Yuhan Yao

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Research Interests: Time Domain Astronomy & Observational High Energy Astrophysics

- Tidal disruption events: Origin of X-ray/UV/optical emission; Luminosity function; Relativistic jets
- Deaths of massive stars: Engine-driven explosions; Ultra-stripped events; Interaction-powered supernovae
- Accretion of black holes across the mass scale

Education

PhD Astrophysics, California Institute of Technology, USA — Expected 2023
- Thesis: *High Energy Transients with ZTF in the Era of X-ray Missions*
- Advisors: Prof. Shrinivas R. Kulkarni & Prof. Fiona A. Harrison

M. Sc. Astrophysics, California Institute of Technology, USA — 2020

B. Sc. Astronomy, Peking University, China — 2018

Honors and Awards

Garmire Scholarship, Caltech — 2021
Study Abroad Scholarship for Outstanding Students, China Scholarship Council — 2017
Benz Scholarship, Peking University — 2017
Summer Undergraduate Research Fellowship, Caltech — 2017
Kwang-Hua Scholarship, Peking University — 2015-16
First Prize in Undergraduate Physics Tournament (8/238), School of Physics, PKU — 2015

Successful Observing Proposals

PI Proposals

NICER Cycle 4 **($44k)**; *NICER* Observation of X-ray Bright Tidal Disruption Events" (300ks, ToO) — 2022
NuSTAR (DDT); *NuSTAR* observations of the Jetted Tidal Disruption Event AT2022cmc (80ks) — 2022
NuSTAR (DDT); *NuSTAR* observation of the Tidal Disruption Event AT2021ehb (80ks) — 2022
NICER (DDT); *NICER* observation of the Tidal Disruption Event AT2021ehb (100ks) — 2021
XMM-Newton AO-21; A Systematic Exploration of Late-time X-rays from ZTF TDEs (298ks) — 2021
Chandra Cycle 23 (**$77k**); Late-time *Chandra* Observations of eROSITA Selected TDEs (75ks) — 2021
Chandra DDT (**$23k**); *Chandra* Observation of AT2020mrf: the Most X-ray Luminous FBOT (40ks) — 2021
NuSTAR Cycle 7 (**$81k**); *NuSTAR* Observations of Tidal Disruption Events" (80ks, ToO) — 2021
NuSTAR Cycle 7; Understanding the Central Engine of Luminous FBOTs (80ks, ToO) — 2021
NuSTAR (DDT); *NuSTAR* Observation of the High-Mass X-ray Binary ZTF18abjpmzf (20ks) — 2020
NuSTAR (DDT); *NuSTAR* Observations of the Low-Mass X-ray Binary AT2019wey (120ks) — 2020
VLA (DDT); VLA observations of AT2019wey (6.3hr) — 2020
Swift (ToO); Submitted >60 approved *Swift* observations (>400ks) — 2018—22

Selected co-I Proposals

LRIS (ToO) Rapid Spectroscopy of Young and Fast ZTF Transients — 2018—21
LRIS (15 nights) Time Domain Astronomy with ZTF and *SRG* — 2021—22
ESI (4 nights) The Role of Black Hole Mass on the TDE phenomena — 2021—22
Gemini (ToO) A Rapid Response to the Youngest ZTF Explosions — 2019—21
Palomar 48-inch (5% of ZTF time) The ZTF-*SRG* shadowing survey — 2021

Invited Talks

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

Selection of Contributed Talks

Theoretical High Energy Astrophysics Group Meeting, U. Columbia, New York, NY 2022
The Spectacular X-ray Tidal Disruption Event AT2021ehb
STScI Science Coffee, Space Telescope Science Institute, Baltimore, MD 2022
The X-ray Bright Tidal Disruption Event AT2021ehb
UCB Explosive Seminar, U.C. Berkeley, Berkeley, CA 2021
AT2020mrf: the Most X-ray Luminous Fast Blue Optical Transient
ZTF Collaboration Meeting, virtual 2021
Tidal Disruption Events from ZTF and SRG
ZTF Collaboration Meeting, virtual 2020
AT2019wey: The Mysterious Galactic Low-mass X-ray Binary
Hot Wiring Transient VI Meeting, Evanston, IL 2019
Supernovae Experiments conducted by the Zwicky Transient Facility
GROWTH Collaboration Meeting, San Diego, CA 2019
Early observations of Type Ia Supernovae by the Zwicky Transient Facility

Service

Collaborations and Working Groups

Zwicky Transient Facility
Organizer of Weekly ZTF AGN/TDE Science Working Group Discussion 2020-21
Co-organizer of Weekly ZTF Transient Discussion at Caltech 2019-21
Ultraviolet Explorer (*UVEX*) AGN/TDE working group 2021-22
Advanced X-ray Imaging Satellite (*AXIS*) Time domain and multi-messenger working group 2022

Time Allocation Committee Reviewer

Palomar Hale Telescope; Liverpool Telescope 2020

Others

Co-organizer of Caltech X-ray Club 2020
Organized 34 lectures given by PIs or core members of various X-ray missions
Graduate Student Mentor, Caltech Astronomy Department 2019-21
Caltech Astronomy Colloquium Committee, Student Representative 2019-21

Teaching

University Teaching

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

Workshops

TA, GROWTH Summer School 2019-20

Public Outreach

Speaker, 240th AAS NASA Hyper-wall Booth, *NuSTAR: Ten Years of the High Energy Universe in Focus* 2022
Speaker, Astronomy on Tap (virtual, in Mandarin), *Searching for Stars Ripped Apart by Black Holes* 2021
Speaker, Amateur Astronomical Society, *Finding Supernovae from Mt. Palomar* 2020
Speaker, ZTF Summer Institute, *Early Observations of Type Ia Supernovae by ZTF* 2019
Volunteer, Caltech Astronomy Outreach Program 2018-19

Press Coverage

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

Publications

As of July 2022: First author refereed = **9** (including 1 submitted under review).
Total refereed = **53** (including 11 submitted under review).
Total citations = **1006**. h-index=**18**. i10-index=**33** (via ADS Metrics)

First Author Journal Publications

[9] **Yao, Y.**, Lu, W., Guolo, M., et al. 2022, arxiv:2206.12713 submitted
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, ApJ, **900**, 46
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, 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)

[#] Andreoni, I., Coughlin, M., Perley, D. A., **Yao, Y.**, et al. 2022, under review
Optical Discovery of a Relativistic Jet from the Tidal Disruption of a Star by a Supermassive Black Hole

[9] Ho, Y. Q. A., Perley, D. A., **Yao, Y.**, et al. 2022, arxiv:2201.12366
Cosmological Fast Optical Transients with the Zwicky Transient Facility: A Search for Dirty Fireballs

[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.**, 2020, 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