

Alexander J. Dittmann

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EDUCATION

- 2018-2024 The University of Maryland, Department of Astronomy
Dissertation: *The Lives and Times of Stars and Black Holes in the Disks of Active Galactic Nuclei*
Degrees: M.S. (2020), Ph.D. (2024) (Advisor: M. Coleman Miller)
- 2014-2020 The University of Illinois
Degrees: B.S. Physics (minor in Mathematics) & B.S. Astronomy (Advisor: Xin Liu)

RESEARCH EXPERIENCE

- 2024-Present Member, The Institute for Advanced Study, School of Natural Sciences
- 2022-2024 Graduate Research Assistant, Los Alamos National Laboratory, Theoretical Division
- 2020, Fall Pre-doctoral Fellow, Flatiron CCA
- 2018-2024 Graduate Research Assistant, University of Maryland
- 2016-2018 Research Assistant, University of Illinois
- 2016, Summer SULI Research Assistant, General Atomics
- 2014-2015 Summer Research Assistant, Catholic University of America

FELLOWSHIPS AND AWARDS

- 2024-2027 Einstein Fellowship, NASA Hubble Fellowship Program
- 2024 IAU Dissertation Prize, Honorable Mention, IAU Division J
- 2024 Board of Visitors Outstanding Graduate Student Award
University of Maryland College of Computer, Mathematical, and Natural Sciences
- 2023 Andrew S. Wilson Prize for Excellence in Research
University of Maryland, Department of Astronomy
- 2023 Michael J. Pelczar Award for Excellence in Graduate Study
University of Maryland Graduate School
- 2022 Bruno Rossi Prize (with the NICER team)
American Astronomical Society, High Energy Astrophysics Division
- 2021, 2022 Outstanding Research Assistant
University of Maryland Graduate School
- 2018 Graduate School Dean's Fellowship
University of Maryland
- 2018 Stanley Wyatt Memorial Award
University of Illinois, Department of Astronomy

PUBLICATIONS

Submitted

- 2025 Eccentric Binaries Accreting from Thin Disks: Orbital Evolution
Dittmann, A. J., Ryan, G., Combi, L.
- 2025 The LISA Astrophysics “Disc-IMRI” Code Comparison Project: Intermediate-Mass-Ratio Binaries in AGN-Like Discs
Derdzinski, A., **Dittmann, A. J.**, Franchini, A., Lupi, A., et al.
- 2025 The Radius of PSR J0437-4715 from NICER Data
Miller, M. C., **Dittmann, A. J.**, Holt, I. M., et al.
- 2025 An Investigation of Systematic Effects from Background Priors on PSR J0740+6620 Radius Estimates using Synthetic NICER and XMM-Newton Data
Holt, I. M., et al.
- 2025 Indirect Forces in Disc-Planet Interaction
Rafikov, R. R., et al.

Journal Articles

Summary: 37 published, 18 first-author, 7 single-author.

h-index 21, 4100+ citations

- 2025 The SHMS 11 GeV/c Spectrometer in Hall C at Jefferson Lab
S. Ali, et al., NIMA 1083, 171070
- 2025 Pushing the Limits of Eccentricity in Planet-Disc Interactions
Fairbairn, C. W., **Dittmann, A. J.**, MNRAS 543, 565
- 2025 The Multiple Paths to Merger of Unequal-Mass Black Hole Binaries in the Disks of Active Galactic Nuclei
Dittmann, A. J., Dempsey, A. M., Li, H., ApJ 990, 137
- 2025 Multi-Point Hermite Methods for the N-Body Problem
Dittmann, A. J., New Astron. 119, 102415
- 2025 Mapping the Outcomes of Stellar Evolution in the Disks of Active Galactic Nuclei
Fabj, G., et al., ApJ 981, 16
- 2025 A Semi-Analytical Model for Stellar Evolution in AGN Disks
Dittmann, A. J., Cantiello, M., ApJ 979, 245
- 2024 Exploring Waveform Variations among Neutron Star Ray-Tracing Codes for Complex Emission Geometries
Choudhury, D., et al., ApJ 975, 202
- 2024 A More Precise Measurement of the Radius of PSR J0740+6620 Using Updated NICER Data
Dittmann, A. J., Miller, M. C., Lamb, F. K., et al., ApJ 974, 295
- 2024 The Effects of Cooling on Boundary Layer Accretion
Dittmann, A. J., ApJ 974, 218
- 2024 Notes on the Practical Application of Nested Sampling: MultiNest, (Non)convergence, and Rectification
Dittmann, A. J., OJA 7 (September)
- 2024 The Santa Barbara Binary-Disk Code Comparison
Duffell, P. C., **Dittmann, A. J.**, D’Orazio, D.J., et al., ApJ 970, 156
- 2024 Runaway Eccentricity Growth: A Pathway for Binary Black Hole Mergers in AGN Disks
Calcino, J., Dempsey, A. M., **Dittmann, A. J.**, Li, H., ApJ 970, 107

