Dr. Anna Mercedes Nierenberg

Contact Information

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Appointments

NASA Postdoctoral Program Fellow Sep. 2018 - present
Jet Propulsion Laboratory

University of California Chancellor's Fellow Sep. 2017- Sep. 2018
Department of Physics and Astronomy,
University of California Irvine

CCAPP Postdoctoral Fellow Sep. 2014 to Sep. 2017
Center for Cosmology and AstroParticle Physics,
The Ohio State University

Education

Ph. D. Physics, University of California Santa Barbara Sep. 2014
Dissertation: *Testing galaxy formation and the nature of dark matter with satellite galaxies*, Advisor: Tommaso Treu

B. S. Physics, University of California Los Angeles *summa cum laude* June 2008

Observing proposals and grants

Principal-Investigator

Hubble Space Telescope GO-15177, 'Testing CDM with the WFC3 Grism', Cycle 25, 18 orbits, WFC3 IR imaging and grism, $158,568 (PI)

Hubble Space Telescope GO-13732, 'Detecting dark matter substructure with narrow-line lensing', Cycle 21, 10 orbits, WFC3 IR imaging and grism, $70,759 (PI)

Hubble Space Telescope AR-13271, 'The cosmic evolution of faint satellites as a test of galaxy formation and the nature of dark matter', archival proposal, $59,784 (Co-PI)

Palomar 200 inch Hale 'High resolution spectra for the tightest constraint on the dark matter free streaming length', 2 nights (PI)

Co-Investigator

VLT Observatory, 0102.A-0335(A) , 'Lens redshifts and the inner structure of high redshift AGN for new gravitationally lensed quads', 12 hours.

Hubble Space Telescope GO-15320, 'Probing the dark universe with quadruply imaged quasars', Cycle 25, 26 orbits, WFC3 IR, UVIS

Keck Observatory, Keck I and II telescopes, 17 nights (OSIRIS, NIRC2, NIRES, ESI)

Lick Observatory, 3 m telescope, 17 nights (Kast, IRCAL)

Fellowships and Awards

NASA Postdoctoral Program Fellowship- Three years postdoctoral funding.

UC Irvine Chancellor's Postdoctoral Fellowship - One year postdoctoral funding and lifetime UC-wide faculty hiring incentive

CCAPP Postdoctoral Fellowship - Three years postdoctoral funding

UCSB Dean's Fellowship -2012-2013 Academic year graduate student researcher salary and tuition

Worster Undergraduate Research Mentor Fellowship - Summer 2013 Undergraduate Research Salary

Physics Chair's Fellowship- Spring 2012 Graduate student researcher salary and tuition

Teaching and Service

Mauna Kea Spectroscopic Explorer Dark Matter Science Working Group

Deflector Redshift Task Force Team Leader
Organize spectroscopic measurements of lens deflectors between international strong lensing teams using telescopes in the northern and southern hemispheres.

LSST Strong Lensing Working Group, LSST Dark Matter Group

TMT IRIS Science Team

Keck LIGER Science Team

HST TAC

NASA Keck TAC

CCAPP seminar co-organizer, OSU, Spring 2016.

CCAPP summer seminar co-organizer, OSU, Summer 2015.

Physics graduate student life committee, UCSB, 2008-2009

Referee MNRAS, Nature Astronomy, ApJ

Physics 4L Electromagnetism lab teaching assistant, UCSB Winter 2009

Physics 3L, Mechanics lab, teaching assistant, UCSB Fall 2008

Outreach

Calbridge Python Workshop
Co-running an introductory python workshop for California State Bridge program participants, UCI, January and March 2018.

Live Eclipse Broadcast from Columbus Center of Science and Industry
Science host on four hour Facebook Live broadcast from COSI on the day of the

August 21, 2017 solar eclipse, broadcast to Columbus libraries and public spaces and publicly available on Facebook. Explained basic eclipse phenomena, and answered live questions from the community.

Eclipse outreach on Columbus News Stations
Guest on Columbus Channel 10 News broadcast answering August 21 2017 eclipse questions from Facebook Live. Guest on Columbus NBC4 morning news discussing eclipse science.

Space in Your Face YouTube Channel
Co-host, Youtube outreach channel with astronomy news, 20 episodes

Columbus Fair Physics Volunteer
August 2016

Columbus Science Pub Speaker
Public lecture on dark matter, June 2016

Science day at Innis Elementary
Created and presented an educational slideshow about astronauts for K-2 students, Winter 2015

Adopt-A-Physicist
Communicate with several high school classes about being a physicist over the course of several weeks, Fall 2015, Fall 2009- 2013, Spring 2011

Astronomy on Tap
Speaker and co-organizer, Spring 2015.

