# Yuhan Yao

California Institute of Technology
1200 E. California Blvd, MC 249-17
Pasadena CA 91125

Email: yyao@astro.caltech.edu
Homepage: https://yaoyuhan.github.io/

## PRIMARY RESEARCH INTERESTS

- Time domain astronomy; Observational high energy astrophysics; Sky surveys
- Tidal disruption events; Deaths of massive stars; Accretion and jet physics; Intermediate-mass black holes

## EDUCATION

| | |
|---|---|
| 2020-2023 | Ph.D., Astrophysics, California Institute of Technology, USA<br>Thesis: *High Energy Transients Powered by Black Holes*<br>Advisors: Prof. Shrinivas R. Kulkarni & Prof. Fiona A. Harrison |
| 2018-2020 | M. Sc. Astrophysics, California Institute of Technology, USA |
| 2014-2018 | B. Sc. Astronomy, Peking University, China |

## SELECTED HONORS and AWARDS

| | |
|---|---|
| 2023 | Miller Fellowship Award, University of California, Berkeley |
| 2021 | Garmire Scholarship, Caltech |
| 2017 | Study Abroad Scholarship for Outstanding Students, China Scholarship Council |
| 2017 | Summer Undergraduate Research Fellowship, Caltech |

## SUCCESSFUL PI OBSERVING PROPOSALS

| | |
|---|---|
| 2023 | **VLA** (DDT): Radio Afterglows from Optically Overluminous Tidal Disruption Events (8.2 hr)<br>***NICER*** Cycle 5 **($43k)**; *NICER+NuSTAR* Observations of Tidal Disruption Events: Opening a New Chapter in Black Hole Super-Eddington Accretion (300ks, ToO) |
| 2022 | **VLA 2023A:** Opening a New Chapter in Relativistic Tidal Disruption Events (28hr)<br>***NICER*** Cycle 4 **($44k)**; *NICER* Observation of X-ray Bright Tidal Disruption Events (300ks, ToO)<br>***NuSTAR*** (DDT); *NuSTAR* observations of the Jetted Tidal Disruption Event AT2022cmc (80ks) |
| 2021 | ***NuSTAR*** (DDT); *NuSTAR* observation of the Tidal Disruption Event AT2021ehb (80ks)<br>***NICER*** (DDT); *NICER* observation of the Tidal Disruption Event AT2021ehb (100ks)<br>***XMM-Newton*** AO-21 (**$105k**); A Systematic Exploration of Late-time X-rays from ZTF TDEs (298ks)<br>***Chandra*** Cycle 23 (**$77k**); Late-time *Chandra* Observations of eROSITA Selected TDEs (75ks)<br>***Chandra*** DDT (**$23k**); *Chandra* Observation of AT2020mrf: the Most X-ray Luminous FBOT (40ks)<br>***NuSTAR*** Cycle 7 (**$81k**); *NuSTAR* Observations of Tidal Disruption Events" (80ks, ToO)<br>***NuSTAR*** Cycle 7; Understanding the Central Engine of Luminous FBOTs (80ks, ToO) |
| 2020 | ***NuSTAR*** (DDT); *NuSTAR* Observation of the High-Mass X-ray Binary ZTF18abjpmzf (20ks)<br>***NuSTAR*** (DDT); *NuSTAR* Observations of the Low-Mass X-ray Binary AT2019wey (120ks)<br>**VLA** (DDT); VLA observations of AT2019wey (6.3hr) |
| 2018-23 | ***Swift*** (ToO); Submitted >60 approved *Swift* observations (>400ks) |

## OBSERVING EXPERIENCE

Keck-I telescope, the Low Resolution Imaging Spectrometer (LRIS) – more than 20 nights
Palomar Hale telescope, the Double Spectrograph (DBSP) – more than 20 nights
Keck-II telescope, the Echellette Spectrograph and Imager (ESI) – 5 nights
Lick Shane telescope, the KAST spectrograph – 3 nights

## INVITED CONFERENCE TALKS

| | |
|---|---|
| 2022/10 | Workshop on Super-massive Black Holes, Cornell University, Ithaca, NY<br>*Tidal Disruption Events: Recent Advances in X-ray Observations* |
| 2022/09 | ZTF Theory Network, Santa Margarita, CA |

*The X-ray Bright Tidal Disruption Event AT2021ehb*

2022/09 NICER 2022 Proposal and Science Workshop, Online meeting
*Characterizing the Black Hole Candidate AT2019wey using NICER & Multi-wavelength Observations*

2022/06 NuSTAR Science Meeting (10-yr Anniversary), Cagliari, Sardinia, Italy (remote talk)
*NuSTAR Observations of Tidal Disruption Events*

## INVITED COLLOQUIUA / SEMINARS

2022/12 AXIS Seminar, Virtual
*Studying Tidal Disruption Events and Luminous Fast Blue Optical Transients with AXIS*

2022/10 Seminar, Theoretical Astrophysics Center, UC Berkeley, Berkeley, CA
*Tidal Disruption Events: Probes of Accretion Physics and Black Hole Demographics*

