering observations of galaxies in the early Universe

I have contributed to the discovery and confirmation of emission-line galaxies at the end-stages of cosmic reionisation with ground-based telescopes and, recently, the *JWST*. I have lead follow-up campaigns to unveil their resolved structures and the properties of their stars, supermassive black holes and gas. I developed and implemented new methods to identify the sources of reionization and am in a key position to test these with the latest facilities.

· A new way to understand galaxy evolution

I developed new ways to analyse the multi-dimensional and temporal correlation structures of simulated galaxies. I revealed intimate connections between the assembly of dark matter halos, the formation of galaxies, the chemical abundances of gas and stars, and how these correlation structures impact well-known scaling relations.

· Publication and Talk record

I have co-authored **82 peer-reviewed publications** in scientific journals, of which I published **20 as first author** and **9 as second author**. Two second author papers are first-authored by students primary supervised by me. These articles have acquired **> 800 citations**, of which **> 1100 on first author papers**. *h*-index: 38. I have given **> 30** invited seminars and colloquia and **> 50** contributed talks at international workshops and conferences.

CAREER & EDUCATION

Assistant Professor, the Institute of Science and Technology Austria *September 2023 -*
Leader of a research group in the astrophysics of galaxies

Zwicky Prize Fellow, ETH Zürich *October 2018 - September 2023*
Independent postdoctoral researcher

PhD in Astronomy, Leiden University *September 2018*
Thesis: “Identifying the origins of galaxy formation”
Promotors: prof. H. Röttgering, prof. J. Schaye, Supervisor: dr. D. Sobral (Lancaster)

Master of Science (MSc) in Astronomy, Leiden University *September 2014*
De Sitter Cosmology specialisation *Cum Laude*. GPA 4.0/4.0.
Thesis: “The origin of scatter in galaxy scaling relations”
Supervisor: Prof. J. Schaye, dr. R. Crain

Bachelor of Science (BSc) in Liberal Arts & Sciences, Utrecht University *September 2012*
Major Physics & Astronomy *Cum Laude*, GPA 4.0/4.0
Honours minor ‘Descartes College’ on Philosophy of Science
Thesis: “Multiple stellar generations in globular clusters”
Supervisor: dr. Soren Larsen

HONORS

- ERC Starting Grant AGENTS, 2022
- MERAC Prize for best PhD Thesis in Observational Astrophysics, 2020
- IAU PhD Prize, Division J Galaxies and cosmology, International Astronomical Union, 2018
- C.J. Kok Jury Award, Best PhD thesis, Science Faculty, Leiden University, 2018
- Zwicky Prize Fellowship, ETH Zurich, 2018 - 2023
- Huygens PhD fellowship, Leiden University, 2014-2018
- Master of Science Cum Laude, Leiden University, 2014
- Bachelor of Science Cum Laude, Utrecht University, 2012

TOP FIVE PUBLICATIONS

“Identification of the brightest Ly α emitters at $z = 6.6$: implications for the evolution of the luminosity function in the reionization era”

2015, MNRAS, 451, 400 (cited 154 times)

Matthee, J.; Sobral, D.; Santos, S. et al.

“ALMA Reveals Metals yet No Dust within Multiple Components in CR7”

2017, ApJ, 851, 145 (cited 91 times)

Matthee, J.; Sobral, D.; Boone, F. et al.

“The origin of scatter in the star formation rate-stellar mass relation”

2019, MNRAS, 484, 915 (cited 85 times)

Matthee, J. & Schaye, J.

“The synchrony of production and escape: half the bright Ly α emitters at $z \approx 2$ have Lyman continuum escape fractions ≈ 50 per cent”

2022, MNRAS, 510, 4582 (cited 61 times, paper by supervised student)

Naidu, R.P.; **Matthee, J.**; Oesch, P.; et al.

“EIGER. II. First Spectroscopic Characterization of the Young Stars and Ionized Gas Associated with Strong H β and [OIII] Line Emission in Galaxies at $z = 5 - 7$ with JWST”

2023, ApJ, 950, 67 (cited 45 times)

Matthee, J.; Mackenzie, R.; Simcoe, R.; et al.

SERVICES

- External PhD advisory committee, Manuel Solimano, Universidad Diego Portales.
- Referee for MNRAS, ApJ, Nature, Nature Astronomy, A&A.
- 10.4m Gran Telescopio Canarias time allocation reviewer.
- Organiser PhD talks in 2016 and Galaxy Journal Club in 2017-2018, both at Leiden Observatory.

STUDENT SUPERVISION

Supervisor **MSc thesis** research projects:

- Peter Lechner, TU Wien, 2023 (ongoing)
- Andrea Gebek, ETH Zurich, 2020 (now a PhD student at University of Ghent with M. Baes).
- Sergio Santos, University of Lisbon (co-supervisor), 2016 (continued to PhD at Lancaster University with D. Sobral).

