CHRISTIAN KRAGH JESPERSEN

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EDUCATION

PhD   Astrophysical Sciences, Princeton University   2021 – 2026 (expected)
Committee: D. N. Spergel (co-chair), P. Melchior (co-chair), R. S. Somerville, S. Ho, J. E. Greene

MA   Astrophysical Sciences, Princeton University   2021– 2023
BSc   Physics, University of Copenhagen   2018 - 2021

PROFESSIONAL EXPERIENCE

Guest Researcher   Aug. 2021 –
Institution: Center for Computational Astrophysics (Flatiron Institute)
Hosts: Prof. Shirley Ho/Prof. David N. Spergel

Undergraduate Researcher and Outreach Assistant   Nov. 2018 – Feb. 2021
Institution: Cosmic Dawn Center (DAWN)
Advisor: Ass. Prof. Charles L. Steinhardt/Prof. Sune Toft

Caltech Summer Undergraduate Research Fellow   Jun. 2019 – Sep. 2019
Institution: California Institute of Technology
Advisor: Marvin L. Goldberger Professor of Planetary Science, David John Stevenson

SCIENTIFIC INTERESTS AND EXPERTISE

My research spans theory, computation, instrumentation, and survey-scale observations—from near to far, from extreme single objects to millions of galaxies, and across subfields—unified by a methods-focused approach that develops physics- and geometry-informed machine learning and statistical frameworks to advance galaxy formation and evolution.

- **Geometrical and graph-based machine learning** – Designing novel algorithms to connect galaxy properties to their dark matter halo assembly histories and environments with geometric and group-theory informed machine learning.
- **Cosmic variance and clustering** – Measuring high-z clustering with cosmic variance and creating clustering-aware analysis methods for both extreme single JWST objects and large galaxy surveys.
- **Galaxy SED modeling** – Developing statistically robust techniques for extracting the most informative and physical parameter constraints from galaxy spectra.
- **Survey calibration and instrumentation** – Innovating precision wavelength and flux calibration methods for next-generation spectroscopic instruments, enabled by deeper understanding of terrestrial atmospheric emission, particularly of molecular origin.
- **Molecular astrophysics** – Identifying previously unknown interstellar molecules.

PUBLICATIONS (CITATIONS: 1338, H-INDEX: 13, TOTAL: 29, FIRST AUTHOR: 6)

Publications with Significant Contributions:

A. Weibel, P. A. Oesch, C. C. Williams, **Jespersen, C. K.,** et al., "Exploring Cosmic Dawn with PANORAMIC I: The Bright End of the UVLF at z~9 -17", 2025, arXiv, arXiv:2507.06292, doi:10.48550/arXiv.2507.06292

Jespersen, C. K., A. C. Carnall, C. C. Lovell, "Explaining Ultramassive Quiescent Galaxies at $3 < z < 5$ in the Context of Their Environments", 2025, ApJL, 988, L19, doi:10.3847/2041-8213/adeb7c

Jespersen, C. K., P. Melchior, D. N. Spergel, A. D. Goulding, C. Hahn, K. G. Iyer, "The optical and infrared are connected", 2025, arXiv, arXiv:2503.03816, doi:10.48550/arXiv.2503.03816

Jespersen, C. K., C. L. Steinhardt, R. S. Somerville, C. C. Lovell, "On the Significance of Rare Objects at High Redshift: The Impact of Cosmic Variance", 2025, ApJ, 982, 23, doi:10.3847/1538-4357/adb422

J. F. Wu, **Jespersen, C. K.,** R. H. Wechsler, "How the Galaxy–Halo Connection Depends on Large-scale Environment", 2024, ApJ, 976, 37, doi:10.3847/1538-4357/ad7bb3

L. Vujeva, C. L. Steinhardt, **Jespersen, C. K.,** B. L. Frye, et al., "Efficient Survey Design for Finding High-redshift Galaxies with JWST", 2024, ApJ, 974, 23, doi:10.3847/1538-4357/ad639d

Jespersen, C. K., R. H. Lupton, J. E. Gunn, P. A. Price, et al., "Airglow and the Subaru Night Sky Spectrograph (SuNSS)", 2024, SPIE, 13096, 1309679, doi:10.1117/12.3018016

C. Chuang, **Jespersen, C. K.,** Y. Lin, S. Ho, S. Genel, "Leaving No Branches Behind: Predicting Baryonic Properties of Galaxies from Merger Trees", 2024, ApJ, 965, 101, doi:10.3847/1538-4357/ad2b6c