- 2024 The Evolution of Accreting Binaries: from Brown Dwarfs to Supermassive Black Holes
Dittmann, A. J., Ryan, G., ApJ 967, 12
- 2024 The Evolution of Inclined Binary Black Holes in the Disks of Active Galactic Nuclei
Dittmann, A. J., Dempsey, A. M., Li, H., ApJ 964, 61
- 2023 A Sensitive Search for Supernova Emission Associated with the Extremely Energetic and Nearby GRB 221009A
Srinivasaragavan, G., **et al.**, ApJL 949, L39
- 2023 The Decoupling of Binaries from Their Circumbinary Disks
Dittmann, A. J., Ryan, G., Miller, M.C., ApJL 949, L30
- 2023 The Influence of Disk Composition on the Evolution of Stars in the Disks of Active Galactic Nuclei
Dittmann, A. J., Jermyn, A. S., Cantiello, M., ApJ 946, 56
- 2022 The Radius of PSR J0740+6620 from NICER with NICER Background Estimates
Salmi, T., **et al.**, ApJ 941, 450
- 2022 A Survey of Disc Thickness and Viscosity in Circumbinary Accretion: Binary Evolution, Variability, and Disc Morphology
Dittmann, A. J., Ryan, G., MNRAS 513, 6158
- 2022 Effects of an Immortal Stellar Population in AGN Disks
Jermyn, A. S., **et al.**, ApJ 929, 133
- 2022 An Analytical, Fully Relativistic Framework for Tidal Disruption Event Streams in Schwarzschild Geometry
Dittmann, A. J., MNRAS 511, 3408
- 2021 On the Terminal Spins of Accreting Stars and Planets: Boundary Layers
Dittmann, A. J., MNRAS 508, 1842
- 2021 Preventing Anomalous Torques in Circumbinary Accretion Simulations
Dittmann, A. J., Ryan, G., ApJ 921, 71
- 2021 The Radius of PSR J0740+6620 from NICER and XMM-Newton Data
Miller, M. C., Lamb, F. K., **Dittmann, A. J.**, et al., ApJL 918, L28
- 2021 NICER Detection of Thermal X-Ray Pulsations from the Massive Millisecond Pulsars PSR J0740+6620 and PSR J1614–2230
Wolff, M., **et al.**, ApJL 918, L26
- 2021 Accretion onto Stars in the Disks of Active Galactic Nuclei
Dittmann, A. J., Cantiello, M., Jermyn, A. S., ApJ 916, 48
- 2021 Stellar Evolution in the Disks of Active Galactic Nuclei Produces Rapidly Rotating Massive Stars
Jermyn, A. S., **Dittmann, A. J.**, Cantiello, M., Perna, R., ApJ 914, 105
- 2021 Constraining the Neutron Star Mass-Radius Relation and Dense Matter Equation of State with NICER. III. Model and Systematics
Bogdanov, S., **et al.**, ApJL 914, L15
- 2021 High-Order Multiderivative IMEX Schemes
Dittmann, A. J., Applied Numerical Mathematics 160, 205
- 2020 Modified Hermite Integrators of Arbitrary Order
Dittmann, A. J., MNRAS 496, 1217
- 2020 Star Formation in Accretion Disks and SMBH Growth
Dittmann, A. J., Miller, M. C., MNRAS 493, 3732
- 2019 PSR J0030+0451 Mass and Radius from NICER Data and Implications for the Properties of Neutron Star Matter
Miller, M. C., Lamb, F. K., **Dittmann, A. J.**, et al., ApJL 887, L24

