

# 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 PhD 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 The SHMS 11 GeV/c Spectrometer in Hall C at Jefferson Lab  
S. Ali, **et al.**
- 2025 Pushing the Limits of Eccentricity in Planet-Disc Interactions  
Fairbairn, C. W., **Dittmann, A. J.**

## Journal Articles

Summary: 35 published, 18 first-author, 7 single-author.

h-index 21, 3700+ citations

- 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 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

### 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 |

<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/>

## Undergraduate Curriculum

Introductory labs    revised, restructured, and tested new labs

## LISA Consortium

Astrophysics Working Group    Coordinator for ongoing Working Group project