

# Charlotte Ward

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## Education

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Ph.D., Astronomy, University of Maryland at College Park 2022  
Thesis: *Tracing the formation and merger-driven growth of massive black holes with the Zwicky Transient Facility*

M.Sc., Astronomy, University of Maryland at College Park 2019

B.Sc. (Adv) (Hons), Physics & Mathematics, University of Sydney 2016  
Thesis: *Machine learning techniques for discovery of Fast Radio Bursts with the Parkes Radio Telescope*

## Professional Employment and Internships

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Postdoctoral Research Associate, Princeton University 2022 – present

HEP Center for Computational Excellence Graduate Summer Internship, Lawrence Berkeley National Laboratory 2019

School of Physics Laboratory Tutor, University of Sydney 2017

Summer Scholar, Centre for Astronomy and Space Science, CSIRO 2015, 2016

Nanjing Research Exchange Visiting Scholar, Nanjing University 2015

Faculty of Science Information Officer, University of Sydney 2014 – 2015

Undergraduate research student, Quantum Control Laboratory, University of Sydney 2015

Undergraduate research student, Institute of Medical Physics, University of Sydney 2014

## Research interests

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Multi-wavelength analysis of astrophysical transients; dwarf galaxy AGN; changing-state AGN; tidal disruption event demographics; multi-resolution image modeling techniques for joint-survey analysis; large-scale analysis pipelines for wide-field time-domain surveys.

## Observing Proposals and Grants

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**PI:** Investigating newly launched radio jets in changing-state AGN (ASKAP Variable And Slow Transients radio survey) 2024A

**PI:** Understanding episodic SMBH accretion triggering with changing-look AGN (Magellan, Princeton allocation) 2023B

**PI:** Investigating 10 Candidates for Gravitational Wave Recoil from an SMBH merger (Keck, NASA allocation, \$15K grant awarded) 2023A

**PI:** Confirming the presence of AGN for the variability-selected IMBH candidates from ZTF and WISE (Magellan, Princeton allocation) 2023A

## Honors, Awards and Press Coverage

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<i>Martin and Beat Block Winter Award</i> , Aspen Center for Physics	2023
<i>ZTF IMBH paper featured in Astrobites article</i>	2023
<i>ZTF Recoiling AGN paper featured in New Scientist</i>	2021
<i>Graduate Student Summer Research Fellowship</i> , University of Maryland at College Park	2020
<i>HEP Center for Computational Excellence Graduate Summer Internship</i> , Lawrence Berkeley National Laboratory	2019
<i>Graduate School Dean's Fellowship for Astronomy</i> , University of Maryland at College Park	2017
<i>Physics Foundation Scholarship No III</i> , University of Sydney	2016
<i>School of Physics Honours Scholarship</i> , University of Sydney	2016
<i>Faculty of Science Merit Scholarship</i> , University of Sydney	2013-2015
<i>School of Physics Smith Prize in Experimental Physics</i> , University of Sydney	2013

## Selected Colloquia and Seminars

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<i>Invited Colloquium</i> , The Pennsylvania State University, Department of Astronomy	2023
<i>Invited Seminar</i> , ASKAP Variable And Slow Transients (VAST) team meeting	2023
<i>Invited Seminar</i> , Naval Research Laboratory Astrophysics Division	2023
<i>Contributed Talk</i> , Aspen Winter Conference: eXtreme Black Holes	2023
<i>Invited Colloquium</i> , Lawrence Berkeley National Laboratory, Computer Sciences Division	2022
<i>Invited Seminar</i> , Stanford KIPAC Tea Talk	2022
<i>Invited Colloquium</i> , Lawrence Berkeley National Laboratory, Physics Division	2022
<i>Invited Colloquium</i> , Australia Telescope National Facility, CSIRO	2022
<i>Invited Seminar</i> , Nanograv Meeting	2022
<i>Contributed Talk</i> , IMBHS: New Science from Stellar Evolution to Cosmology conference	2022
<i>Contributed Talk</i> , Aspen Winter Conference: Dynamical Formation of GW Sources	2022
<i>Invited Seminar</i> , Johns Hopkins University AGN Journal Club	2021
<i>Invited Seminar</i> , NASA Goddard AGN Seminar Series	2021
<i>Contributed Talks</i> , ZTF Team Meetings in Stockholm, Tel Aviv, and Pasadena	2018-2019

## Leadership, Service and Public Outreach

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<i>Peyton Observatory Public Observing: volunteer/lead observer/co-coordinator</i> , Princeton U.	2022 - ongoing
<i>EDI seminar series coordinator</i> , Princeton University	2023 - ongoing
<i>Astronomy on Tap Trenton Chapter: speaker/co-coordinator</i> , Princeton University	2023 - ongoing
<i>Astrocoffee (arXiv journal club) host</i> , Princeton University	2023 - ongoing
<i>Postdoc - Grad Student Mentoring Program mentor</i> , Princeton University	2023 - ongoing
<i>CanTAC Gemini proposal reviewer</i>	2022
<i>Referee for MNRAS</i> (2 papers)	2022 - 2023
<i>Co-lead of GRAD-MAP (Graduate Resources Advancing Diversity in Maryland Astronomy and Physics) program</i> , University of Maryland	2020-2021

<i>Co-coordinator of the Department of Astronomy Journal Club, University of Maryland</i>	2019-2021
<i>Astronomy outreach volunteer, University of Maryland. Selected events:</i>	
GRAD-MAP Open House (speaker, coordinator)	2019-2021
GRAD-MAP visits to Prince George's Community College, Howard University, Montgomery CC and Howard CC (speaker, coordinator)	2019-2021
Anne Arundel County Public Library's STEM day (volunteer)	2019
UMD observatory Open House (volunteer)	2018
<i>Pulse@Parkes High School Outreach Program volunteer, CSIRO</i>	2014-2015

