

# CURRICULUM VITAE

**Hy Trac**

Associate Professor

Carnegie Mellon University

Department of Physics | McWilliams Center for Cosmology and Astrophysics

## PROFILE

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## APPOINTMENTS

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- 07/2016 - **Associate Professor**  
McWilliams Center for Cosmology, Dept. of Physics, Carnegie Mellon University
- 07/2010 - 06/2016 **Assistant Professor**  
McWilliams Center for Cosmology, Dept. of Physics, Carnegie Mellon University
- 08/2007 - 06/2010 **ITC Postdoctoral Fellow**  
Institute for Theory and Computation, Harvard-Smithsonian Center for Astrophysics  
Advisor Abraham Loeb
- 10/2004 - 07/2007 **Postdoctoral Research Associate**  
Department of Astrophysical Sciences, Princeton University  
Advisors David Spergel, Uros Seljak

## EDUCATION

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- 09/2000 - 09/2004 **PhD in Astronomy and Astrophysics**  
Department of Astronomy and Astrophysics, University of Toronto  
Out-of-core Hydrodynamic Simulations of Cosmological Structure Formation  
Advisor Ue-Li Pen
- 09/1999 - 08/2000 **MSc in Astronomy and Astrophysics**  
Department of Astronomy and Astrophysics, University of Toronto  
Stochastic Bias and Redshift Distortions in the PSCz Survey  
Advisor Ue-Li Pen
- 09/1995 - 05/1999 **BSc in Honours Physics and Astronomy**  
Department of Physics and Astronomy, University of Toronto  
Discriminating between Models of Structure Formation using Topological Statistics  
Advisors Paul Hickson, Robert Brandenberger

## SELECT PUBLICATIONS

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A. Hsu, M. Ho, J. Lin, C. Markey, M. Ntampaka, **H. Trac**, & B. Poczós, Reconstructing Galaxy Cluster Mass Maps using Score-based Generative Modeling, 2024, [arXiv:2410.02857](#)

D. Mukherjee, A.M. Holgado, O. Go, & **H. Trac**, Examining the Effects of Dark Matter Spikes on Eccentric Intermediate Mass Ratio Inspirals Using N-body Simulations, 2024, [MNRAS](#), **20**, 2335

N. MacCrann & the ACT Collaboration, The Atacama Cosmology Telescope: Reionization kSZ Trispectrum Methodology and Limits, 2024, [MNRAS](#), **532**, 4247

D. Mukherjee, A. Siraj, **H. Trac**, & A. Loeb, Close Encounters of the Interstellar Kind: Exploring the Capture of Interstellar Objects in Near-Earth Orbit, 2023, [MNRAS](#), **525**, 908

N. Chen, **H. Trac**, S. Mukherjee, & R. Cen, Patchy Kinetic Sunyaev-Zel'dovich Effect with Controlled Reionization History and Morphology, 2023, [ApJ](#), **943**, 138

M. Ho, M. Ntampaka, M.M. Rau, M. Chen, A. Lansbury, F. Ruehle, & **H. Trac**, The Dynamical Mass of the Coma Cluster from Deep Learning, 2022, [Nature Astronomy](#), **6**, 936

**H. Trac**, N. Chen, I. Holst, M.A. Alvarez, & R. Cen, AMBER: A Semi-Numerical Abundance Matching Box for the Epoch of Reionization, 2022, [ApJ](#), **927**, 186

Y. He, P. Mansfield, M.M. Rau, **H. Trac**, & N. Battaglia, Debaised Galaxy Cluster Pressure Profiles from X-ray Observations and Simulations, 2021, [ApJ](#), **908**, 91

M. Ntampaka, **H. Trac**, D.J. Sutherland, S. Fromenteau, B. Poczós, & J. Schneider, Dynamical Mass Measurements of Contaminated Galaxy Clusters using Machine Learning, 2016, [ApJ](#), **831**, 135

**H. Trac**, R. Cen, & P. Mansfield, SCORCH I: The Galaxy-Halo Connection in the First Billion Years, 2015, [ApJ](#), **813**, 54

## SELECT PRESENTATIONS

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10/2024 **Learning to See the Dark Matter in Galaxy Clusters**  
Cosmology Seminar, University of Michigan

09/2024 **Learning to See the Dark Matter in Galaxy Clusters**  
Physics Colloquium, McGill University

06/2024 **Galaxy Cluster Mass Reconstruction with HYPER Sims and Diffusion Models**  
Cosmology Seminar, Institute for Astrophysics Paris

06/2022 **AMBER and HYPER Simulations of the SZ Effect Across Cosmic Time**  
SZ Workshop, Center for Computational Astrophysics

03/2022 **A Semi-Numerical Abundance Matching Box for the Epoch of Reionization**  
Reionization and Cosmic Dawn Workshop, Berkeley Center for Cosmological Physics

- 11/2020 **Inferring Dark Matter in Galaxy Clusters with Bayesian Deep Learning**  
Astronomy Colloquium, UC Riverside
- 10/2018 **The Reionization of Hydrogen: A Tale of Two Optical Depths**  
Cosmology Seminar, Canadian Institute for Theoretical Astrophysics
- 09/2018 **Simulations and Constructions of the Reionization of Cosmic Hydrogen**  
IGM Workshop, Kavli Institute for the Physics and Mathematics of the Universe
- 09/2018 **Cluster Cosmology with Forward Modeling and Machine Learning**  
Astronomy Colloquium, Penn State University
- 01/2018 **Hydro Sims: Today and Tomorrow**  
Modeling the Extragalactic Sky Workshop, Berkeley Center for Cosmological Physics

