Dr. Renee Ludlam

Curriculum Vitæ

Wayne State University
Department of Physics and Astronomy
Detroit, MI, 48201 USA
reneeludlam.com

Research Positions

2022-present **Assistant Professor of Physics and Astronomy**, *Wayne State University*

Education

2019 **PhD**, *Astronomy and Astrophysics*, University of Michigan, Ann Arbor, Michigan
Advisor: Jon M. Miller

2017 **MS**, *Astronomy and Astrophysics*, University of Michigan, Ann Arbor, Michigan

2015 **BA**, *Astronomy*, Wayne State University, Detroit, Michigan

2015 **BS**, *Physics*, Wayne State University, Detroit, Michigan

Scientific and Oversight Positions

2023-present **HEAD Deputy Secretary**

2022-present **HEX-P**, *lead for Accretion Power subtopic on neutron stars*

2021-present **IACHEC Coordinated Observations Working Group**, *Member*

2021-present **Athena Scientific Working Group**, *Member*, SWG 2.5: Physics of Accretion

2021-2022 **NICER Users Group (NUG)**, *Member*

2019-present **Strobe-X Scientific Working Group**, *Member*

2018-present **NASA NICER Science Team**, *Member*

Experience

Mentoring/Advising

Postdoctoral Research Advisor

2023 – present: Dr. Malu Sudha

Graduate Research Advisor

2022 – present: David Moutard

2022 – present: Songwei Li

2022 – present: Hayden Hall

Undergraduate Research Advisor

2023 – present: Dalal Darwish

Caltech Summer Undergraduate Research Fellowship (SURF) Program, *Project: NuSTAR StrayCats Analysis*

2021: Lynn Yang (Caltech)

2020: Catherine Slaughter (Dartmouth College)

Teaching

2023 **Professor**, *AST 2031: Life in the Universe*

2022 **Professor**, *PHY/ASTRO 5010: Astrophysics and Stellar Astronomy*

2020-2021 **Research Project Leader**, *Warrior–Scholar Project @ Caltech*, California Institute of Technology, Pasadena, CA

Previous Research Positions

2019-2022 **NASA Hubble Fellowship Program - Einstein Fellow**, *California Institute of Technology*

2015-2019 **Graduate Research Assistant**, *University of Michigan*, Ann Arbor, MI
Physical Properties of Neutron Stars.

2014 **Undergraduate Research Assistant**, *University of Michigan*, Ann Arbor, MI
Spin Estimate of the Black Hole GX 339-4.

2013-2014 **Undergraduate Research Assistant**, *Wayne State University*, Detroit, MI
Electronics fabrication for Belle II detector.

2013 **Research Experience for Undergraduates (REU)**, *Wayne State University*, Detroit, MI
X-Ray Properties of Intermediate Mass Black Holes in low-mass AGN.

Observing

2020 **200" Hale Telescope**, *Instrument: DBSP*, Palomar Observatory, California

2018 **Magellan Baade Telescope**, *Instruments: FIRE, FourStar, & IMACS*, Las Campanas Observatory, Chile

Professional Societies

2018-present **American Astronomical Society**, *High Energy Division*

2015-present **Phi Beta Kappa Society**

2014-present **Sigma Pi Sigma**

2014-present **American Physical Society**

Awards & Grants

2023 **AAS Newton Lacy Pierce Prize**

2022 **XRISM Guest Scientist**

2021 **AAS HEAD Dissertation Prize**

2019-2022 **NASA Hubble Fellowship Program – Einstein Fellowship**, *California Institute of Technology, CA*

2017-2019 **NASA Earth and Space Science Fellowship**

2017, 2018 **Rackham Travel Grants**, *University of Michigan*, Ann Arbor, MI

2016 **NSF GSRF Honorable Mention**

2015-2017 **Rackham Merit Fellowship**, *University of Michigan*, Ann Arbor, MI

2015 **Summa Cum Laude**, *Wayne State University*, Detroit, MI

2014-2015 **McNair Scholar**, *Wayne State University*, Detroit, MI

Diversity, Equity, and Inclusion Efforts

2020-2021 **Warrior–Scholar Project @ Caltech**, *Research project leader*

2018 **FEMMES Capstone Event**, *Gravitational Waves Demo*

2018 **Science Communication Fellows Program**, *Fulfills NSF Portal to the Public Program*