J. F. Wu, **Jespersen, C. K.,** "Learning the galaxy-environment connection with graph neural networks", 2023, Machine Learning for Astrophysics, arXiv:2306.12327, doi:10.48550/arXiv.2306.12327

Jespersen, C. K., M. Cranmer, P. Melchior, S. Ho, R. S. Somerville, A. Gabrielpillai, "Mangrove: Learning Galaxy Properties from Merger Trees", 2022, ApJ, 941, 7, doi:10.3847/1538-4357/ac9b18

C. L. Steinhardt, **Jespersen, C. K.,** N. B. Linzer, "Finding High-redshift Galaxies with JWST", 2021, ApJ, 923, 8, doi:10.3847/1538-4357/ac2a2f

Jespersen, C. K., J. B. Severin, C. L. Steinhardt, J. Vinther, et al., "An Unambiguous Separation of Gamma-Ray Bursts into Two Classes from Prompt Emission Alone", 2020, ApJL, 896, L20, doi:10.3847/2041-8213/ab964d

Other Publications:

K. G. Iyer, T. K. Starkenburg, G. L. Bryan, R. S. Somerville..., **Jespersen, C. K.,** ..., et al., "How does feedback affect the star formation histories of galaxies?", 2025, arXiv, arXiv:2508.21152, doi:10.48550/arXiv.2508.21152

N. Huang, R. Stiskalek, J. Lee, A. E. Bayer..., **Jespersen, C. K.,** ..., et al., "CosmoBench: A Multiscale, Multiview, Multitask Cosmology Benchmark for Geometric Deep Learning", 2025, arXiv, arXiv:2507.03707, doi:10.48550/arXiv.2507.03707

F. Valentino, K. E. Heintz, G. Brammer, K. Ito..., **Jespersen, C. K.,** ..., et al., "Gas outflows in two recently quenched galaxies at $z = 4$ and 7", 2025, A&A, 699, A358, doi:10.1051/0004-6361/202553908

K. Ito, F. Valentino, G. Brammer, M. L. Hamadouche..., **Jespersen, C. K.,** ..., et al., "DeepDive: A deep dive into the physics of the first massive quiescent galaxies in the Universe", 2025, arXiv, arXiv:2506.22642, doi:10.48550/arXiv.2506.22642

W. M. Baker, F. Valentino, C. d. P. Lagos, K. Ito..., **Jespersen, C. K.,** ..., et al., "Exploring over 700 massive quiescent galaxies at $z = 2$-7: Demographics and stellar mass functions", 2025, arXiv, arXiv:2506.04119, doi:10.48550/arXiv.2506.04119

K. Ito, F. Valentino, M. Farcy, G. De Lucia..., **Jespersen, C. K.,** ..., et al., "A merging pair of massive quiescent galaxies at $z = 3.44$ in the Cosmic Vine", 2025, A&A, 697, A111, doi:10.1051/0004-6361/202453211

Euclid Collaboration, L. Zalesky, J. R. Weaver, C. J. R. McPartland..., **Jespersen, C. K.,** ..., et al., "Euclid preparation: TBD. Cosmic Dawn Survey: evolution of the galaxy stellar mass function across $0.2<z<6.5$ measured over 10 square degrees", 2025, arXiv, arXiv:2504.17867, doi:10.48550/arXiv.2504.17867

M. Shuntov, O. Ilbert, S. Toft, R. C. Arango-Toro..., **Jespersen, C. K.,** ..., et al., "COSMOS-Web: Stellar mass assembly in relation to dark matter halos across $0.2 < z < 12$ of cosmic history", 2025, A&A, 695, A20, doi:10.1051/0004-6361/202452570

L. Paquereau, C. Laigle, H. J. McCracken, M. Shuntov..., **Jespersen, C. K.,** ..., et al., "Tracing the galaxy-halo connection with galaxy clustering in COSMOS-Web from $z = 0.1$ to $z \sim 12$", 2025, arXiv, arXiv:2501.11674, doi:10.48550/arXiv.2501.11674

N. Tamura, K. Yabe, S. Koshida, Y. Moritani..., **Jespersen, C. K.,** ..., et al., "Prime Focus Spectrograph (PFS) for Subaru Telescope: progressing final steps to science operation", 2024, SPIE, 13096, 1309605, doi:10.1117/12.3015967

