Jordy Davelaar

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Flatiron Institute
Center for Computational Astrophysics
162 Fifth Avenue New York, NY 10010, US

Citizenship: The Netherlands

Professional experience

2023 - present **Adjunct Associate Research Scientist**
Department of Astronomy, Columbia University, New York, USA

2020 - present **Joint Columbia/Flatiron Institute Postdoctoral Prize Fellow**
Department of Astronomy, Columbia University, New York, USA

2020 - present **Guest Researcher**
Department of Astronomy, Radboud University, Nijmegen, The Netherlands

2019 **Research Analyst**
Flatiron Institute, Center for Computational Astrophysics, NY, USA

Large Collaborations

2022 - present **Junior Member of the International Astronomical Union**

2022 - present **Associate Member of the LISA Consortium**
Part of the Multi-messenger astronomy working group

2016 - present **Member of the Event Horizon Telescope Collaboration**
Part of the Theory and Polarimetry Working groups

Education

2016 - 2020 **Ph.D. in Astronomy**
Radboud University, Nijmegen, The Netherlands.
Advisors Prof. Heino Falcke (promotor) and dr. Monika Mościbrodzka.
Thesis title *"Connecting the micro to macrophysics"*.
Defended on 24th of August 2020.

2013 - 2016 **M.Sc. in Physics and Astronomy (Cum Laude)**
Radboud University, Nijmegen, The Netherlands.
Advisors Prof. Heino Falcke and dr. Monika Mościbrodzka.

Thesis title: *"Modeling M81* with a tilted accretion disk."*

2010 - 2013 **Bachelor Physics and Astronomy (Cum Laude)**
Radboud University, Nijmegen, The Netherlands.
Advisor Prof. Abraham Achterberg.
Thesis title: *"The propagation of cosmic rays in the galaxy."*

Leaves

2021 Partial medical leave — January - November. In total 6 month of partial medical leave.

Grants and Awards

Research grants

2020-2024 Flatiron Research Fellow Postdoctoral Prize Fellowship,

2020-2024 Columbia University Theoretical High-Energy Astrophysics Postdoctoral Fellowship

2020-2023 Harvard University Black Hole Initiative Postdoctoral Prize Fellowship (declined)

2020-2023 CITA Postdoctoral Fellowship (declined)

Computing grants - Principle Investigator

2020 **PRACE Distributed European Computing Initiative (DECI)** — *High resolution simulations of accreting black holes*, 20 million CPU hours

2018 **Cartesius tier 1 grant** — *High resolution simulations of accreting black holes*, 6 million CPU hours

2017 **Cartesius starting grant** — *High resolution simulations of accreting black holes,* 500,000 CPU hours

Observing grants - Principle Investigator

2017 **Effelsberg telescope** — *Single-dish flux density monitoring of M81*.* Accepted for observations, not scheduled for observations.

2017 **VLBA** — *Core position angle measurements of M81*.* Accepted for observations, not scheduled for observations.

2016 **EVN** — *Core position angle measurements of M81**. Twelve hours observing time. Accepted and observed, project code ED042

Awards

2020 **EHT Outstanding Ph.D. thesis award**
Organization: Event Horizon Telescope Collaboration
For my PhD Thesis submitted to Radboud University Nijmegen.

2020 **Bruno Rossi Prize**
Organization: American Astronomical Society - High Energy Astrophysics Division
Rewarded to the Event Horizon Telescope collaboration for the first image of a black hole.

2020 **Einstein Medal**
Organization: Albert Einstein Society
Rewarded to the Event Horizon Telescope collaboration for the first image of a black hole.

2020 **Breakthrough Prize in Fundamental Physics ($3,000,000)**
Organization: Breakthrough Prize Board
Rewarded to the Event Horizon Telescope collaboration for the first image of a black hole.

2019 **NSF Diamond Achievement Award**
Organization: National Science Foundation
Rewarded to the Event Horizon Telescope collaboration for the first image of a black hole.

2018 **KNAW Face of Science**
Organization: the Royal Netherlands Society for Arts and Sciences (KNAW)
The KNAW elected me as a Face of Science for being a promising PhD student who combines excellent research with being active in science communication to the general public.

2015 **University Student Award**
Organization: Radboud University, The Netherlands
Reward for my contributions to the the many years I served in student politics at faculty and university level at Radboud University combined with excellent study results. Reward once a year to at most two students.