JW Science Extravaganza
Elementary School crater exhibit presenter, April 2015.

La Colina Middle School Career Day
Discuss science career with middle school students October 2011, 2012

Student Advising

Daniel Gilman
Graduate student in Physics, University of California, Los Angeles. Worked with Daniel to design, test and apply the software pipeline for the statistical inference of the properties of dark matter using flux ratios. Supervised with Professor Tommaso Treu 2014 to present.

Alexandra Davis
Graduate student in Physics, The Ohio State University. Detecting new dwarf galaxies in the local volume. Supervised with Professor Annika Peter. 2016 to present.

Daniella Roberts
Bridge graduate student in Physics, The Ohio State University. Measuring the luminosity function of satellites around sub-Milky Way mass host galaxies. Supervised with Professor Annika Peter. 2016 to present.

Kaitlin McTague
Undergraduate in Astronomy and Astrophysics, The Ohio State University. Searching for new ultra-faint satellite galaxies in the local volume. Supervised with Professor Annika Peter.

Dylan Oldenburg
Undergraduate in Physics, UCSB. Measured the luminosity function of satellites around gravitational lenses. June 2012-November 2013.

Invited Talks

ISSI Workshop on Strong Gravitational Lensing *rescheduled to Spring 2021*
UCLA Dark Matter 2020, *March 2020, cancelled*
Caltech, California, Cosmology Seminar, October 2019
UCLA, California, Astronomy Colloquium, April 2019
UC Merced, California, Physics Colloquium, March 2019
UC Riverside, California, Astrophysics Seminar, March 2019
Sexten, Italy 'Cosmic Beacons', February 2019
Napa, California 'Near-far Connection', December 2018
Texas A&M, Astrophysics Seminar, October 2018
Caltech, California, IPAC seminar, September 2018
Milan Italy, 'The Universe as a telescope: probing the cosmos at all scales with strong lensing', September 2018
Vulcano Italy, 'Frontier Objects in Astrophysics and Particle Physics', May 2018
Kavli Institute for Particle Astrophysics and Cosmology, Cosmology seminar, May 2018
UCI, Astrophysics Seminar, April 2018
UCLA, 'Shedding Light on the Dark Universe with Extremely Large Telescopes', April 2018
University of Kentucky, Physics Colloquium, February 2018
University of California Davis, Astrophysics Seminar, February 2018
University of California San Diego Center for Astrophysics and Space Science, seminar, October 2017
University of Minnesota, Astrophysics Colloquium, October 2017
Cogne Italy, 'Strong gravitational lensing by galaxies and clusters', June 2017
CfA, ITC Galaxies and Cosmology Seminar, January 2017
Kavli IPMU, 'The Astrophysics of Dark Matter' conference, October 2016
Leiden University, April 2016, Galaxy lunch talk
University of Texas at Dallas, 'Symposium on relativistic astrophysics', December 2013
The Ohio State University, CCAPP Seminar, October 2013
INPAC, panel member 'LCDM and astronomical probes of dark matter physics', April 2013.
Pepperdine University, Science Seminar, October 2012

Contributed Conference Talks

Durham, UK 'Small Galaxies, Cosmic Questions', August 2019.
UCLA, 'UCLA Dark Matter 2018', February 2018.
Cogne Italy, 'Strong gravitational lensing by galaxies and clusters' workshop, June 2017.

Leiden University, 'Astrophysics of Dark Matter' workshop, April 2016.
Kavli IPMU, 'Galaxies and cosmology in light of strong lensing' conference, October 2014.
223 AAS meeting, January 2015
Courmayeur Italy, 'Galaxy formation under the magnifying glass of gravitational lensing' workshop, June 2013.
University of California, San Diego, 'Keck Science Meeting', September 2012.
University of Bologna, 'Dark Matter from Globular Clusters to Clusters of Galaxies', September 2012.
Courmayeur, Italy, 'Strong lensing from stars to dark matter halos', workshop, June 2012.

