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 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, 4000+ 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-MAP[1]

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[2]

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

[1] Graduate Resources Advancing Diversity with Maryland Astronomy and Physics, https://www.umdgradmap.org/
[2] Computational Research Access NEtwork, https://www.cranephysics.org/