Community Service

2020 - recent **Dutch Cancer Society**
Member of the patient advisory council, tasked with ranking cancer research proposals from patient perspective

2017 - 2019 **IMAPP board Ph.D. representative**
IMAPP department, Radboud University, Nijmegen, The Netherlands

Mentoring

Undergraduate students

Daniel Kok — B.Sc. student at Radboud University 2017. Co-supervised with prof. Heino Falcke. Topic: *Black hole accretion from a particle perspective.*

Joost de Kleuver — B.Sc. student at Radboud University 2018.
Co-supervised with prof. Heino Falcke. Topic: *Autonomous Bayesian parameter estimation for accreting supermassive black holes.*

Jeffrey van der Gucht — M.Sc. student at Radboud University 2018.
Co-supervised with prof. Heino Falcke. Topic: *Deep Horizon: A machine learning network that recovers accreting black hole parameters.*

Jesse Vos — M.Sc. student projects at Radboud University 2019.
Co-supervised with prof. Heino Falcke. Topic: *Simulating the variability and time-lags of Sagittarius A*.*

Micaela Menegaldo — Exchange student at Radboud University 2019. Co-supervised with prof Heino Falcke and prof. Roger Deane. Topic: *Unsupervised classification of simulated black hole shadows.*

Bram van den Berg — B.Sc. student at Radboud University 2021. Co-supervised with prof. Heino Falcke. Topic: Modeling the jet of Centaurs A with the $\boldsymbol{\kappa}$-jet model.

Renze Oosterhuis — B.Sc. student at Radboud University 2021. Co-supervised with prof. Heino Falcke. *Topic: Bayesian parameter estimation of the jet launching region in the Centaurus A galaxy.*

Aristo Liu — Undergraduate student at Columbia University 2022 to present. Co-supervised with prof. Lorenzo Sironi. Topic: *Black hole spin down in GRMHD simulations.*

Stan DeLaurentiis — Undergraduate student at Columbia University 2022 to present. Co-supervised with prof. Zoltan Haiman. Topic: *Accretion on eccentric supermassive black hole binaries.*

Graduate students

Anthony Chow — Graduate student at Columbia University 2022 to present. Co-supervised with prof. Lorenzo Sironi. Topic: *Kelvin-Helmholtz instability at jet-wind interfaces.*

Luke Krauth — Graduate student at Columbia University 2022 to present. Co-supervised with prof. Zoltan Haiman. Topic: *Electromagnetic signatures of massive black hole binaries.*

Joost de Kleuver — Ph.D. student at Radboud University 2022 to present
Formal co-promotor with prof. Heino Falcke. Topic: *Spin measurement of Event Horizon Telescope targets*

Teaching

2020 - present	Guest lectures on black holes, high energy astrophysics, and the event horizon telescope, Columbia University, Astronomy Department
2018 - 2019	Guest lectures on radiation processes, Radboud University, Astronomy Department
2016 - 2019	Coordinator of the problem classes of Introduction to Astronomy. Responsible for preparing questions and solutions for weekly problem sets and the final exam. Radboud University, Astronomy Department
2012 - 2019	Teaching assistant, Radboud University, physics and astronomy courses including; general relativity, introduction to astronomy, observational astronomy, electromagnetism, waves and vibrations,

Leadership

2020 - 2021	Coordinator and founder of the electron distribution function task force, Event Horizon Telescope Collaboration, 2020-2021.
2018	LOC Event Horizon Telescope Conference 2018, Radboud University Nijmegen.

Technical skills

Programming languages: C, C++, CUDA, Fortran, Python, Julia, bash

Codes: Main developer of RAPTOR, and κmonty. User of BHAC, Sailfish, tristan-mp, HARM3D, grtrans.
Analysis: Python, Paraview, Visit, Mathematica, GNUplot
HPC: PRACE GRID, Cartesius Supercomputer (The Netherlands), popeye (USA), Pleiades (USA), Breniac (Belgium).

Public Outreach

2018 - 2020 Face of Science, multiple public talks, media interviews, newspaper, magazines, radio and television.

2018 - 2019 Altaïr program. Lecturer on black holes at an educational program aimed at high school children from Islamic minority groups in Amsterdam.

2018 Organization of the Radboud Space Experience, a public astronomy experience during the four days marches festival in Nijmegen (visited by over 1 million people).