K. Ito, F. Valentino, G. Brammer, A. L. Faisst..., **Jespersen, C. K.,** ..., et al., "Size–Stellar Mass Relation and Morphology of Quiescent Galaxies at $z \geq 3$ in Public JWST Fields", 2024, ApJ, 964, 192, doi:10.3847/1538-4357/ad2512

S. Hassan, C. C. Lovell, P. Madau, M. Huertas-Company..., **Jespersen, C. K.,** ..., et al., "JWST Constraints on the UV Luminosity Density at Cosmic Dawn: Implications for 21 cm Cosmology", 2023, ApJ, 958, L3, doi:10.3847/2041-8213/ad0239

J. R. Weaver, I. Davidzon, S. Toft, O. Ilbert..., **Jespersen, C. K.,** ..., et al., "COSMOS2020: The galaxy stellar mass function. The assembly and star formation cessation of galaxies at $0.2< z \leq 7.5$", 2023, A&A, 677, A184, doi:10.1051/0004-6361/202245581

F. Valentino, G. Brammer, K. M. L. Gould, V. Kokorev..., **Jespersen, C. K.,** ..., et al., "An Atlas of Color-selected Quiescent Galaxies at $z > 3$ in Public JWST Fields", 2023, ApJ, 947, 20, doi:10.3847/1538-4357/acbefa

C. L. Steinhardt, W. J. Mann, V. Rusakov, **Jespersen, C. K.,** "Classification of BATSE, Swift, and Fermi Gamma-Ray Bursts from Prompt Emission Alone", 2023, ApJ, 945, 67, doi:10.3847/1538-4357/acb999

A. Leśniewska, M. J. Michałowski, P. Kamphuis, K. Dziadura..., **Jespersen, C. K.,** ..., et al., "The Interstellar Medium in the Environment of the Supernova-less Long-duration GRB 111005A", 2022, ApJS, 259, 67, doi:10.3847/1538-4365/ac5022

J. R. Weaver, O. B. Kauffmann, O. Ilbert, H. J. McCracken..., **Jespersen, C. K.,** ..., et al., "COSMOS2020: A Panchromatic View of the Universe to $z\sim10$ from Two Complementary Catalogs", 2022, ApJS, 258, 11, doi:10.3847/1538-4365/ac3078

Book chapters:

Textbook (in Danish): Hansen, C, Bruun, S. H., Robl, J. B., **Jespersen, C. K**., Larsen, J. Ø., Jensen, R. B., Ditlefsen, E. S., Thomsen, J. S. (2019). *Kompendium for Fysik Camp 2019 (Compendium for Physics Camp 2019)*, *UNF Print*.

Textbook (in Danish): Hansen, C, Bruun, S. H., Robl, J. B., **Jespersen, C. K**., Osman, J. O., Jensen, R. B., Ditlefsen, E. S., Thomsen, J. S. (2018). *Kompendium for Fysik Camp 2018 (Compendium for Physics Camp 2019)*, *UNF Print*.

TALKS (INVITED: 38)

"Inferring assembly from environment", John Hopkins/Space Telescope Science Institute Galaxy Evolution Group, 2025, Invited

"Everything is connected", University of Texas Austin, Austin, 2025, Invited

"Inferring assembly from environment", Toronto ART seminar, Toronto, 2025, Invited

"The optical and infrared are connected", Toronto TASTY seminar, Toronto, 2025, Invited

"Inferring assembly from environment", Chicago SkAI seminar, Chicago, 2025, Invited

"Everything is connected", Stanford University Galaxy Formation and Cosmology Seminar, Stanford, 2025, Invited

"Inferring assembly from environment", Harvard AstroAI seminar, Cambridge, 2025, Invited

"The optical and infrared are connected", Harvard Institute for Theory and Computation, Cambridge, 2025, Invited

"Everything is connected", Oskar Klein Centre, Stockholm, 2025, Invited

"Clustering and the statistics of extreme JWST objects", JWST Miracles, University of Geneva, 2025, Contributed

"The optical and infrared are connected", Bristol SBI workshop, 2025, Contributed

"Clustering and the statistics of extreme JWST objects", Annual Danish Astronomy Meeting, 2025, Contributed

"The optical and infrared are connected", Annual Danish Astronomy Meeting, 2025, Poster, Contributed

"The optical and infrared are connected", CCA Cosmology x ML, 2025, Invited

"Everything is connected: galaxy properties couple internally, environmentally, and historically", DAWN Copenhagen, 2024, Invited

"Everything is connected: galaxy properties couple internally, environmentally, and historically", Cambridge, 2024, Invited

