Ethan Nadler | Curriculum Vitae

Carnegie Observatories & University of Southern California

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Research

Dark Matter
– Linking dark matter particle properties to small-scale structure throughout cosmic history;
– Modeling dark matter–baryon interactions, self-interactions, and production mechanisms.

Computational Astrophysics
– Emulating the impact of baryons on small scales using cosmological simulations;
– Empirically modeling the connection between faint galaxies and dark matter halos.

Near-field Cosmology
– Unifying dark matter constraints from dwarf galaxies and strong gravitational lensing;
– Developing constrained N-body simulations of Milky Way and strong lens analogs.

Positions

Carnegie Observatories & University of Southern California *2021–*
Postdoctoral Research Fellow

Education

Stanford University *2021*
Ph.D., Physics
Thesis: Faint Galaxies and Small Halos: Probes of Galaxy Formation and Dark Matter

University of California, Santa Barbara *2016*
B.S., Physics
Thesis: Universality in the Structure and Abundance of Dark Matter Halos

Scientific Collaborations

Satellites Around Galactic Analogs Survey: Member	*2019–*
DECam Local Volume Exploration (DELVE) Survey: Member	*2019–*
Rubin LSST Dark Energy Science Collaboration: Member, Dark Matter Working Group	*2018–*
Dark Energy Survey: Member, Milky Way Working Group	*2018–*

Fellowships & Awards

XSEDE Allocation: Simulations of Milky Way Halos with Large Magellanic Cloud Analogs	*2020–*
NSF Graduate Research Fellow: National Science Foundation	*2018–21*
Faculty Committee Commendation of Excellence: UCSB College of Creative Studies	*2016*
Outstanding Senior Award: UCSB Department of Physics	*2016*
Highest Academic Honors: UCSB Department of Physics	*2016*

Mentoring

Graduate Students   *2021–*
- ○ Trey Driskell, USC: Generating constrained dark matter merger trees;
- ○ Noah Glennon, University of New Hampshire: Soliton orbital evolution with axion self-interactions;
- ○ Elise Darragh-Ford, Stanford: Integrating *Gaia* data in dwarf galaxy searches;
- ○ Yunchong Wang, Stanford: Modeling dwarf galaxy star formation histories;
- ○ Sidney Mau, Stanford: Dwarf galaxy constraints on decaying dark matter;

Undergraduate & Post-baccalaureate Students   *2018–*
- ○ Nyal McCrea, Central Washington '22 & NSBP: Visualizing subhalos in cosmological simulations;
- ○ Resherle Verna, USC '20: Self-interacting dark matter in hydrodynamic simulations;
- ○ Deveshi Buch, Stanford '23: Cosmological simulations of Milky Way-like halos;
- ○ Veronica Pratt, Stanford '23: Statistics of Large Magellanic Cloud analogs in SAGA data;
- ○ Nicel Mohamed-Hinds, Stanford '19 → UW: Emulating hydrodynamic zoom-in simulations;
- ○ Abigail Lee, UPenn '19 → UChicago: Subhalo disruption in galaxy clusters.

Teaching

Teaching Assistant (Stanford)   *2017–21*
- ○ *Structure Formation & Galaxy Formation, Modern Astrophysics, Cosmology & Extragalctic Astrophysics, Origin & Development of the Cosmos,* and *Electricity & Magnetism.*

Course Assistant (UCSB)   *2015–16*
- ○ *Relativistic Quantum Mechanics, Kinetic Theory & Relativity, Mechanics & Waves,* and *Newtonian Mechanics.*

Tutor (UCSB Campus Learning Assistance Services)   *2015-16*
- ○ Held biweekly supplementary lectures for *Basic Physics, Linear Algebra,* and *Differential Equations.*

Service & Outreach

USC Physics Climate Committee (Member)	*2021–*
San Mateo County Astronomical Society (Speaker) [video]	*2021*
Journal Referee (*ApJ, Astropart. Phys., JCAP, MNRAS*)	*2019–*
Astronomy on Tap San Francisco (Speaker and Volunteer)	*2018–20*
Stanford Future Advancers of Science and Technology (Physics Mentor)	*2017–19*

Media

Fermilab Press Release, *DES census of the smallest galaxies hones the search for dark matter*	2020
SLAC Press Release, *Milky Way satellites reveal link between dark matter and galaxy formation*	2020
AAS Nova Research Highlight, *Constraining collisions of dark matter*	2019
SLAC Press Release, *Satellite galaxies provide new clues about dark matter*	2019
KIPAC Research Highlight, *Dark matter subhalo disruption: insights from machine learning*	2018