- 2019 Constraining the Neutron Star Mass-Radius Relation and Dense Matter Equation of State with NICER. II. Emission from Hot Spots on a Rapidly Rotating Neutron Star
Bogdanov, S., **et al.**, ApJL 887, L26
- 2018 A Candidate Tidal Disruption Event in a Quasar at $z = 2.359$ from Abundance Ratio Variability
Liu, X., **Dittmann, A. J.**, Shen, Y., Jiang, L., ApJ 859, 8
- 2018 Separated kaon electroproduction cross section and the kaon form factor from 6 GeV JLab data
Carmignotto, M., **et al.**, PhysRevC 97, 025204
- 2017 The Aerogel Čerenkov detector for the SHMS magnetic spectrometer in Hall C at Jefferson Lab
Horn, T., **et al.**, NIMA 842, 28
- 2015 PSR J1930-1852: A Pulsar in the Widest Known Orbit Around Another Neutron Star
Swiggum, J. K., **et al.**, ApJ 805, 156

SEMINARS, COLLOQUIA, AND SYMPOSIA

(* = invited)

- 2025 Stellar-Mass Object in AGN Discs
Strong Gravity Group Meeting (Perimeter Institute), November 5
- 2025 *What Can Circumbinary Discs do for You?
CITA Seminar, November 3
- 2025 Eccentric Supermassive Black Hole Binaries
NASA Hubble Fellowship Program Symposium (STScI), October 10
- 2025 Eccentric Binaries and Their Disks
Los Alamos Astrophysics Seminar (LANL), August 14
- 2025 Eccentric Planets
Planets Meeting (Northwestern), February 27
- 2025 *Accretion onto Supermassive Black Hole Binaries Approaching Merger Theory Meeting (Northwestern), February 27
- 2025 *Eccentric Binaries and Their Disks
TAC Seminar (Berkeley), February 24
- 2024 *Probing Neutron Star Structure and Surfaces with NICER
SCEECS Seminar (Virtual), November 25
- 2024 Accreting Binaries: From Brown Dwarfs to Major Mergers
Astrophysics Seminar (IAS), October 24
- 2024 Accretion onto Supermassive Binary Black Holes
NASA Hubble Fellowship Program Symposium (NExSci), September 17
- 2024 Neutron Star Masses and Radii from NICER Data
Particle, Nuclear, and Astrophysics Seminar (LANL), July 25
- 2024 Updated NICER constraints on the radius of the high-mass neutron star PSR J0740
Nuclear Physics Journal Club (UIUC), April 12
- 2024 *Accreting Binaries: From Brown Dwarfs to Major Mergers
Astrophysics Seminar (Clemson), March 14
- 2023 *Supermassive Black Hole Binary Mergers and their Multi-Messenger Signatures,
Center for Astrophysical Sciences Seminar (JHU), October 9
- 2023 Supermassive Black Hole Binary Mergers and their Multi-Messenger Signatures,
Los Alamos Astrophysics Seminar (LANL), August 25

- 2023 The Decoupling of Binaries from their Circumbinary Disks, Astrophysics Seminar (Columbia), April 13
- 2023 Inclined and Eccentric Binaries in AGN Disks, Compact Objects Group Meeting (CCA), April 13
- 2023 The Decoupling of Binaries from their Circumbinary Disks, Galread (Princeton), April 10
- 2022 *The Evolution of Stars and Black Holes in AGN disks, Astrophysics Seminar (GMU), November 3
- 2022 *The Evolution of Stars and Black Holes in AGN disks, Physics Colloquium (GWU), October 20
- 2022 The Evolution of Stars and Black Holes in AGN disks, Transient Astronomy Meeting (UMD), September 2
- 2022 *The Evolution of Stars and Black Holes in AGN disks, Los Alamos Astrophysics Seminar (LANL), August 25
- 2022 *The Orbital Evolution and Appearance of Binaries Fed by Circumbinary Disks, Gravitational Astrophysics Laboratory lunch seminar (GSFC), February 24
- 2021 Neutron Star Masses and Radii from NICER Data, JSI Minisymposium on Neutron Stars and Dense Matter (UMD), December 10
- 2021 The Orbital Evolution and Appearance of Binaries Fed by Circumbinary Disks, Center for Theory and Computation Seminar (UMD), November 10
- 2021 Measuring the Heaviest Known Neutron Star: the Radius of PSR J0740 from X-ray Data, Compact Objects Group Meeting (CCA), April 22
- 2021 *Circumbinary Disks, sink particles, and making simulations less sensitive to tuning parameters, Hernquist Group Meeting (CfA), March 5
- 2021 Stellar Evolution in AGN Disks, Flatiron/CCA Predoc Symposium, February 26
- 2021 Circumbinary Disks, sink particles, and making simulations less sensitive to tuning parameters, Compact Objects Group Meeting (CCA), January 28
- 2020 Stars in AGN disks, CCA lunch talk, October 1