2022/10 Seminar, Center for Cosmology and Astroparticle Physics, Ohio State University, Columbus, OH
*The X-ray Bright Tidal Disruption Event AT2021ehb*

2022/09 Colloquium, Department of Astronomy, University of Maryland, College Park, MD
*Tidal Disruption Events: Probes of Accretion Physics and Black Hole Demographics*

2021/12 Explosive Seminar, UC Berkeley, Berkeley, CA
*AT2020mrf: A Radio-loud Fast Blue Optical Transient with Luminous Variable X-ray Emission*

## SELECTION OF CONTRIBUTED TALKS

2023/03 *UVEX* Community Workshop, Pasadena, CA
*Studying Tidal Disruption Events with UVEX*

2023/01 PhD Dissertation Talk, 241$^{th}$ AAS Meeting, Seattle, WA
*Tidal Disruption Events: Probes of Accretion Physics and Black Hole Demographics*

2022/06 Theoretical High Energy Astrophysics Group Meeting, U. Columbia, New York, NY
*The Spectacular X-ray Tidal Disruption Event AT2021ehb*

2021/11 ZTF Collaboration Meeting, virtual
*Tidal Disruption Events from ZTF and SRG*

2020/10 ZTF Theory Network, virtual
*Ultra-stripped Supernovae*

2019/08 Hot Wiring Transient VI Meeting, Evanston, IL
*Supernovae Experiments conducted by the Zwicky Transient Facility*

2019/08 GROWTH Collaboration Meeting, San Diego, CA
*Early observations of Type Ia Supernovae by the Zwicky Transient Facility*

## LEADERSHIP & PROFESSIONAL SERVICE

| | |
|---|---|
| 2022-present | Referee/reviewer for ApJ, MNRAS |
| 2022-present | Member, Advanced X-ray Imaging Satellite (*AXIS*) TDA&MM working group |
| 2021-present | Member, Ultraviolet Explorer (*UVEX*) AGN/TDE working group |
| 2020-21 | Organizer, Weekly ZTF AGN/TDE Science Working Group Discussion |
| 2019-21 | Co-organizer, Weekly ZTF Caltech Transient Discussion |
| 2020 | Time Allocation Committee (Palomar Hale Telescope; Liverpool Telescope) |
| 2020 | Co-organizer, Caltech X-ray Club (34 lectures given by PIs or members of X-ray missions) |
| 2019-21 | Peer Mentor, Caltech Astronomy Mentorship Program |
| 2019-21 | Student Representative, Caltech Astronomy Colloquium Committee |

## TEACHING

| | |
|---|---|
| Spring 2020 | TA for Ay125 at Caltech (graduate course, "High Energy Astrophysics") |
| Winter 2020 | TA for Ay102 at Caltech (undergraduate course, "Physics of ISM", taught 2 lectures) |
| Fall 2019 | TA for Ay121 at Caltech (graduate course, "Radiative Processes") |
| 2019-20 | TA, GROWTH Summer School |

## PRESS CONVERAGE

2023/03 Caltech magazine featuring my TDE studies in honor of NASA black hole week

2022/12 NASA-JPL news-release on my study of AT2021ehb (see a short writeup on yahoo!life)

2022/01 I presented AT2020mrf at the 239$^{th}$ AAS press conference [video], which received some media attention (e.g., Caltech News, Scientific American, Science News, IFLScience, BigThink, spacecom)

## PUBLIC OUTREACH

2023 Speaker, Caltech Stargazing Lecture Series, *Fireworks from Black Holes Devouring Stars*
2023 Speaker, 241th AAS AXIS Splinter Session, *Transient Science with the AXIS Probe Mission*
2022 Speaker, 240th AAS NASA Hyper-wall Booth, *NuSTAR: Ten Years of the High Energy Universe in Focus*
2021 Interviewee, KAZN AM1300 Radio Station (in Mandarin), *Life as a Scientist at Caltech*
2021 Speaker, Astronomy on Tap (virtual, in Mandarin), *Searching for Stars Ripped Apart by Black Holes*
2020 Speaker, Amateur Astronomical Society, *Finding Supernovae from Mt. Palomar*
2019 Speaker, ZTF Summer Institute, *Early Observations of Type Ia Supernovae by ZTF*
2018-23 Volunteer, Caltech Astronomy Outreach Program

## PUBLICATION SUMMARY & SELECTED HIGHLIGHTS

- Total / **as first author**: 63 (including 8 submitted under review) / **10 (including 1 submitted under review)**
- Citations: >1600 / **>200**
- h-index: 25 / **8**

### First Author Journal Submission & in Preparation

[2] **Yao, Y.**, Lu, W., Harrison, F., et al. 2023, to be submitted to ApJ
*The On-axis Relativistic Tidal Disruption Event AT2022cmc:*
*X-ray Observations and Broadband Spectral Modeling*

[1] **Yao, Y.**, Ravi, V., Gezari, S., et al. 2023, submitted to ApJ, arxiv: 2303.06523
*Tidal Disruption Event Demographics with the Zwicky Transient Facility:*
*Volumetric Rates, Luminosity Function, and Implications for the Local Black Hole Mass Function*