2015 - 2017 Coordinator open star gazing evening, Radboud University, The Netherlands

Scientific Talks

Invited talks

Feb 2023 Improving Black Hole Accretion Models with Plasma Theory, PCTS, USA
Jan 2023 Astronomy seminar, KU Leuven, Belgium
Dec 2022 Special seminar, Tel Aviv University, Israel
Dec 2022 Conference Unsolved problems in Astrophysics, Hebrew University, Israel
Aug 2022 ngEHT workshop "*Broadening Horizons"*, Harvard University, USA
Jul 2022 Computation Astrophysics Summer seminar, Clemson University, USA
Jun 2022 GRAPA seminar, University of Amsterdam (canceled covid19), The Netherlands
Jun 2022 Astronomy Colloquium, Radboud University, The Netherlands
May 2022 Astronomy Colloquium, University of Delaware, USA
May 2022 CCPP Colloquium, NYU, USA
Feb 2022 Astronomy Colloquium, MIT, USA
July 2020 Seminar, Institute For Astronomy Research, Yunnan University, China
Feb 2020 Astronomy Colloquium, MPIK, Germany
Dec 2019 Multi messenger workshop, Prague, Czech Republic
Nov 2019 GRPIC workshop, University of Grenoble, France
Aug 2019 JILA seminar, Boulder University, USA
Jun 2019 Flatiron series seminar, Flatiron Institute, USA
Apr 2019 Black Hole Initiative seminar, Harvard University, USA

Apr 2019 High energy astrophysics seminar, Princeton university, USA
Apr 2019 Astronomy seminar, Columbia University, USA
Mar 2019 GRPIC workshop, Flatiron Institute, USA
Feb 2019 High Energy Astrophysics seminar, Columbia University
Oct 2018 Conference "The Central Arcsecond", Ringberg, Germany
Jul 2018 Astronomy Colloquium, KU Leuven, Belgium
May 2018 Workshop "the radio to x-ray connection in accreting objects", Puglia Italy

Contributed talks

Jan 2023 241th winter meeting of the American Astronomy Society, USA
Jul 2022 LISA Symposium, virtual
Jun 2022 LISA Astrophysics Working Group meeting, virtual
Apr 2022 KITP program, *Bridging the Gap: Accretion and Orbital Evolution in Stellar and Black Hole Binaries*, USA
Nov 2020 IAU Challenges in Computation Astrophysics, virtual
Oct 2020 KITP mini conference, The Frontiers of Event Horizon Scale Accretion (canceled due to medical reasons)
Aug 2019 KITP conference, Connecting the micro to macro scales, USA
Apr 2019 Event Horizon Collaboration meeting, Princeton, USA
May 2017 Dutch astronomy conference, The Netherlands
Nov 2016 Event Horizon Telescope collaboration meeting, Boston, USA

Contributed posters

May 2018 Dutch astronomy conference, The Netherlands
May 2017 Dutch astronomy conference, The Netherlands
May 2016 Dutch astronomy conference, The Netherlands

Collaborators

L. Sironi (Columbia University), Z. Haiman (Columbia University), Brian Metzger (Columbia Univesity), H. Falcke (Radboud University), A. Philippov (University of Maryland), A. McFayden (NYU), J. Zrake (Clemson University), O. Porth (University of Amsterdam), B. Ripperda (IAS), S. Markoff (University of Amsterdam), D. D'Orazio (University of Copenhagen) Thomas Bronzwaer (Radboud University), H. Olivares (Radboud University), M. Janssen (MPIfR), T. Hertogh (KU Leuven), D. Mayerson (KU Leuven), F. Bachinii (KU Leuven)

Publication list - Jordy Davelaar

Total published papers: 61

First author papers; 7

Citations (as of Jan 9 2023, ADS): **8358**

h-index (as of Jan 9 2023, ADS): **32**

First author papers

1. kmonty: a Monte Carlo Compton Scattering code including non-thermal electrons — **Davelaar, J.**, Ryan, B., et al., 2023, arXiv, 2023arXiv230315522D
2. Self-Lensing Flares from Black Hole Binaries: Observing Black Hole Shadows via Light Curve Tomography — **Davelaar, J.**, Haiman, Z. 2022, PhRvL, 128, 191101
3. Self-lensing flares from black hole binaries: General-relativistic ray tracing of black hole binaries — **Davelaar, J.**, Haiman, Z. 2022, PhRvD, 105, 103010
4. Particle Acceleration in Kink-unstable Jets — **Davelaar, J.** et al. 2020, ApJL, 896, L31
5. Modeling non-thermal emission from the jet-launching region of M 87 with adaptive mesh refinement — **Davelaar, J.** et al 2019, A&A, 632, A2
6. Observing supermassive black holes in virtual reality — **Davelaar, J.** et al. 2018 CompAC, 5, 1
7. General relativistic magnetohydrodynamical $\varkappa$-jet models for Sagittarius A* — **Davelaar, J.** et al. 2018, A&A, 612, A34