CONFERENCES AND WORKSHOPS

(* = invited)

- 2025 *Eccentric Supermassive Black Hole Binaries
CIERA Fellows at 15, Northwestern, August 28
- 2025 *Stories, Myths, and Legends in Circumbinary Accretion
Open Problems in Astrophysical Dynamics, NBIA, June 11
- 2025 *Neutron Star Masses and Radii from NICER Data
Modern Equations of State and Spectroscopy in Neutron-Star Matter, Universidad de Alcalá, May 28
- 2025 NICER Constraints on the Properties of PSR J0740+6620
Extreme Physics of Neutron Star Interiors, PCTS, May 14
- 2025 *Stellar-Mass Objects in AGN Disks
Frontiers of Astrophysical Black Holes, Sexten CfA, March 17
- 2024 New NICER Constraints on the Equation of State of High-Density Matter
APS April Meeting, April 5

- 2023 *Neutron Star Masses and Radii from NICER Data invited talk, DMV Physics of Neutron Stars Workshop, October 27
- 2023 Circumbinary Disks: from Brown Dwarfs to Major Mergers DC Consortium Astrophysics Graduate Student Conference, August 19
- 2023 Multi-messenger signatures of black hole binary-disk interactions in the LISA regime, Summer AAS, June 7
- 2023 Binary black hole accretion across the disk and gravitational wave-driven regimes, poster, AAS HEAD, March 27
- 2022 Promoting BIPOC and Marginalized Students to Pursue Computational Physics through CRANE, by Ernesto Barraza-Valdez, et al., APS DPP, October 17
- 2018 A Time-domain Analysis of Nitrogen-Rich Quasars, poster, Winter AAS, January 10
- 2016 Ray-tracing studies of fast waves in the lower hybrid range of frequencies, poster, APS DPP, November 1
- 2015 Exploring the potential for studies of the electromagnetic structure of the kaon at 12 GeV JLab, APS DNP, October 31
- 2014 The Optical Characterization of Aerogel Tiles for Cherenkov Detectors at Jefferson Lab, APS DNP, October 10

PUBLIC/OUTREACH

- 2023 Stars in Accretion Disks That Orbit Black Holes, National Capital Astronomers, March 11

TEACHING EXPERIENCE

University of Maryland

- | | | |
|---------------|--------------------------|---|
| 2020 - spring | Theoretical Astrophysics | wrote and taught discussions, graded |
| 2020 - spring | Black Holes | graded, updated lecture material |
| 2019 - fall | General Astronomy | presented 3 lectures, taught discussions and labs, graded |
| 2019 - spring | General Astronomy | taught and graded discussions and labs |
| 2018 - fall | General Astronomy | taught and graded discussions and labs |

COMPUTING

- | | |
|-----------|-------------------------------|
| Languages | C, Python, Fortran, CUDA, IDL |
| Tools | git, SLURM |

SERVICE, OUTREACH, AND PROFESSIONAL CONTRIBUTIONS

Organization

IAS/Princeton Astrophysics Colloquium Committee 2025-2026

Scientific Organizing Committee, NHFP Symposium 2025

LISA Astrophysics Working Group Project Coordinator (DISC-IMRI code comparison)

Journals

Referee for Nature, PRL, ApJL, OJAp, PRD, ApJ, MNRAS, A&A

GRAD-MAP¹

Winter Workshop mentoring N-body simulations of stellar binaries and SMBHs (2020),
the perturbed circular restricted 3-body problem (2022)

Winter Workshop Python Bootcamp Co-lead (2022, 2023), teaching (2020, 2021, 2023)

Summer Scholars mentoring Hydrodynamical simulations of tidal disruption event streams

Summer Scholars teaching Lectured on visualizing multidimensional data using Python
and an introduction to programming in C

CRANE²

Notebook co-author Runge-Kutta methods, PDEs

Lecturer Hyperbolic PDEs, the Boris push algorithm

Teaching assistant Numerical integration, ODEs, PDEs, PIC Methods

Undergraduate Curriculum

Introductory labs revised, restructured, and tested new labs

¹Graduate Resources Advancing Diversity with Maryland Astronomy and Physics, <https://www.umdgradmap.org/>

²Computational Research Access NEtwork, <https://www.cranephysics.org/>