

# 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 PhD Dissertation 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 Pushing the Limits of Eccentricity in Planet-Disc Interactions  
Fairbairn, C. W., **Dittmann, A. J.**
- 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.

### Journal Articles

Summary: 34 published, 17 first-author, 7 single-author.

h-index 20, 3500+ citations

- 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

- 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

- 2025 Stories, Myths, and Legends in Circumbinary Accretion  
Open Problems in Astrophysical Dynamics, NBIA
- 2025 Neutron Star Masses and Radii from NICER Data  
2nd Workshop, Madrid
- 2025 NICER Constraints on the Properties of PSR J0740+6620  
Extreme Physics of Neutron Star Interiors, PCTS
- 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

### Journals

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

### GRAD-MAP<sup>1</sup>

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

### CRANE<sup>2</sup>

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

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

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

## LISA Consortium

Astrophysics Working Group    Coordinator for ongoing Working Group project