Highlighted papers (Primary author or major contributions)

8. Disappearing thermal X-ray emission as a tell-tale signature of merging massive black hole binaries, Krauth, L., Davelaar, J., arXiv, 2023arXiv230402575M
9. Radio jet precession in M 81*, von Fellenberg S, Janssen M., **Davelaar, J.**, et al., 2023 A&A, 672, L5
10. Comparison of Polarized Radiative Transfer Codes used by the EHT Collaboration — Prather, B., et al., 2023, arXiv, 2023arXiv230312004P
11. The Kelvin-Helmholtz instability at the boundary of relativistic magnetized jets — Chow, A., Davelaar, J., Sironi, L., 2022, arXiv, 2022arXiv220913699C
12. First Sagittarius A* Event Horizon Telescope Results. V. Testing Astrophysical Models of the Galactic Center Black Hole — EHTC et al. 2022, ApJL, 930, L16|
13. Fuzzball Shadows: Emergent Horizons from Microstructure — Bacchini, F. et al. 2021, PhRvL, 127, 171601
14. Visibility of black hole shadows in low-luminosity AGN — Bronzwaer, T, **Davelaar, J.**, et al. 2020, MNRAS, 501, 4722
15. RAPTOR. II. Polarized radiative transfer in curved spacetime — Bronzwaer, T., Younsi, Z., **Davelaar, J.,** et al. 2020, A&A, 641, A126
16. Verification of Radiative Transfer Schemes for the EHT — Gold, et al. 2020, ApJ, 897, 148
17. Deep Horizon: A machine learning network that recovers accreting black hole parameters — van der Gucht, J., **Davelaar, J.** et al. 2020, A&A, 636, A94
18. Kink Instability: Evolution and Energy Dissipation in Relativistic Force-free Nonrotating Jets — Bromberg, O et al. 2019, ApJ, 884, 39

19. Constrained transport and adaptive mesh refinement in the Black Hole Accretion Code — Olivares, H., Porth, O., **Davelaar, J.**, et al. 2019, A&A, 629, A61
20. The Event Horizon General Relativistic Magnetohydrodynamic Code Comparison Project — Porth, O. et al. 2019, ApJS, 243, 26
21. First M87 Event Horizon Telescope Results. V. Physical Origin of the Asymmetric Ring — EHTC et al. 2019, ApJL, 875, L5
22. RAPTOR. I. Time-dependent radiative transfer in arbitrary spacetimes — Bronzwaer, T., **Davelaar, J.** et al. 2018, A&A, 613, A2
23. Faraday rotation in GRMHD simulations of the jet launching zone of M87 — Mościbrodzka, M. et al. 2017, MNRAS, 468, 2214

Collaboration and contributed papers

24. The Event Horizon Telescope Image of the Quasar NRAO 530 — Jorstad, S., et al. 2022, ApJ, 943, 17
25. Resolving the Inner Parsec of the Blazar J1924-2914 with the Event Horizon Telescope — Issaoun, S., Wielgus, M. et al., 2022, ApJ, 934, 145
26. The science case and challenges of space-borne sub-millimeter interferometry — Gurvits, L. et al. 2022, AcAau, 196, 314
27. MeqSilhouette v2: spectrally resolved polarimetric synthetic data generation for the event horizon telescope — Natarajan, I. et al. 2022, MNRAS, 512, 490
28. Characterizing and Mitigating Intraday Variability: Reconstructing Source Structure in Accreting Black Holes with mm-VLBI — Broderick, A. et al. 2022, ApJL, 930, L21
29. A Universal Power-law Prescription for Variability from Synthetic Images of Black Hole Accretion Flows — Georgiev, B. et al.2022, ApJL, 930, L20
30. Millimeter Light Curves of Sagittarius A* Observed during the 2017 Event Horizon Telescope Campaign — Wielgus, M. et al. 2022, ApJL, 930, L19
31. Selective Dynamical Imaging of Interferometric Data — Farah, et al. 2022, ApJL, 930, L18
32. First Sagittarius A* Event Horizon Telescope Results. VI. Testing the Black Hole Metric — EHTC et al. 2022, ApJL, 930, L17
33. First Sagittarius A* Event Horizon Telescope Results. IV. Variability, Morphology, and Black Hole Mass — EHTC et al. 2022, ApJL, 930, L15
34. First Sagittarius A* Event Horizon Telescope Results. III. Imaging of the Galactic Center Supermassive Black Hole — EHTC et al. 2022, ApJL, 930, L14
35. First Sagittarius A* Event Horizon Telescope Results. II. EHT and Multiwavelength Observations, Data Processing, and Calibration —EHTC et al. 2022, ApJL, 930, L13
36. First Sagittarius A* Event Horizon Telescope Results. I. The Shadow of the Supermassive Black Hole in the Center of the Milky Way — EHTC et al. 2022, ApJL, 930, L12
37. Impact of non-thermal particles on the spectral and structural properties of M87 — Fromm, C. et al. 2022, A&A, 660, A107
38. State-of-the-art energetic and morphological modelling of the launching site of the M87 jet — Cruz-Osorio, A. et al. 2022, NatAs, 6, 103