"The most massive galaxy we will find with JWST", IAP, Paris, 2024, Contributed

"Everything is connected: galaxy properties couple internally, environmentally, and historically", CosmoStat, Saclay, 2024, Invited

"Everything is connected: galaxy properties couple internally, environmentally, and historically", IAP, Paris, 2024, Invited

"Galaxies, their dark matter environments, formation histories, and couplings", Perimeter Institute, 2024, Invited

"Challenging modelling assumptions by connecting the optical and IR", CCA, 2024, Invited

"New perspectives in galaxy formation", CU Boulder, 2024, Invited

"Challenging modelling assumptions by connecting the optical and IR", Princeton, 2024, Invited

"Challenging modelling assumptions by connecting the optical and IR", UCSC, 2024, Contributed

"Airglow and The Subaru Night Sky Spectrograph (SuNSS)", Hilo, Hawaii, 2024, Invited

"Galaxies, their dark matter environments, and formation histories", Mila/Ciela Institute, 2024, Invited

"The most massive galaxy we will find with JWST", CCA, 2024, Invited

"Airglow and The Subaru Night Sky Spectrograph (SuNSS)", AAS Winter Meeting, 2024, Contributed Poster

"Galaxies and Graphs", Hammers & Nails Conference, 2023, Invited

"Galaxies and Graphs", Center for Computational Astrophysics Cosmic Connections Meeting, 2023, Invited

"Mangrove: Learning Galaxy Properties from Merger Trees", John Hopkins/Space Telescope Science Institute Galaxy Evolution Group, 2023, Invited

"Mangrove: Learning Galaxy Properties from Merger Trees", Kavli Institute of Theoretical Physics Data-Driven Galaxy Evolution Workshop, 2023, Invited

"The Unreasonable Efficiency of Graph Neural Networks in Physics", Kavli Institute of Theoretical Physics Data-Driven Galaxy Evolution Workshop, 2023, Invited

"The Unreasonable Efficiency of Graph Neural Networks in Physics", Instituto de Astrofísica de Canarias, 2023, Invited

"The Unreasonable Efficiency of Graph Neural Networks in Physics", Flatiron Institute, 2023, Invited

"Learning Galaxy Properties from Merger Trees with Mangrove", Euclid Consortium Meeting, 2022, Contributed

"Learning Galaxy Properties from Merger Trees with Graph Neural Networks", Ciela Institute (remote), 2022, Invited

"Learning Galaxy Properties from Merger Trees with Graph Neural Networks", Brown University Machine Leaning Seminar, 2022, Invited

"Learning Galaxy Properties from Merger Trees", Flatiron Institute MLxAstro Group, 2021, Invited

"Finding High-Redshift Galaxies with JWST", CCA, 2021, Invited

"Optimizing Reconstruction and Error Estimation of IceCube Events Using Graph Neural Networks," University of Toronto, 2021, Invited

"An Unambiguous Separation of Gamma-Ray Bursts into Two Classes from Prompt Emission Alone," University of Toronto, 2021, Invited

"Optimizing Reconstruction and Error Estimation of IceCube Events Using Graph Neural Networks," IceCube Collaboration, 2021, Invited

"Optimizing Reconstruction and Error Estimation of IceCube Events Using Graph Neural Networks," NBI and Technical University of Munich IceCube Groups, 2021, Invited

"Physics, Science, and How to Become an Astrophysicist," Guest Lecturer, Fredensborg Skole and Frederiksborg Gymnasium og HF, 2020, Invited, For the general public

"Gradient Boosted Reweighting: A tool for improving models trained in Monte Carlo Simulation," Niels Bohr Institute, IceCube Neutrino Group Workshop, 2020, Invited

"An Unambiguous Separation of Gamma-Ray Bursts into Two Classes from Prompt Emission Alone," DAWN Summit, Cosmic Dawn Center, 2020, Contributed

"PSF Deconvolution in the COSMOS2020 Field," Cosmic Dawn Center, DARK, and AstroNu Groups, 2020

"Investigating Radius Increases in Hot Exoplanets," Chambliss Poster Presentation, 235th AAS Meeting, 2019, Contributed

"Possibilities for Undergraduate Research – in Denmark and Overseas," University of Copenhagen STEM Council, 2019, Invited

"Investigating Radius Increases in Hot Exoplanets," Caltech Summer Seminar, 2019, contributed

"A Possible Unambiguous Separation of Gamma-Ray Bursts from Prompt Emission Alone," NBI Astronomy Cake Talk, Cosmic Dawn Center, DARK, and AstroNu Groups, 2019, Invited

MEDIA APPEARANCES

"Connaissez-vous l'airglow, la lueur de l'atmosphère?" Québec Science Magazine, print and online article.