### First Author Journal Publications

[9] **Yao, Y.**, Lu, W., Guolo, M. et al. 2022, ApJ, **937**, 8
*The Tidal Disruption Event AT2021ehb:*
*Evidence of Relativistic Disk Reflection, and Rapid Evolution of the Disk—Corona System*

[8] **Yao, Y.**, Ho, Y. Q. A., Medvedev, P. et al., 2022, ApJ, **934**, 104
*The X-ray and Radio Loud Fast Blue Optical Transient AT2020mrf:*
*Implications for an Emerging Class of Engine-driven Massive Star Explosions*

[7] **Yao, Y.**, Kulkarni S. R., Gendreau, K. C. et al., 2021, ApJ, **920**, 121
*A Comprehensive X-ray Report on AT2019wey*

[6] **Yao, Y.**, Kulkarni, S. R., Burdge, K. B. et al., 2021, ApJ, **920**, 120
*Multi-wavelength Observations of AT2019wey: a New Candidate Black Hole Low-mass X-Ray Binary*

[5] **Yao, Y.**, De, K., Kasliwal, M. M. et al., 2020 August 31, ApJ, **900**, 46 (24 pages)
*SN2019dge: a Helium-rich Ultra-Stripped Envelope Supernova*

[4] **Yao, Y.**, Miller, A. A., Kulkarni, S. R. et al., 2019, ApJ, **886**, 152
*ZTF Early Observations of Type Ia Supernovae. I. Properties of the 2018 Sample*

[3] **Yao, Y.**, & Feng, H. 2019 October 3, ApJL, **884**, L3
*A Wind-disk Self-irradiation model for Supercritical Accretion*

[2] **Yao, Y.**, Meyer, M. R., Covey, K. R. et al., 2018, ApJ, **869**, 72
*IN-SYNC. VIII. Primordial Disk Frequencies in NGC 1333, IC 348, and the Orion A Molecular Cloud*

[1] **Yao, Y.**, Liu, C., Deng, L., et al. 2017, ApJS, **232**, 16
*Mira Variable Stars from LAMOST DR4 Data:*
*Emission Features, Temperature Types, and Candidate Selection*

### Selected Co-author Publications (with Significant Contribution)

[11] Andreoni, I., Coughlin, M. W., Perley, D. A., **Yao, Y.** et al. 2022, Nature, **612**, 430
*A very luminous jet from the disruption of a star by a massive black hole*

[10] Ho, Y. Q. A., Perley, D. A., **Yao, Y.** et al. 2022 October 14, ApJ, **938**, 85
*Cosmological Fast Optical Transients with the Zwicky Transient Facility: A Search for Dirty Fireballs*

[9] Ho, Y. Q. A., Margalit, B., Bremer, M., Perley, D. A., **Yao, Y.** et al., 2022, ApJ, **932**, 116
*Luminous Millimeter, Radio, and X-Ray Emission from ZTF 20acigmel (AT 2020xnd)*

[8] Perley, D. A., Sollerman, J., Schulze, S., **Yao, Y.** et al., 2022, ApJ, **927**, 180
*The Type Icn SN 2021csp:*
*Implications for the Origins of the Fastest Supernovae and the Fates of Wolf-Rayet Stars*
[7] Sazonov, S., Gilfanov, M., Medvedev, P., **Yao, Y.** et al. 2021, MNRAS, **508**, 3820
*First tidal disruption events discovered by SRG/eROSITA:*
*X-ray/optical properties and X-ray luminosity function at z<0.6*
[6] Perley, D. A., Ho, Y. Q. A., **Yao, Y.** et al. 2021, MNRAS, **508**, 5138
*Real-time Discovery of AT2020xnd: A Fast, Luminous Ultraviolet Transient with Minimal Radioactive Ejecta*
[5] Yadlapalli, N., Ravi, V., **Yao, Y.** et al. 2021, ApJL, 909, L27
*VLBA Discovery of a Resolved Source in the Candidate Black Hole X-ray Binary AT2019wey*
[4] Piro, A. L., Haynie, A., **Yao, Y.** 2021, ApJ, **909**, 209
*Shock Cooling Emission from Extended Material Revisited*
[3] Bulla, M., Miller, A. A., **Yao, Y.** et al. 2020, ApJ, **902**, 48
*ZTF Early Observations of Type Ia Supernovae III:*
*Early-Time Colors as a Test for Explosion Models and Multiple Populations*
[2] Miller, A. A., **Yao, Y.**, Bulla, M. et al. 2020, ApJ, **902**, 47
*ZTF Early Observations of Type Ia Supernovae II:*
*First Light, the Initial Rise, and Time to Reach Maximum Brightness*
[1] Zhou, Y., Feng, H., Ho, L. C., **Yao, Y.** 2019, ApJ, **871**, 115
*Evidence for Optically Thick, Eddington-limited Winds Driven by Supercritical Accretion*