2017 **Wayne State University McNair Alumni Panel**, *Panel Member*, Choosing the Right Graduate Program and School for You

2017 **Conference for Undergraduate Women in Physics**, *Panel Member*, Undergraduate Research Opportunities, Advice for Life in Graduate School

2016 **Camp Cosmos**, *Volunteer Counselor*, Detroit, MI

2015 **Society of Physics Students Zone 7 Meeting**, *Panel Member*, Undergraduate Research

Publications (h-index=22, citations=3,500+)

First Author

14 **Ludlam et al.** 2023, *"The High-Energy X-ray Probe (HEX-P): A New Window into Neutron Star Accretion"*, Fronteirs in Astronomy and Space Sciences, $submitted$

13 **Ludlam et al.** 2022, *"StrayCats II: An Updated Catalog of NuSTAR Stray Light Observations"*, ApJ, 934, 59

12 **Ludlam et al.** 2022, *"Radius constraints from reflection modeling of Cygnus X-2 with NuSTAR and NICER"*, ApJ, 927, 112

11 **Ludlam et al.** 2021, *"Simultaneous NICER and NuSTAR Observations of the Ultra-compact X-ray Binary 4U 1543−624"*, ApJ, 911, 123

10 **Ludlam et al.** 2020, *"NICER-NuSTAR View of the Neutron Star Low-mass X-ray Binary 4U 1735−44"*, ApJ, 895, 45

9 **Ludlam et al.** 2019, *"Observations of the Ultra-compact X-ray Binary 4U 1543-624 in Outburst with NICER, INTEGRAL, Swift, and ATCA"*, ApJ, 883, 39

8 **Ludlam et al.** 2019, *"NuSTAR Observation of the Accreting Atolls GX 3+1, 4U 1702−429, 4U 0614+091, and 4U 1746−371"*, ApJ, 873, 99

7 **Ludlam et al.** 2018, *"Detection of Reflection Features in the Neutron Star Low-mass X-ray Binary Serpens X-1 with NICER"*, ApJL, 858, L5

6 **Ludlam et al.** 2017, *"Truncation of the Accretion Disk at One Third of the Eddington Limit in the Neutron Star Low-Mass X-Ray Binary Aquila X-1"*, ApJ, 847, 135

5 **Ludlam et al.** 2017, *"Relativistic Disk Reflection in the Neutron Star X-ray Binary XTE J1709-267 with NuSTAR"*, ApJ, 838, 79

4 **Ludlam et al.** 2017, *"A Hard Look at the Neutron Stars and Accretion Disks in 4U 1636-53, GX 17+2, and 4U 1705-44 with NuSTAR"*, ApJ, 836, 140

3 **Ludlam et al.** 2016, *"NuSTAR and XMM-Newton Observations of the Neutron Star X-ray Binary 1RXS J180408.9-34205"*, ApJ, 824, 37

2 **Ludlam et al.** 2015, *"Reapproaching the Spin Estimate of GX 339-4"*, ApJ, 806, 262

1 **Ludlam et al.** 2015, *"X-ray Spectral and Variability Properties of Low-Mass Active Galactic Nuclei"*, MNRAS, 447, 2112

Co-Author (* member of research group under my direct supervision)

39 * Moutard, D., **incl. Ludlam, R. M.**, et al., 2023, *"Simultaneous NICER and NuSTAR Observations of the Ultra-compact X-ray Binary 4U 0614+091"*, ApJ, $accepted$, arXiv:2308.15581

38 Coughenour et al., **incl. Ludlam, R. M.**, 2023, *"Reflection and timing study of the transient black hole X-ray binary MAXI J1803-298 with NuSTAR"*, ApJ, 949, 70

37 Yun, Grefenstette, **Ludlam,** et al., 2023, *"Revealing the spectral state transition of the Clocked Burster, GS 1826-238 with NuSTAR StrayCats"*, ApJ, 947, 81

36 Mastroserio et al., **incl. Ludlam, R. M.**, 2022, *"NuSTAR spectral analysis beyond 79 keV with stray light"*, ApJ, 941, 35