39. The Variability of the Black Hole Image in M87 at the Dynamical Timescale — Satapathy, K. et al. 2022, ApJ, 925, 13
40. Event Horizon Telescope observations of the jet launching and collimation in Centaurus A — Janssen, M. et al. 2021, NatAs, 5, 1017
41. THEZA: TeraHertz Exploration and Zooming-in for Astrophysics — Gurvits, L et al. 2021, ExA, 51, 559
42. Constraints on black-hole charges with the 2017 EHT observations of M87* Kocherlakota, P. et al. — 2021, PhRvD, 103, 104047
43. The Polarized Image of a Synchrotron-emitting Ring of Gas Orbiting a Black Hole — Narayan, R. et al. 2021, ApJ, 912, 35
44. Black hole parameter estimation with synthetic very long baseline interferometry data from the ground and from space — Roelofs, F. et al. 2021, A&A, 650, A56
45. Broadband Multi-wavelength Properties of M87 during the 2017 Event Horizon Telescope Campaign — EHT MWL Science Working Group et al. 2021, ApJL, 911, L11
46. An Event Horizon Imager (EHI) Mission Concept Utilizing Medium Earth Orbit Sub-mm Interferometry* — Kudriashov, V. et al. 2021, ChJSS, 41, 211
47. Polarimetric Properties of Event Horizon Telescope Targets from ALMA — Goddi, C. et al. 2021, ApJL, 910, L14
48. First M87 Event Horizon Telescope Results. VIII. Magnetic Field Structure near The Event Horizon — EHTC et al. 2021, ApJL, 910, L13
49. First M87 Event Horizon Telescope Results. VII. Polarization of the Ring — EHTC et al. 2021, ApJL, 910, L12
50. Gravitational Test beyond the First Post-Newtonian Order with the Shadow of the M87 Black Hole — Psaltis, D. et al. 2020, PhRvL, 125, 141104
51. Monitoring the Morphology of M87* in 2009-2017 with the Event Horizon Telescope — Wielgus, M et al. 2020, ApJ, 901, 67
52. Event Horizon Telescope imaging of the archetypal blazar 3C 279 at an extreme 20 microarcsecond resolution — Kim, J et al. 2020, A&A, 640, A69
53. THEMIS: A Parameter Estimation Framework for the Event Horizon Telescope — Broderick, A et al. 2020, ApJ, 897, 139
54. SYMBA: An end-to-end VLBI synthetic data generation pipeline. Simulating Event Horizon Telescope observations of M 87 — Roelofs, F. et al. 2020, A&A, 636, A5
55. First M87 Event Horizon Telescope Results and the Role of ALMA — Goddi, C. et al. 2019, Msngr, 177, 25
56. First M87 Event Horizon Telescope Results. VI. The Shadow and Mass of the Central Black Hole — EHTC et al. 2019, ApJL, 875, L6
57. First M87 Event Horizon Telescope Results. IV. Imaging the Central Supermassive Black Hole — EHTC et al. 2019, ApJL, 875, L4
58. First M87 Event Horizon Telescope Results. III. Data Processing and Calibration — EHTC et al. 2019, ApJL, 875, L3
59. First M87 Event Horizon Telescope Results. II. Array and Instrumentation — EHTC et al. 2019, ApJL, 875, L2

60. First M87 Event Horizon Telescope Results. I. The Shadow of the Supermassive Black Hole — EHTC et al. 2019, ApJL, 875, L1
61. BlackHoleCam: Fundamental physics of the galactic center — Goddi, C. et al 2017, IJMPD, 26, 1730001-239