## SELECT ACTIVITIES

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- 08/2024 - **Astro PhD**, committee member
- 12/2023 - 06/2024 **Reionisation in Relic Radiation Workshop**, scientific organizing committee
- 03/2023 - **NSF REU in Physics and AI**, program coordinator
- 06/2022 - 09/2022 **Reionization on a Blackboard Workshop**, scientific organizing committee
- 01/2022 - 05/2024 **Astro Seminars**, committee head
- 09/2020 - 08/2023 **NSF AI Physics SURP**, program coordinator
- 09/2020 - **CMB-S4**, collaboration member
- 09/2018 - 08/2021 **Physics Graduate Admissions**, committee head
- 04/2018 - 04/2020 **CMU Faculty Senate**, physics representative
- 07/2016 - 05/2018 **Physics Colloquium**, committee head
- 06/2016 - **Simons Observatory**, collaboration member
- 01/2012 - 04/2015 **Physics Graduate Admissions**, committee member
- 01/2010 - 06/2010 **Great Lakes Cosmology Workshop**, scientific organizing committee
- 10/2004 - **Atacama Cosmology Telescope**, collaboration member

## TEACHING

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- 08/2022 - **Introduction to Computational Physics**  
3 semesters, FCE: teaching 4.42, course 4.33
- 01/2022 - 05/2024 **Upperclass Colloquium**  
4 semesters, FCE: teaching 4.31, course 4.16
- 08/2017 - 12/2020 **Introduction to Computational Physics**  
4 semesters, FCE: teaching 4.21, course 4.14
- 01/2014 - **Extragalactic Astrophysics and Cosmology**  
11 semesters, FCE: teaching 4.61, course 4.62

01/2013 - 05/2015 **Physics for Engineering Students I**  
3 semesters, FCE teaching 3.77, course 3.95

08/2011 - 12/2012 **Introductory Astrophysics**  
3 semesters, FCE: teaching 4.50, course 4.25

## UNDERGRADUATE STUDENTS

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08/2024 - **Iris Reed**, applying for graduate studies  
08/2024 - 12/2024 **Leo Hsu**, searching for industry job  
05/2024 - **Zhennan Li**, applying for graduate studies  
05/2024 - 10/2024 **Xinyi Zhao**, junior at Shanghai Jiao Tong University  
01/2024 - 12/2024 **Jacques Moye**, applying for graduate studies  
08/2023 - 05/2024 **Jayanth Tumuluri**, applying for graduate studies  
06/2023 - 12/2023 **Eileen Xiao**, graduate studies at CMU  
05/2022 - 05/2023 **Joyce Lin**, NSF graduate fellowship at UWM  
08/2021 - 05/2023 **Alan Hsu**, graduate studies at Harvard  
01/2020 - 05/2020 **Emeline Fromont**, graduate studies at JHU  
01/2020 - 05/2020 **Faith Ruehle**, industry  
03/2019 - 12/2019 **Nihar Dalal**, graduate studies at OSU  
04/2018 - 05/2019 **Daniel Glazer**, graduate studies at Chicago  
06/2016 - 05/2019 **Ian Holst**, graduate studies at Chicago  
09/2017 - 12/2018 **Desmond Reed**, software engineer  
10/2015 - 05/2018 **Minghan Chen**, graduate studies at UCSB  
10/2011 - 05/2014 **Phil Mansfield**, Cutkosky award, McCormick graduate fellowship at Chicago  
04/2011 - 05/2012 **Matt Dailey**, software engineer at Amazon  
01/2011 - 05/2012 **Yelena Goryunova**, graduate studies at Dartmouth

## GRADUATE STUDENTS

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01/2022 - 12/2022 **Carleen Markey**, ARCS graduate fellowship, hockey analyst with NJ Devils  
09/2019 - **Dipto Mukherjee**, upcoming GPU-ML engineer at Apple  
09/2018 - 05/2024 **Nianyi Chen**, Peoples graduate fellowship, McWilliams graduate fellowship, postdoctoral fellowship at IAS  
09/2017 - 08/2022 **Matt Ho**, Peoples graduate fellowship, Simons postdoctoral fellow at IAP & Columbia  
01/2017 - 08/2021 **Yizhou He**, data scientist in China

02/2017 - 12/2020 **Aristide Doussot**, postdoctoral fellow at IAP, research engineer in Paris

09/2012 - 10/2017 **Michelle Ntampaka**, M. Hildred Blewett graduate fellowship, McWilliams graduate fellowship, Data Science postdoctoral fellowship at Harvard, Associate Research Scientist at STScI

01/2012 - 09/2016 **Paul La Plante**, HERA postdoctoral fellow at UPenn, BCCP postdoctoral fellowship at UC Berkeley, Assistant Professor-in-Residence at UNLV

## POSTDOCTORAL FELLOWS

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09/2018 - 10/2019 **Arya Farahi**, McWilliams postdoctoral fellowship, faculty at UT Austin

09/2018 - 10/2021 **Qirong Zhu**, McWilliams postdoctoral fellowship, software engineer at Ansys

11/2017 - 08/2021 **Markus Rau**, DOE/NSF-funded postdoctoral fellow, postdoctoral fellow at Argonne, lecturer at New Castle University

09/2015 - 04/2016 **Layne Price**, DOE-funded postdoctoral fellow, data scientist at Amazon

09/2014 - 07/2018 **Anson D'Aloisio**, NSF-funded postdoctoral fellow at UW, faculty at UC Riverside

09/2010 - 08/2014 **Aravind Natarajan**, McWilliams postdoctoral fellowship, data scientist at Google

09/2011 - 08/2014 **Nick Battaglia**, McWilliams postdoctoral fellowship, Lyman Spitzer Jr postdoctoral fellowship at Princeton, faculty at Cornell