35 Guver et al., **incl. Ludlam, R. M.**, 2022, *"Burst - Disk Interaction in 4U 1636-536 as observed by NICER"*, ApJ, 935, 154

34 Pike et al., **incl. Ludlam, R. M.**, 2022, *"MAXI and NuSTAR observations of a low-luminosity X-ray transient in the GLIMPSE-C01 Cluster"*, ApJ, 927, 190

33 Brumback et al., **incl. Ludlam, R. M.**, 2022, *"Extending the baseline for SMC X-1's spin and orbital behavior with NuSTAR stray light"*, ApJ, 926, 187

32 García, Dauser, **Ludlam**, et al. 2022, *" Relativistic X-ray Reflection Models for Accreting Neutron Stars"*, ApJ, 926, 13

31 Trueba et al., **incl. Ludlam, R. M.**, 2022, *"A Spectroscopic Angle on Central Engine Size Scales in Accreting Neutron Stars"*, ApJ, 925, 113

30 Yao et al., **incl. Ludlam, R. M.**, 2021, *"A Comprehensive X-ray Report on AT2019wey"*, ApJ, 920, 121

29 Riley et al., **incl. Ludlam, R. M.**, 2021, *"A NICER View of the Massive Pulsar PSR J0740+6620 Informed by Radio Timing and XMM-Newton Spectroscopy"*, ApJL, 918, L27

28 Pike et al., **incl. Ludlam, R. M.**, 2021, *"Photospheric Radius Expansion and a double-peaked type-I X-ray burst from GRS 1741.9–2853"*, ApJ, 918, 9

27 Grefenstette, **Ludlam**, et al. 2021, *"$StrayCats$: A Catalog of NuSTAR Stray Light Observations"*, ApJ, 909, 30

26 Shaw et al., **incl. Ludlam, R. M.**, 2020, *"Measuring the masses of magnetic white dwarfs: A NuSTAR Legacy Survey"*, MNRAS, 498, 3457

25 Alabarta et al., **incl. Ludlam, R. M.**, 2020, *"X-ray Spectral and Timing evolution of MAXI J1727–203 with NICER"*, MNRAS, 497, 3896

24 Wang et al., **incl. Ludlam, R. M.**, 2020, *"Relativistic Reflection and Reverberation in GX 339−4 with NICER and NuSTAR"*, ApJ, 899, 44

23 Fabian et al., **incl. Ludlam, R. M.**, 2020, *"The Soft State of the Black Hole Transient Source MAXI J1820+070: Emission from the Edge of the Plunge Region?"*, MNRAS, 493, 5389

22 van den Eijnden, Degenaar, **Ludlam**, et al. 2020, *"A strongly changing accretion morphology during the outburst decay of the neutron star X-ray binary 4U 1608-52"*, MNRAS, 493, 1318

21 Rowan et al., **incl. Ludlam, R. M.**, 2020, *"A NICER View of Spectral and Profile Evolution for Three X-ray Emitting Millisecond Pulsars"*, ApJ, 892, 150

20 Raaijmakers et al., **incl. Ludlam, R. M.**, 2020, *"Constraining the dense matter equation of state with joint analysis of NICER and LIGO/Virgo measurements"*, ApJL, 893, 21

19 Bogdanov et al., **incl. Ludlam, R. M.**, 2019, *"Constraining the Neutron Star Mass-Radius Relation and Dense Matter Equation of State with NICER. I. The Millisecond Pulsar X-ray Data Set"*, ApJL, 887, L25

18 Miller et al., **incl. Ludlam, R. M.**, 2019, *"PSR J0030+0451 Mass and Radius from NICER Data and the Implications for the Properties of Neutron Star Matter"*, ApJL, 887, L24

17 Raaijmakers et al., **incl. Ludlam, R. M.**, 2019, *"A Nicer View of PSR J0030+0451: Implications fro the Dense Matter Equation of State"*, ApJL, 887, L22

16 Riley et al., **incl. Ludlam, R. M.**, 2019, *"A NICER View of PSR J0030+0451: Millisecond Pulsar Parameter Estimation"*, ApJL, 887, L21

15 Fiocchi et al., **incl. Ludlam, R. M.**, 2019, *"Quasi-simultaneous INTEGRAL, Swift, and NuSTAR Observations of the new Clocked Burster 1RXS J180408.9-342058"*, ApJ, 887, 30