Presentations

Dark Matter Constraints from a Unified Analysis of Strong Lenses and Satellite Galaxies   *2021*
LSS DESC Dark Matter Working Group*
Virginia Tech Center for Neutrino Physics, Journal Club*

The Faintest Galaxies and their Dark Matter Halos   *2020–21*
Caltech, TAPIR Seminar*

Minnesota Institute for Astrophysics, Cosmology Lunch Seminar*
Harvard-Smithsonian Center for Astrophysics, GCSP Seminar [video]
International Centre for Theoretical Sciences, Less Travelled Path of Dark Matter* [video, slides]
UC Santa Cruz, FLASH Seminar*
UC Berkeley Center for Cosmological Physics, Cosmology Seminar* [slides]
STScI, The Local Group: Assembly and Evolution
KITP, The Galaxy–Halo Connection Across Cosmic Time: Recent Updates [video]
LIneA, Webinar* [video, slides]
KIPAC, Astrophysics Colloquium* [video]
Fermilab, New Perspectives [slides]
USC, CosmoLab Seminar*
BSM Pandemic Seminar* [video, slides]
Fermilab, Wine & Cheese*

Milky Way Satellites: Probes of Dark Matter Microphysics *2019*
University of Chicago, Cosmic Controversies [slides]
KICP, LSST Dark Matter Workshop* [slides]
Institute for Advanced Study, Astro Coffee*
Johns Hopkins, High Energy Physics/Cosmology Seminar*
UC Berkeley, LSST DESC Winter Collaboration Meeting

Modeling Subhalos and Satellites in Milky Way-like Systems *2018*
KICP, Near-Field Cosmology with DES DR1* [slides]
KITP, The Small-Scale Structure of Cold(?) Dark Matter [video, slides]
UC Berkeley Center for Cosmological Physics, Cosmology Seminar* [slides]

Predicting Realistic Subhalo Populations *2017*
KITP, The Galaxy–Halo Connection Across Cosmic Time

*invited presentation

First & Co-Authored Publications

E. O. Nadler, S. Birrer, D. Gilman, R. H. Wechsler, X. Du, A. Benson, A. Nierenberg, and T. Treu. *Dark Matter Constraints from a Unified Analysis of Strong Gravitational Lenses and Milky Way Satellite Galaxies.* 2101.07810 (ApJ in press).

S. Das & **E. O. Nadler**. *Constraints on the epoch of dark matter formation from Milky Way satellites.* 2021, PRD 103, 043517.

E. O. Nadler & A. Drlica-Wagner et al. (DES Collaboration). *Constraints on Dark Matter Properties from Observations of Milky Way Satellite Galaxies.* 2021, PRL 126, 091101.

E. O. Nadler, A. Banerjee, S. Adhikari, Y.-Y. Mao, and R. H. Wechsler. *Signatures of Velocity-dependent Dark Matter Self-interactions in Milky Way-mass Halos.* 2020, ApJ, 896, 112.

E. O. Nadler & R. H. Wechsler et al. (DES Collaboration). *Milky Way Satellite Census. II. Galaxy-Halo Connection Constraints Including the Impact of the Large Magellanic Cloud.* 2020, ApJ, 893, 48.

E. O. Nadler, V. Gluscevic, K. K. Boddy, and R. H. Wechsler. *Constraints on Dark Matter Microphysics from the Milky Way Satellite Population.* 2019, ApJL, 878, 32.

E. O. Nadler, Y.-Y. Mao, G. M. Green, and R. H. Wechsler. *Modeling the Connection between Subhalos and Satellites in Milky Way-like Systems.* 2019, ApJ, 873, 34.

E. O. Nadler, Y.-Y. Mao, R. H. Wechsler, S. Garrison-Kimmel, and A. Wetzel. *Modeling the Impact of Baryons on Subhalo Populations with Machine Learning.* 2018, ApJ, 859, 129.

E. O. Nadler, A. Perko, and L. Senatore. *On the bispectra of very massive tracers in the Effective Field Theory of Large-Scale Structure.* 2018, JCAP, 1, 058.

E. O. Nadler, S. P. Oh, and S. Ji. *On the apparent power law in CDM halo pseudo-phase space density profiles.* 2017, MNRAS, 470, 500.

