

# 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</i> , University of Maryland	2019-2021
<i>Astronomy outreach volunteer</i> , University of Maryland. Selected events:	
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</i> , CSIRO	2014-2015

## Teaching and Research Mentoring

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