14 Jaisawal et al., **incl. Ludlam, R. M.**, 2019, *"An evolving broad iron line from the first Galactic ultraluminous X-ray pulsar Swift J0243.6+6124"*, ApJ, 885, 18

13 Bult et al., **incl. Ludlam, R. M.**, 2019, *"A NICER thermonuclear burst from the millisecond X-ray pulsar SAX J1808.4-3658"*, ApJL, 885, L1

12 Miller et al., **incl. Ludlam, R. M.**, 2019, *"A NICER Look at Strong X-ray Obscuration in the Seyfert-2 Galaxy NGC 4388"*, ApJ, 884, 106

11 Jaisawal et al., **incl. Ludlam, R. M.**, 2019, *"NICER observes a secondary peak in the decay of a thermonuclear burst from 4U 1608−52"*, ApJ, 883, 61

10 Strohmayer et al., **incl. Ludlam, R. M.**, 2019, *"NICER Discovers Spectral Lines During Photospheric Radius Expansion Bursts from 4U 1820-30: Evidence for Burst-driven Winds"*, ApJL, 878, L27

9 Coughenour et al., **incl. Ludlam, R. M.**, 2018, *"A NuSTAR Observation of the Low-Mass X-ray Binary GX 349+2 Throughout the Z Track"*, ApJ, 867, 64

8 Stevens et al., **incl. Ludlam, R. M.**, 2018, *"A NICER Discovery of a Low-Frequency QPO in the Soft-Intermediate State of MAXI J1535-571"*, ApJL, 865, L15

7 Miller et al., **incl. Ludlam, R. M.**, 2018, *"Black Hole Spin and A Warped Disk in a NICER Spectrum of MAXI J1535-571"*, ApJL, 860, L28

6 Nielson et al., **incl. Ludlam, R. M.**, 2018, *"A Persistent Disk Wind in GRS 1915+105 with NICER"*, ApJL, 860, L19

5 Bult et al., **incl. Ludlam, R. M.**, 2018, *"NICER Detects a Soft X-ray Kilohertz QPO in 4U 0614+091"*, ApJL, 860, L9

4 Bult et al., **incl. Ludlam, R. M.**, 2018, *"A NICER look at the Aql X-1 hard state"*, ApJL, 859, L1

3 Keek et al., **incl. Ludlam, R. M.**, 2018, *"NICER Observes the Effects of an X-ray Burst on the Accretion Environment in Aql X-1"*, ApJL, 855, L4

2 Homan et al., **incl. Ludlam, R. M.**, 2018, *"Absence of reflection features in NuSTAR spectra of the luminous neutron star X-ray binary GX 5-1"*, ApJ, 853, 157

1 Degenaar et al., **incl. Ludlam, R. M.**, 2016, *"Disk reflection and a possible disk wind during a soft X-ray state in the neutron star low-mass X-ray binary 1RXS J180408.9-342058"*, MNRAS, 461, 4049

Accepted Proposals & Observations

Accepted Proposal	Observatory	PI	Funding ($k)	Time
Cycle 9	NuSTAR	Ludlam	61.8	30 ksec
Cycle 5	NICER (w/ NuSTAR)	Ludlam	43	30 ksec
XGS	XRISM	Ludlam	120	–
ADAP	NuSTAR	Ludlam	371	–
Cycle 7	NuSTAR (w/ NICER)	Ludlam	93.6	120 ksec
Cycle 2	NICER (w/ NuSTAR)	Ludlam	41.1	20 ksec
Cycle 5	NuSTAR	Ludlam	10.0	40 ksec
Keck 2020A	Keck-LRIS	Ludlam	—	0.75 nights
DDT XRB	NICER	Ludlam	—	10 ksec
ToO XRB	Swift	Ludlam	—	1 ksec
UM NGSO 2018b	Swift	Ludlam	—	26 ksec
ToO XRB	ATCA	Ludlam	—	4 hours
ToO XRB	INTEGRAL	Ludlam	—	45 ksec
DDT XRB Outburst	NuSTAR	Ludlam	—	40 ksec
ToO XRB Monitoring	Swift	Ludlam	—	20 ksec