Nth-Author Publications

S. Bhattacharyya, S. Adhikari, A. Banerjee, S. More, A. Kumar, **E. O. Nadler**, and S. Chatterjee. *The Signatures of Self-Interacting Dark Matter and Subhalo Disruption on Cluster Substructure.* 2106.08292 (submitted to ApJ).

A. Drlica-Wagner, J. Carlin, D. L. Nidever *et al.* (DELVE Collaboration). *The DECam Local Volume Exploration Survey: Overview and First Data Release.* 2103.07476 (submitted to ApJ).

Y. Wang, **E. O. Nadler** *et al.* UNIVERSEMACHINE: *Predicting Galaxy Star Formation over Seven Decades of Halo Mass with Zoom-in Simulations.* ApJ 915, 116.
- Major contributions: Interpretation of dwarf galaxy star formation history predictions, simulation analysis.

E. Darragh-Ford, **E. O. Nadler** *et al.* *Searching for Dwarfs in Gaia DR2 Phase-space Data using Wavelet Transforms.* 2021, ApJ 915, 48.
- Major contributions: Pilot study, search algorithm development, predictions for number of detected dwarfs.

K. Maamari, V. Gluscevic, K. K. Boddy, **E. O. Nadler**, and R. H. Wechsler. *Bounds on velocity-dependent dark matter–proton scattering from Milky Way satellite abundance.* 2021, ApJL 907, 46.
- Major contributions: Development of numerical techniques to constrain interacting dark matter models.

Y.-Y. Mao, M. Geha, R. H. Wechsler, B. Weiner, E. J. Tollerud, **E. O. Nadler**, and N. Kallivayalil. *The SAGA Survey. II. Building a Statistical Sample of Satellite Systems around Milky Way-like Galaxies.* 2021, ApJ, 907, 85.
- Major contributions: Interpretation of SAGA observations in the context of galaxy–halo connection models.

A. Drlica-Wagner, K. Bechtol, S. Mau, M. McNanna, **E. O. Nadler** *et al.* (DES Collaboration). *Milky Way Satellite Census. I. The Observational Selection Function for Milky Way Satellites in DES Y3 and Pan-STARRS DR1.* 2020, ApJ, 893, 47.
- Major contributions: Machine-learning modeling of satellite detection sensitivity, simulation analysis.

S. Mau & W. Cerny *et al.* (DELVE Collaboration). *Two Ultra-Faint Milky Way Stellar Systems Discovered in Early Data from the DECam Local Volume Exploration Survey.* 2020, ApJ, 890, 136.

C. E. Martínez-Vázquez *et al.* (DES Collaboration). *Search for RR Lyrae stars in DES ultrafaint systems: Grus I, Kim 2, Phoenix II, and Grus II.* 2019, MNRAS 490, 2183.

K. M. Stringer *et al.* (DES Collaboration). *Identification of RR Lyrae stars in multiband, sparsely-sampled data from the Dark Energy Survey using template fitting and Random Forest classification.* 2019, AJ 158, 16.

White Papers

V. Gluscevic *et al.* *Cosmological Probes of Dark Matter Interactions: The Next Decade.* 2019, 1903.05140.

J. Simon *et al.* *Dynamical Masses for a Complete Census of Local Dwarf Galaxies.* 2019, 1903.047435.

K. Bechtol *et al.* *Dark Matter Science in the Era of LSST.* 2019, 1903.04425.

A. Drlica-Wagner & Y.-Y. Mao *et al.* *Probing the Fundamental Nature of Dark Matter with the Large Synoptic Survey Telescope.* 2019, 1902.01055.
- Major contributions: Forecasts and theoretical development for LSST dwarf galaxy dark matter constraints.

Interdisciplinary Studies

D. Guilbeault, **E. O. Nadler** *et al.* *Color associations in abstract semantic domains.* 2020, Cognition 201, 104306.

B. S. Desikan, T. Hull, **E. O. Nadler** *et al.* comp-syn: *Perceptually Grounded Word Embeddings with Color.* 2020, Proceedings of the 28th International Conference on Computational Linguistics, 1744.

Stanford Art of Science 2020, *The Graduate Students in Electrical Engineering 2nd Place Prize*: Changing Views in Data Science over Fifty Years.

Stanford CS230/Deep Learning, *Project Award*: Neural Network Implementation of UniverseMachine.