Supervisor **undergraduate** research projects:

- Gauri Kotiwale, Andrei Cristea, Ivan Kramarenko at ISTA, 2023 - now.
- Artem Basyrov, Yuzheng Kang, Andrea Gebek, Cheryl Lüssi, Christopher Golling, Remy Moll at ETH Zurich, 2019-2023.
- Bayu Wilson, summer student at Leiden Observatory, 2017.

TEACHING

- **Substitute lecturer** ‘Astrophysics I’ at ETH Zurich, 2020-2022.
- **Substitute lecturer and teaching assistant** ‘Evolution of the Universe’ at ETH Zurich, 2019.
- **Teaching assistant** BSc course ‘Life in the Universe’ at ETH Zurich, 2019 and 2020.
- **Teaching assistant** for 2nd year BSc course ‘Stars’ at Leiden University in the years 2014-2017.

TALKS

Invited seminars, long talks and colloquia:

2015-2020: Hilo (Hawaii, USA), Lisbon (Portugal), Santa Cruz de La Palma (Spain), Riverside (USA), Leiden (NL), Lancaster (UK), Oslo (Norway), STScI (Baltimore, USA, remote), Plenary seminar during EAS 2020 (Leiden, remote), UC Santa Barbara workshop (remote), University of Geneva/EPFL Lausanne (remote), Stockholm University (remote)

2021: UC London (remote), ESO (remote), ESO Hypatia Colloquium (remote), Cosmic Dawn Centre Copenhagen (remote), University of Zurich (remote), Kapteyn Institute Groningen (remote), Instituto Astrofisica Canarias (Spain), University of Arizona (remote)

2022: XXXIst General Assembly of the International Astronomical Union (Korea), the Institute of Science and Technology Austria (Austria)

2023: CRAL Lyon (France), MPA Garching (Germany), University of Durham (UK), Crete (Greece), MIT Boston (USA), EAS 2023 Krakow (Poland), University of Edinburgh (UK)

Contributed talks at international workshops and conferences:

2015-2020: Sintra (Portugal), Groningen (NL), Paris (France), Crete (Greece), Nunspeet (NL), Heidelberg (Germany), Salt Lake City (USA), Cambridge (UK), Leiden (NL), Liverpool (UK), Strasbourg (France), Crete (Greece), Leiden (Netherlands), Goslar (Germany), Viana do Castelo (Portugal), Rome (Italy), Braga (Portugal), Sesto (Italy), Sazerac (virtual), EAS (virtual), STScI (virtual), Toulouse (virtual)

2021: EAS Leiden (remote)

2022: Carnegie / Universidad Diego Portales (remote)

2023: WST Symposium, Vienna (Austria), EAS 2023 Krakow (Poland)

SUMMARY OF AWARDED TELESCOPE TIME

· **Principal Investigator** for **87 hours** on the James Webb Space Telescope using NIRCam and NIRSpec (2021-2023), **218 hours** on the Very Large Telescope with the X-SHOOTER, MUSE and FLAMES instruments (2017-2022), **15 hours** on ALMA (2017-2019) and **36 nights** on the Isaac Newton Telescope (2016-2018).

· **Co-Investigator** on programs totalling 311 hours on JWST, 293 hours VLT, 106 hours VST, 14 hours ALMA, 38 orbits HST, 7 nights Keck, 10 nights CFHT, 8 hours GTC, 15 nights WHT and 49 nights INT.

Selected PI proposals:

- **47 hours on JWST**, ‘All the Little Things: Pop III Signatures & the Ionizing Photon Budget of Dwarf Galaxies in the Epoch of Reionization’, 2023.
- **21 hours on JWST**, ‘Mapping Quasar Light Echoes with Lyman-alpha Forest Tomography during the Epoch of Reionization’, (co-PI), 2023.
- **26 hours on VLT/MUSE**, ‘Disentangling the role of ISM and IGM on the Ly α Escape fraction from galaxies in JWST QSO fields’, 2022.
- **36 hours on VLT/FLAMES**, ‘Solving the Lyman Continuum escape fraction problem with high-resolution Lyman- α ’, 2022.
- **41.2 hours on VLT/X-SHOOTER**, ‘Charting the luminosity dependence of the escape fraction of ionizing photons using lensed Ly α emitters at $z \sim 3$ ’, 2022.

- **18.3 hours on JWST**, ‘Anatomy of an ionized bubble at $z=6.6$: Which galaxies reionized the Universe?’, 2021.
- **16 hours on VLT/FLAMES**, ‘How does the shape and strength of the Ly α line vary among [OIII] emitters at $z = 3$?’, 2021.
- **6.8 hours on ALMA**, ‘The ISM properties and systemic redshift of a unique double-peaked Ly α emitter in the epoch of re-ionisation’, 2018.
- **72 hours on VLT/X-SHOOTER**, ‘LYRS-z2: A spectroscopic Lyman- α Reference Sample at the peak of cosmic star formation history’, 2018.