## Teaching and Research Mentoring

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<i>Undergraduate Summer Research Program Advisor, Princeton University</i>	2023
<i>Junior Thesis Co-advisor (astronomy), Princeton University</i>	2023
<i>Masters Thesis Co-advisor (engineering), Princeton University</i>	2023
<i>GROWTH time-domain astronomy school tutor, San Diego State University</i>	2020
<i>Research advisor, GRAD-MAP Winter Workshop, University of Maryland</i>	2019
<i>Teaching Assistant, 'Special Problems in Astronomy: Big Data', University of Maryland</i>	2018
<i>Research co-advisor, GRAD-MAP Winter Workshop, University of Maryland</i>	2018
<i>GRAD-MAP Python Bootcamp developer, University of Maryland</i>	2018
<i>3rd year computational physics lab tutor, University of Sydney</i>	2017
<i>2nd year experimental physics lab tutor, University of Sydney</i>	2017

## Selected Peer-Reviewed and Submitted Publications

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**32 total, 3 first author and 19 with significant contributions, h-index=19, 2056 total citations .**

\*: graduate or undergraduate student

**Ward, C.,** Gezari, S., Nugent, P et al. 'Panic at the ISCO: the visible accretion disks powering optical variability in ZTF AGN', **2023**, arXiv: 2309.02516.

**Ward, C.,** Gezari, S., Nugent, P et al. 'Variability-selected intermediate mass black hole candidates in dwarf galaxies from ZTF and WISE', **2022**, The Astrophysical Journal, 936, 104.

**Ward, C.,** Gezari, S., Frederick, S. et al. 'AGNs on the Move: A Search for Off-nuclear AGNs from Recoiling Supermassive Black Holes and Ongoing Galaxy Mergers with the Zwicky Transient Facility', **2021**, The Astrophysical Journal, 913, 102.

Ridley, E. \*, Nicholl, M., **Ward, C.** et al. 'AT2017bcc: time-varying double-peaked emission lines following the sudden ignition of a dormant galactic nucleus', **2023**, arXiv: 2310.20408

Brightman, M., **Ward, C.** et al. 'A Luminous X-Ray Transient in SDSS J143359.16+400636.0: A Likely Tidal Disruption Event', **2021**, The Astrophysical Journal, 909, 102.

Hammerstein, E.\*, Gezari, S., van Velzen, S. et al. (**author of 6 of 20**) ‘Tidal Disruption Event Hosts Are Green and Centrally Concentrated: Signatures of a Post-merger System’, Erica Hammerstein et al. **2021**, The Astrophysical Journal Letters, 908, L20.

van Velzen, S., Hammerstein, E.\*, Gezari, S., et al. (**author 6 of 44**) ‘Seventeen Tidal Disruption Events from the First Half of ZTF Survey Observations: Entering a New Era of Population Studies’, **2021**, The Astrophysical Journal, 908, 4.

Liang, Y.\*, Melchior, P., et al. (**author 7 of 7**) ‘Outlier Detection in the DESI Bright Galaxy Survey’, **2023**, ApJL, 956, L6.

Liang, Y.\*, Melchior, P. et al. (**author 5 of 5**), ‘Autoencoding Galaxy Spectra II: Redshift Invariance and Outlier Detection’, **2023**, ApJ, 166, 75.

Hammerstein, E.\*, Gezari, S. et al. (**author 7 of 9**), ‘Integral Field Spectroscopy of 13 Tidal Disruption Event Hosts from the ZTF Survey’, **2023**, ApJ, 957, 86.

## Papers in preparation

**Ward, C.**, Melchior, P., Burke, C., et al. ‘The variable dwarf galaxy AGN in deep Hyper Suprime Cam time-domain imaging: wandering fractions and mass functions’, in prep.

**Ward, C.**, Kerr, M., et al. ‘A population of optically detected white dwarf companions to radio pulsars in the PanSTARRS, HSC-wide and Legacy Surveys’, in prep.

Uppal, A.\*, **Ward C.**, et al. ‘Using Astrometric Jitter to Find Recoiling AGN Candidates in Optical Imaging Survey Data: A Pilot Study with Pan-STARRS’, in prep.

Sampson, M.\*, Melchior, P., **Ward, C.**, Birmingham, S.\* ‘Score matching diffusion models as data-driven priors for improved multi-band source separation’, in prep.

## Skills

*Software:* Key astronomy and computing software such as Github, Docker, Swarp, Scamp, SExtractor, Psfex, APLPY, astropy, ds9, Hotpants, iraf, LaTeX, scikit-learn.

*Observing and data reduction:* Obtaining and reducing optical imaging, spectrograph and IFU observations.

*Time-domain astronomy tools:* Source investigation and follow-up with the Transient Name Server, VizieR, NED, the HEASARC Data Archive, the GROWTH Marshal, SkyPortal and alert brokers such as AMPEL.

*Transient alert filtering:* Developing filters for transient alerts from large optical surveys and implementing machine learning classifiers for transient discovery.

*Optical image modeling:* Forward modeling optical images for source characterization and photometry.

*High performance computing:* Developing software for computationally intensive analysis and processing of large data sets on supercomputing clusters. Use of cluster resource management and checkpointing software. Use of HPSS archives for data storage.

*Database management:* SQL query construction. Use of PostgreSQL for database management.

## References

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**Prof. Peter Melchior**

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**Prof Michael Strauss**

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