Professional References

Tommaso Treu Professor, UCLA Department of Astronomy, tt@astro.ucla.edu

Annika Peter, Associate Professor, OSU Department of Physics and Department of Astronomy, peter.33@osu.edu

David Weinberg Professor and Chair OSU Department of Astronomy, weinberg.21@osu.edu

James Bullock Professor and Dean of School of Physical Sciences, UCI, bullock@uci.edu

Leonidas Moustakas Section Leader of Astrophysics and Space Sciences,
JPL, leonidas@jpl.nasa.gov

Publications

30. Sijie Yu; James S. Bullock; Andrew Wetzel, Robyn E. Sanderson; Andrew S. Graus; Michael Boylan-Kolchin; **Anna M. Nierenberg**; Michael Y. Gurdić; Philip F. Hopkins; Dušan Kereš, Claude-André Faucher-Giguère. 'Stars made in outflows may populate the stellar halo of the Milky Way'. MNRAS 494, 1539. (2020).

29. **Nierenberg, A. M.**; Gilman, D.; Treu, T.; Brammer, G.; Birrer, S.; Moustakas, L.; Agnello, A.; Anguita, T.; Fassnacht, C. D.; Motta, V.; Peter, A. H. G.; Sluse, D. 'Double dark matter vision: twice the number of compact-source lenses with narrow-line lensing and the WFC3 Grism', MNRAS 492, 5314 (2020).

28. Davis, A. Bianca; **Nierenberg, Anna M.**; Peter, Annika H. G.; Garling, Christopher T.; Greco, Johnny P.; Kochanek, Christopher S.; Utomo, Dyas; Casey, Kirsten; Pogge, Richard W.; Roberts, Daniella; Sand, David J.; Sardone, Amy 'The LBT Satellites of Nearby Galaxies Survey (LBT-SONG): The Satellite Population of NGC 628'. ArXiv:2003.08352 (2020).

25. Gilman, Daniel; Du, Xiaolong; Benson, Andrew; Birrer, Simon; **Nierenberg, Anna**; Treu, Tommaso. 'Constraints on the mass-concentration relation of cold dark matter halos with 11 strong gravitational lenses'. MNRAS 492, 12 (2020).

27. Gilman, Daniel; Birrer, Simon; **Nierenberg, Anna**; Treu, Tommaso; Du, Xialong;

Benson, Andrew. 'Warm dark matter chills out: constraints on the halo mass function and the free-streaming length of dark matter with 8 quadruple-image strong gravitational lenses'. MNRAS 491, 6077, (2020).

26. Krone-Martins, A.; et al. **inc AMN**, 'Gaia GraL: Gaia DR2 Gravitational Lens Systems. V. Doubly-imaged QSOs discovered from entropy and wavelets', arXiv:1912.08977 (2019).

24. Gilman, Daniel; Birrer, Simon; Treu, Tommaso; **Nierenberg, Anna**; Benson, Andrew 'Probing dark matter structure down to 10^7 solar masses: flux ratio statistics in gravitational lenses with line of sight halos', MNRAS, 487, 5721 (2019).

23. Andrade, Kevin E.; Minor, Quinn; **Nierenberg, Anna**; Kaplinghat, Manoj 'Detecting Dark Matter Cores in Galaxy Clusters with Strong Lensing', MNRAS, 487, 1905 (2019).

22. Moustakas, Leonidas; et al. **inc. AMN**, 'Quasar microlensing: Revolutionizing our understanding of quasar structure and dynamics', Astro2020: Decadal Survey, 3, 487 (2019).

21. Rhodes, Jason; **Nierenberg, Anna**; Masters, Daniel; et al. 'The end of galaxy surveys'. Astro2020: Decadal Survey 3, 114 (2019).

20. Li, Ting S.; et al. **inc. Nierenberg, Anna** 'Astrophysical Tests of Dark Matter with Maunakea Spectroscopic Explorer', arXiv:1903.03155 (2019). (**AMN co-author of Chapter 6.1**)

19. Keel, William C.; Bennert, Vardha N.; Pancoast, Anna; Harris, Chelsea E.; **Nierenberg, Anna**; Chojnowski, S. Drew; Moiseev, Alexei V.; Oparin, Dmitry V.; Lintott, Chris J.; Schawinski, Kevin; Mitchell, Graham; Cornen, Claude, 'AGN photoionization of gas in companion galaxies as a probe of AGN radiation in time and direction', MNRAS, 483, 4847 (2019).

18. Gilman, Daniel; Birrer, Simon; Treu, Tommaso; Keeton, Charles R.; **Nierenberg, Anna M.** 'Probing the nature of dark matter by forward modeling flux ratios in strong gravitational lenses', MNRAS, 481, 819 (2018).