"Solved astronomy mystery after just one year at university," University of Copenhagen University Post, print and online article.

"Tre danske studerende har løst astronomisk mysterium - folk ringer fra hele verden (*Three Danish students have solved an astronomical mystery – people are calling from all over the world*)," TV2, Go'morgen Danmark (*Good Morning Denmark*), national cable.

COLLABORATION MEMBERSHIPS

Simons Collaboration for Learning the Universe (LtU)
Prime Focus Spectrograph (PFS)
Legacy Survey of Space and Time Dark Energy Science Collaboration (LSST-DESC)
COSMOS Survey
James Webb Space Telescope – The Beasts in The Bubbles
James Webb Space Telescope - PANORAMIC survey

TEACHING

Lecturer, Machine Leaning for the Physical Sciences, Princeton University Wintersession, 2025
Lecturer, Quebec Centre for Research in Astrophysics (CRAQ) Summer School, Montréal, 2024
Assistant Instructor, "The Universe", AST204 (Undergraduate level), Princeton University, 2023
Assistant Instructor, "Modern Statistics", SML505 (Graduate level), Princeton University, 2025

ADVISING

Veena Krishnaraj (Undergraduate Student, Princeton University)	Jun. 2024 –
Adi Varshney (Graduate Student, Cambridge University)	Oct. 2023 – Jun. 2024
Suvan Shah (Graduate Student, Cambridge University)	Oct. 2023 – Jun. 2024
Chen-Yu Chuang (Graduate Student, ASIAA/U of Arizona)	May 2022 – Jun 2024
W. J. Mann (Undergraduate, U of Massachusetts, Amherst)	Sep. 2021 – Jan. 2023
A. Mullan (High School Student)	Jul. 2023 – Nov. 2023

COMMUNITY SERVICE AND OUTREACH

Community Garden Coordinator   Oct. 2023 –
Lakeside Graduate Apartments Committee

Outreach Speaker   Aug. 2023 –
Astronomy on Tap Trenton

Invited Reviewer   Dec 2022 –
ApJ, ApJS, AJ, MNRAS, OJA, A&A, ICML

Graduate Student Peer Mentor   Sep. 2022 –
Princeton University, Department of Astrophysical Sciences

Organizer/Observer   Sep. 2022 –
Princeton University Public Observing Nights

Graduate Student Committee   Sep. 2021 –
Princeton University, Department of Astrophysical Sciences

Head Organizer   May 2019 – Jul. 2021
Physics* – Inspirational Talks, University of Copenhagen

Co-Founder and Co-Organizer   Sep. 2018 – Jul. 2021
Project Eøler Coding Club, University of Copenhagen

Lecturer and Curriculum Co-Author   Jun. 2018 – Aug. 2019
Danish Youth Association of Science

CONFERENCES/WORKSHOPS ORGANIZED

Learning the Universe Collaboration meeting
Member of the Local Organizing Committee, Princeton University   Mar. 2025

Simulation-Based Inference for Galaxy Formation
Member of the Scientific Organizing Committee, Bristol University   Apr. 2024

HONOURS AND AWARDS

Best Poster (1st/58)   2025
Annual Danish Astronomy Meeting

Laura Bassi Scholarship   2025
Laura Bassi Foundation

PLANCKS National Qualification (2nd/19 Competing Teams)   2023
Team Qualified for PLANCKS Milano 2023 Final

PLANCKS National Qualification (2nd/27 Competing Teams)   2020
Team Qualified for PLANCKS London 2020 Final

National Team   2018
Danish Physics Olympiad

National Team   2018
Danish Chemistry Olympiad

Youngest Finalist   2017
Danish Physics Olympiad

CODING LANGUAGES & SOFTWARE	SPOKEN/WRITTEN LANGUAGES
Python – Expert	Danish – Native
Linux – Advanced	English – Bilingual Proficiency
Julia – Advanced	Portuguese – Bilingual Proficiency
Git – Intermediate	Spanish – Advanced (Oral)/Advanced (Written)
IDL – Intermediate	French – Advanced (O)/Advanced (W)
HTML – Intermediate	Swedish – Advanced (O)/Intermediate (W)
	Norwegian – Advanced (O)/Intermediate(W)
	German – Intermediate (O)/ Intermediate(W)