

Markus R. Mosbech

Curriculum Vitae

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September, 2025

- 2025 **PostDoc, KIT, Germany**
Institute of Theoretical Particle Physics (TTP),
In the group of Prof. Felix Kahlhöfer
- 2025 **PostDoc, RWTH Aachen University, Germany**
2023 Institute of Theoretical Particle Physics and Cosmology (TTK),
In the group of Prof. Julien Lesgourgues

Education

- 2023 **Ph.D., The University of Sydney, Australia**
2020 Supervisors: Prof. Celine Boehm, A.Prof. Yvonne Y. Y. Wong
Peering into the Dark: Investigating dark matter and neutrinos with cosmology and astrophysics
Education: as well as regular coursework, helped organize pedagogical journal clubs on advanced astrophysics and particle physics topics.
- 2019 **Master of Science (Physics), Aarhus University, Denmark**
2017 Supervisor: Steen Hannestad
Thesis: Linear modeling of baryon-dark matter interactions with CLASS
- 2017 **Bachelor of Science (Physics), Aarhus University, Denmark**
2014

Papers

My research interests center on how we can use cosmology and astrophysics to learn more about the fundamentals of our universe, in particular the nature of dark matter.

- 2025 **OLE - Online Learning Emulation in Cosmology**, S. Gunther, ..., M.R. Mosbech, et al., 2025
2503.13183 [astro-ph.CO], DOI: 10.1088/1475-7516/2025/09/059, JCAP 09 (2025) 059
- 2025 **Emulating the Lyman-Alpha forest 1D power spectrum from cosmological simulations: New models and constraints from the eBOSS measurement**, M. Walther, ..., M.R. Mosbech, et al., 2024
2412.05372 [astro-ph.CO], DOI: 10.1088/1475-7516/2025/05/099, JCAP 05 (2025) 099
- 2025 **DESI forecast for Dark Matter-Neutrino interactions using EFTofLSS**, M.R. Mosbech, et al., 2024
2410.08163 [astro-ph.CO], DOI: 10.1088/1475-7516/2025/05/040, JCAP 05 (2025) 040
- 2025 **Everything hot everywhere all at once: Neutrinos and hot dark matter as a single effective species**, A. Upadhye, M.R. Mosbech, G. Pierobon, Y.Y.Y. Wong, 2025
2410.05815 [astro-ph.CO], DOI: 10.1088/1475-7516/2025/01/077, JCAP 01 (2025) 077
- 2024 **One trick to treat them all: SuperEasy linear response for any hot dark matter in N-body simulations**, G. Pierobon, M.R. Mosbech, A. Upadhye, Y.Y.Y. Wong, 2022
2410.05816 [astro-ph.CO], DOI: 10.1088/1475-7516/2024/12/032, JCAP 12 (2024) 032
- 2022 **Hybrid multi-fluid-particle simulations of the cosmic neutrino background**, J.Z. Chen, M.R. Mosbech, A. Upadhye, Y.Y.Y. Wong, 2022
2210.16012 [astro-ph.CO], DOI: 10.1088/1475-7516/2023/03/012, JCAP 03 (2023) 012

- 2022 **Gravitational-wave event rates as a new probe for dark matter microphysics**, *M.R. Mosbech, A.C. Jenkins, S. Bose, C. Boehm, M. Sakellariadou, Y.Y.Y. Wong*, 2022
2207.14126 [astro-ph.CO], Accepted for publication in Phys. Rev. D
- 2022 **Probing dark matter interactions with 21cm observations**, *M. Mosbech, C. Boehm, Y.Y.Y. Wong*, 2022
2207.03107 [astro-ph.CO], DOI: 10.1088/1475-7516/2023/03/047, JCAP 03 (2023) 047
- 2022 **Recoil imaging for dark matter, neutrinos, and physics beyond the Standard Model**, *C.A.J. O'Hare, et al.*, 2022
2203.05914 [physics.ins-det], Snowmass 2021 Contribution
- 2022 **Effects of Hawking evaporation on PBH distributions**, *M.R. Mosbech, Z.S.C. Picker*, 2022
arXiv:2203.05743 [astro.ph.HE], DOI: 10.21468/SciPostPhys.13.4.100, SciPost Phys. 13, 100 (2022)
- 2021 **The full Boltzmann hierarchy for dark matter-massive neutrino interactions**, *M.R. Mosbech, C. Boehm, S. Hannestad, O. Mena, J. Stadler, Y.Y.Y. Wong*, 2021
arXiv:2011.04206 [astro.ph.CO], DOI: 10.1088/1475-7516/2021/03/066, JCAP 03 (2021) 066