Services

2023 **NuSTAR Cycle 9 Review Panel**, *co-chair*

2022-2023 **Reviewer for NASA FINESST**

2021 **Swift Cycle 18 Review Panel**, *co-chair*

2021 **NICER Cycle 3 Review Panel**, *Member*

2021-present **Referee for A&A**

2020 **NASA ADAP Review Panel**, *Member*

2020-2021 **Cahill "Tea Talk" Series**, *Organizer*, Caltech

2019 **Swift Cycle 16 Review Panel**, *Member*

2019-present **NuSTAR QA Team Member**, Verifies that recent $NuSTAR$ observations are nominal prior to passing data to PIs

2019-present **Referee for MNRAS**

2017-2019 **University of Michigan Prospective Graduate Student Visit Weekend**, *Activities Coordinator*

2017-2019 **High Energy Journal Club**, *Organizer*, University of Michigan

2018 **Magellan/MDM 2018B Time Allocation Committee**, *Member*

Presentations

Invited Talks/Seminars

2022 **Leveraging NICER to Understand Accretion in Neutron Star Low-mass X-ray Binaries**, *NICER 2022 Workshop*

2022 **Radius Constraints from NICER-NuSTAR observations of the NS LMXB Cygnus X-2**, *Harvard Center for Astrophysics*, Cambridge, MA

2021 **Characterizing the Properties of NS LMXBS in the NICER-NuSTAR Era**, *University of Cambridge*, Cambridge, UK

2021 **A Hard Look at Accretion Around Neutron Stars**, *HEAD Dissertation Prize Talk at the 237th AAS Meeting*

2020 **Characterizing the Properties of Neutron Stars in the NICER-NuSTAR Era**, *Max Planck Institute for Gravitational Physics*, Hannover, Germany

2018 **Utilizing NICER & NuSTAR for NS LMXBs**, *NASA Goddard Space Flight Center*, Greenbelt, MD

2018 **The Physics That Can Be Extracted From Neutron Stars**, *Washington University - St. Louis Astrophysics Seminar*, St. Louis, MO

2016 **Neutron Stars: Iron lines, magnetic fields, boundary layers. Oh My!**, *NuSTAR Science Meeting 2016*, Pasadena, CA

Contributed Talks

2022 **Radius Constraints from NICER-NuSTAR observations of the NS LMXB Cygnus X-2**, *NuSTAR Science Meeting 2022: Ten Years of the High Energy Universe in Focus*, Cagliari, Italy

2021 **NICER-NuSTAR Spectral Fitting of NS LMXBs**, *NICER Spectral Fitting Workshop*

2020 **A Hard Look at Accretion in Neutron Star Low-mass X-ray Binaries**, *Dissertation talk at the 235th AAS Meeting*, Honolulu, HI

2019 **Spectral Evolution in the Ultra-compact X-ray binary 4U 1543-624 during the 2017 Outburst**, *17th AAS/HEAD Meeting*, Monterey, CA

2019 **The NICER-NuSTAR View of NS LMXBs**, *233rd AAS Meeting: NASA Earth and Space Science Special Session*, Seattle, WA

2018 **The NICER-NuSTAR View of accretion disks in NS LMXBs**, *Chandra Accretion in Stellar Systems Workshop*, Cambridge, MA

2018 **Characterizing the Properties of Neutron Stars in the NuSTAR-NICER Era**, *42nd COSPAR Scientific Assembly*, Pasadena, CA

2018 **Mapping the Radii Around Neutron Stars with NICER**, *APS Quarks to Cosmos April Meeting*, Columbus, OH

2017 **A Hard Look at NS LMXBs with NuSTAR**, *AAS/HEAD 2017 Meeting*, Sun Valley, ID

2017 **A Hard Look at NS LMXBs**, *The X-ray Universe 2017*, Rome, Italy

2016 **NuSTAR and XMM-Newton View of LMXB 1RXS J180408.9-3**, *4th Annual Michigan Compact Objects Meeting*, Detroit, MI

2015 **X-ray Spectral and Variability Properties of Low-Mass AGN**, *3rd Annual Michigan Compact Objects Meeting*, Ann Arbor, MI

2015 **X-ray Spectral and Variability Properties of Low-Mass AGN**, *Society of Physics Students Zone 7 Meeting*, Detroit, MI