17. Graus, Andrew S.; Bullock, James S.; Boylan-Kolchin, Michael; **Nierenberg, Anna M.** 'Through a Smoother Lens: An expected absence of LCDM substructure detections from hydrodynamic and dark matter only simulations', MNRAS 480, 1322 (2018).

16. Pancoast, A. et al. **inc. AMN**, 'Stability of the Broad-line Region Geometry and Dynamics in Arp 151 Over Seven Years', ApJ 856, 108 (2018).

15. **Nierenberg, A. M.** ; Treu, T.; Brammer, G.; Peter, A. H. G.; Fassnacht, C. D.; Keeton, C. R.; Kochanek, C. S.; Schmidt, K. B.; Sluse, D. ; Wright, S. A., 'Probing dark matter substructure in the gravitational lens HE0435-1223 with the WFC3 grism',

MNRAS 471, 2224 (2017).

14. Gilman, Daniel; Agnello, Adriano; Treu, Tommaso; Keeton, Charles R.; **Nierenberg, Anna M.**, 'Strong lensing signatures of luminous structure and substructure in early-type galaxies', MNRAS 467, 3970 (2017)

13. Ding, Xuheng; Liao, Kai; Treu, Tommaso; Suyu, Sherry H.; Chen, Geoff C.-F.; Auger, Matthew W.; Marshall, Philip J.; Agnello, Adriano; Courbin, Frederic; **Nierenberg, Anna M.** ; Rusu, Cristian E.; Sluse, Dominique; Sonnenfeld, Alessandro; Wong, Kenneth C., 'H0LiCOW. VI. Testing the fidelity of lensed quasar host galaxy reconstruction', MNRAS 465, 4634 (2017)

12. **Nierenberg, A. M.** ; Treu, T.; Menci, N.; Lu, Y.; Torrey, Paul; Vogelsberger, M., 'The Missing Satellite Problem in 3D', MNRAS 462, 4473 (2016).

11. Barth, Aaron J. et al., **including AMN**, 'The Lick AGN Monitoring Project 2011: Spectroscopic Campaign and Emission-line Light Curves' ApJS 217, 26 (2015)

10. **Nierenberg, A. M.**; Treu, T.; Wright, S. A.; Fassnacht, C. D.; Auger, M. W., 'Detection of substructure with integral field spectroscopy of the gravitational lens B1422+231', MNRAS 422, 2434 (2014).

9. **Nierenberg, A. M.**; Oldenburg, Dylan; Treu, T., 'Do lens galaxies have an excess of luminous substructure?', MNRAS 436, 2120 (2013)

8. **Nierenberg, A. M.**; Treu, T.; Menci, N.; Wang, W., 'The Cosmic Evolution of Faint Satellite Galaxies as a Test of Galaxy Formation and the Nature of Dark Matter', ApJ 772, 146 (2013)

7. Barth, Aaron et al. **including AMN**, 'The The Lick AGN Monitoring Project 2011: Fe II Reverberation from the Outer Broad-line Region', ApJ 769, 128 (2013)

6. Pancoast, Anna et al. **including AMN**, 'The Lick AGN Monitoring Project: Dynamical Modeling of the Broad Line Region in Mrk 50', ApJ 754, 49 (2012)

5. **Nierenberg, A. M.**; Auger M. W.; Treu, T.; Marshall, P.J.; Fassnacht, C. D.; Busha, Michael T., 'Luminous Satellites of Early-Type Galaxies II: Spatial Distribution, Luminosity Function and Cosmic Evolution', ApJ 752, 99 (2012)

4. Keel, William C. et al. **including AMN**, 'The Galaxy Zoo survey for giant AGN-ionized clouds: past and present black hole accretion events', MNRAS 420, 878 (2012)

3. Barth, Aaron J. et al., **including AMN**, 'The Lick AGN Monitoring Project 2011: Reverberation Mapping of Markarian 50', ApJ 743, 4 (2011)

2. Barth, Aaron J. et al., **including AMN**, 'Broad-line Reverberation in the Kepler-field Seyfert Galaxy Zw 229-015', ApJ 732, 121 (2011)

1. **Nierenberg, A. M.**; Auger, M.W.; Treu, T.; Marshall, P.J.; Fassnacht, C. D. 'Luminous Satellites of Early-Type Galaxies I: Spatial Distribution', ApJ 731, 44 (2011)