Talks and Presentations

Invited Talks

- 2025 **News From The Dark 10**, *University of Montpellier*, 30 mins
'Probing Dark Matter-Neutrino interactions in Cosmology'
- 2025 **Invited Talk**, *University of Swansea*, 45 mins
'OLÉ - Online Learning in Cosmology'
- 2025 **Friday Talks**, *University of Groningen*, 45 mins
'Probing dark matter microphysics with structure formation'
- 2023 **CosKASI ECR Seminar**, *KASI*, 45 mins
'Current and future cosmological probes of dark matter microphysics'
- 2022 **Centre Annual Workshop**, *ARC Centre of Excellence for Dark Matter Particle Physics*, 10 mins
'Probing dark matter microphysics with gravitational waves and cosmology'
- 2022 **TEPAPP Seminar**, *UCLA*, 50 mins
'Probing dark matter microphysics with gravitational waves and cosmology'
- 2022 **ICTP-AP Seminar**, *International Centre for Theoretical Physics Asia-Pacific*, 50 mins
'Probing dark matter microphysics with gravitational waves and cosmology'
- 2022 **ICAP seminar series**, *IAP Paris*, 20 mins
'Dark matter microphysics with next generation observatories'
- 2022 **SIFA Morning tea**, *Sydney Institute for Astronomy*, 15 mins
'Probing dark matter with next-gen observatories'
- 2022 **Invited Seminar**, *Aarhus University*, 60 mins
'Constraining DM-neutrino interactions and primordial black holes'
- 2022 **Fortnightly Centre meeting**, *ARC Centre of Excellence for Dark Matter Particle Physics*, 15 mins
'Constraining dark matter-neutrino interactions with linear and non-linear cosmology'

Other Presentations

- 2024 **Kosmologietag 2024**, *Bielefeld University*, 15 mins
'Probing dark matter microphysics with structure formation'
- 2023 **Light Dark World 2023**, *KIT Karlsruhe*, 10 mins
'Probing dark matter microphysics with gravitational waves and 21cm emission'

2023	COSMO'23, UAM Madrid, 15 mins 'Investigating Dark Matter with Gravitational waves and cosmology'
2022	Dark Side of the Universe, UNSW Sydney, 20 mins 'Probing dark matter microphysics with gravitational waves and 21cm emission'
2022	Cosmology from Home 2022  , <i>Online</i> , 18 mins 'Signatures of dark matter interactions at high and higher redshifts'
2022	Invisibles 2022 workshop, Orsay, 5 mins 'Mixed messages: constraining dark matter with astrophysical signals (or lack thereof)'
2021	Bright Ideas for a Dark Universe, DESY Hamburg, 15 mins 'Easing the sigma8-tension with nu-DM interactions'
2021	Asia-Pacific Workshop on Particle Physics and Cosmology, Yonsei University, 15 mins 'Easing the sigma8-tension with nu-DM interactions'
2021	Invisibles 2021 Workshop, Madrid, 5 mins 'Easing the sigma8-tension with nu-DM interactions'
2021	First EuCAPT annual symposium, CERN, 5 mins 'Easing the sigma8-tension with nu-DM interactions'
<u>Outreach and Other Content</u>	
2024	Probing Dark Matter Microphysics with Next Generation Experiments, poster COSMO'24, Kyoto University
2021	Easing the sigma8-tension with nu-DM interactions, poster Second Centre Annual Workshop, ARC Centre of Excellence for Dark Matter Particle Physics, 2021 Invisibles2021 Workshop, 2021
2021	Dark Chatter  , <i>Episode 8</i> , 30 mins, Interviewer 'Lyman alpha data and dark matter interactions'
2020	Dark Chatter  , <i>Episode 2</i> , 20 mins, Interviewee 'Dark matter-neutrino interactions in cosmology'
2020	Dark Chatter  , <i>Episode 1</i> , 30 mins, Interviewer 'Primordial black holes'

Teaching and Academic Duties

I enjoy teaching and have been doing it for most of my PhD. I am also passionate about fostering a good research environment, and was selected for the **Collaboration and Centre Values Award** for my contributions, including committee work, at the ARC Centre of Excellence for Dark Matter Particle Physics.

University teaching

2023–	PostDoc Teaching Duties, RWTH Aachen University, Germany Bachelor's level Electrodynamics and Statistical Physics, Master's Level Cosmology
2023 2021	University Tutor, The University of Sydney, Australia Astronomy modules, 1st-3rd year courses: 'Earth to exoplanets', 'Stars to black holes', 'Big bang to darkness' Including running tutorial classes, marking assignment and exams, and running observing sessions with a teaching telescope.
2019 2018	Mentor, Aarhus University, Denmark Mentor program for first year students
2017	University TA, Aarhus University, Denmark Philosophy and Ethics of Science: Physics, Chemistry and Geology, Running tutorial classes and marking weekly assignments

Other duties



Research Committee, *ARC Centre of Excellence for Dark Matter Particle Physics*, Australia
Graduate student representative, duties include organising the annual Early Career Researcher workshop.



Equity, Diversity, and Inclusion Committee, *ARC Centre of Excellence for Dark Matter Particle Physics*, Australia



Physics Early and Mid Career Researcher committee, *The University of Sydney*, Australia



ISR Coordinator, *Aarhus University*, Denmark

Coordinator of the Student Representation at the Department of Physics and Astronomy (ISR), facilitating dialogue between the student body and department leadership.