Selected co-I proposals:

- **50 hours on JWST/NIRCam** ‘Medium bands, Mega Science: spatially-resolved R 15 spectrophotometry of 50,000 sources at $z=0.3-12$ ’ (PI W. Suess), 2023.
- **60 hours on JWST/NIRSpec** ‘A complete census of the rare, extreme and red: a NIRCam-selected extragalactic community survey with JWST/NIRSpec’ (PI A. de Graaff), 2023.
- **114.3 hours on JWST/NIRCam** ‘Exploring the End of Cosmic Reionization’ (PI S. Lilly), 2021.
- **23.9 hours on JWST/NIRSpec** ‘Emission line galaxies beyond the limits of the Hubble UDF: Physical conditions in ultra-faint star forming galaxies’ (PI M. Maseda), 2021.
- **41.9 hours on JWST/NIRCam** ‘The first blind H-alpha narrow-band survey of star-formation at $z > 6$ ’ (PI P. Best), 2021.
- **24.4 hours on JWST/NIRSpec** ‘Unraveling the knots of gaseous Cosmic Web filaments at $z \sim 3$ through H-alpha emission observations’ (PI S. Cantalupo), 2021.
- **42 hours on ALMA** ‘Unveiling a Massive Node of the Cosmic Web at $z=3$ ’ (PI S. Cantalupo), 2021.
- **100 hours on VLT/MUSE** ‘The MUSE cosmic assembly survey targeting extragalactic legacy fields (MUSCATEL)’ (PI L. Wisotzki), 2019-2021.
- **63 hours on VLT/MUSE** ‘Extended Lyman alpha emission in the neighbourhood of high redshift quasars at $z > 3$ ’ (PI S. Cantalupo/S. Lilly), 2018.

INTERNATIONAL COLLABORATIONS

- Principal Investigator ‘The X-SHOOTER Lyman- α Survey’, including collaborators in the UK, Switzerland, Sweden, Germany, The Netherlands, Chile, France and the US.
- Principal Investigator JWST Medium program ‘All the Little Things: Pop III Signatures & the Ionizing Photon Budget of Dwarf Galaxies in the Epoch of Reionization’.
- Core-Member of JWST/NIRCam Large Program Emission-line galaxies and Intergalactic Gas in the Epoch of Reionization (EIGER, PI: Lilly).
- JWST JELS survey member of advisory board (PI: P. Best)
- MUSE GTO instrument science team member (PI: R. Bacon)
- JWST FRESCO survey team member (PI: P. Oesch)
- WST Coordinator working group ‘Galaxy assembly and the cosmic web’

OUTREACH ACTIVITIES

- Provided cover image for Quanta Magazine, August 2023. · Interview Nature online article, August 2023.
- Interview NASA/STScI press release, June 2023.
- Interview Scientific American online article, June 2023.
- Interview in online outreach video on Bilibili (Chinese, clickable link), 82k views, July 2022.
- Interview in online outreach video on Bilibili (Chinese, clickable link), 17k views, December 2021.
- Interview in online outreach video on YouTube (clickable link), 1.1k views, July 2020.
- Public talk ‘Witnessing the formation of galaxies’, part of a series on ‘Cosmos: Science & Arts’, Museum Boerhaave Leiden (NL), March 2020.
- Public seminar on ‘Where do we come from? An astrophysical perspective’, Windisch (CH), June 2019.

- Public talk on ‘The first stars’, Physics on Tap, ETH Zurich, March 2019.
- Public talk on ‘The first stars’, Astronomy on Tap, Leiden University, July 2018.
- Volunteered on ‘NEMO/Klokhuis vragendag’ organised by Dutch public broadcaster NTR (~ 500 participants). Answered live questions on astronomy from 6-12 year olds. May 2018.
- Research article on ALMA observations of CR7 featured in ‘NOVA’ - research highlights from the American Astronomical Society. 18 April 2018.

OUTREACH WRITINGS

- Invited publication in ‘News & Views’, ‘Differences in galaxy colours are not just about the mass’, Nature Astronomy 5, pages 984-985 (2021).
- Publication in Dutch amateur astronomy magazine ‘Universum’, target audience 8-18 year old, Spring edition 2018, in Dutch.
- Publication in the Dutch magazine for physicists, ‘Nederlands Tijdschrift voor de Natuurkunde’, June 2017. Printed Dutch version, online Dutch+English version.
- Press release ‘Photons struggle to escape distant galaxies’, January 2017. Covered in national and international astronomy news websites.
- Press release on the CR7 galaxy through ESO, June 2015. World wide coverage in e.g. NY Times, Nature news, Phys.org, National Geographic, BBC sports, and others. Japanese NHK broadcasted a 1hr TV documentary. Story covered in several popular science magazines.

REFERENCES

- Dr. David Sobral, Quantitative data analyst / BNP Paribas, dssobral@gmail.com
- Prof. Simon Lilly, Professor of Experimental Astrophysics, ETH Zurich, simon.lilly@phys.ethz.ch
- Prof. Joop Schaye, Professor in Galaxy Formation, Universiteit Leiden, schaye@strw.leidenuniv.nl
- Prof. Huub Röttgering, Professor in Cosmology, Universiteit Leiden, rottgering@strw.leidenuniv.nl