Chengchao Yuan

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Appointments

2022 -	**Postdoctoral Fellow**, Deutsches Elektronen-Synchrotron DESY, Germany
2018 - 2022	**Research Assistant**, Dept. of Physics, Penn State, USA
2016 - 2022	**Teaching Assistant**, Dept. of Physics, Penn State, USA
Summer 2015	**REU Intern**, Dept. of Astronomy and Astrophysics, Penn State, USA

Education

08/2022	**Ph.D. in Physics, Pennsylvania State University, USA** Supervised by Prof. Péter Mészáros and Prof. Kohta Murase Thesis: *Neutrino and Electromagnetic Counterparts of Galaxy and Astrophysical Black Hole Mergers*
06/2016	**B.Sc. in Astronomy, Nanjing University, China**

Research Interests

- HE astrophysics (CR acceleration, transport and radiation processes): theoretical & numerical
- Multimessenger astrophysics: gamma rays, neutrinos and cosmic rays from TDEs, compact objects (e.g., GRBs and FRBs), AGNs, and SMBH mergers

Fellowships & Awards

2022	**TDLI Prize Postdoctoral Fellowship**, Tsung-Dao Lee Institute (declined)
2021-2022	**W. Donald Miller Graduate Fellowship (x2)**, Pennsylvania State University
2019-2022	**David C. Duncan Graduate Fellowship (x4)**, Pennsylvania State University
2018	**APS Graduate Student Travel Grant**, American Physical Society
2017	**Homer F. Braddock Scholarship**, Pennsylvania State University
2016	**School of Astronomy and Space Science Dean's Scholarship**, Nanjing Univ.
2016	**Merit Student**, Education Department of Jiangsu Province, China
2015	**REU Intern Travel Grant** (host institution: Penn State), Nanjing University
2015	**Duxia Scholarship**, Nanjing University

Conferences and Scientific Talks

Invited talks & seminars

09/2024	**Roma International Conference on AstroParticle Physics (RICAP-24), Italy** *"Neutrinos from TDEs"*
09/2024	**NCfA Astrophysics Forum, UNLV, USA** *"Multi-Messenger Pictures for Neutrino-Emitting and Jetted TDEs"*
04/2024	**Oxford-Berlin Neutrino Lectures, Humboldt University Berlin, Germany**, *"Neutrinos from Tidal Disruptions of Massive Stars"*

02/2024 **2nd Numerical Lepto-Hadronic Modeling Workshop, Paris, France** *"Multi-Messenger Modeling of TDEs using AM^3"*

12/2023 **HE Astrophysics Seminar, Nanjing University, China**, *"Multi-Messenger Signals from TDEs"*

12/2023 **Astrophysics Colloquium, USTC, China**, *"Multi-Messenger Signals from TDEs"*

11/2023 **DESY Astroparticle Seminar**, *"TDEs in the Era of Multi-Messenger Astrophysics"*

08/2023 **Panelist of HE Transients, NEMMA Workshop, Penn State Univ.** *"Multi-Messenger Modeling of Neutrino-Coincident TDEs"*

04/2023 **CP3 seminar, UCLouvain, Belgium** *"Multi-Messenger Signals of Tidal Disruption Events and Supermassive Black Hole Mergers"*

02/2023 **Lepto-Hadronic Workshop, Bochum, Germany** *"Modeling the Hadronic Cascade Emission from Neutrino-Emitting TDEs"*

11/2022 **DESY THAT Seminar** *"Neutrino and Electromagnetic Counterparts of Galaxy and Compact Binary Mergers"*

03/2022 **University of Maryland CTC talk series** *"The Multimessenger View of Galaxy and Compact Binary Mergers"*

12/2021 **Columbia University HEP Seminar** *"The Multimessenger View of Galaxy and Compact Binary Mergers"*

11/2021 **DESY THAT Seminar** *"The Multimessenger View of Galaxy and Compact Binary Mergers"*

10/2021 **UNLV Astronomy Colloquium** *"The Multimessenger View of Galaxy and Compact Binary Mergers"*

10/2020 **Tohoku University Astroparticle Seminar, Japan** *"Galaxy and Supermassive Black Hole Mergers in the Era of Multi-Messenger Astrophysics"*

10/2020 **CCAPP AstroParticle Lunch, Ohio State University** *"High-energy neutrino emission from super-massive black hole (SMBH) mergers"*

09/2020 **Penn State Astronomy Lunch Talk** *"High-energy neutrino emission subsequent to gravitational wave radiation from SMBH mergers"*

08/2020 **Time-Domain High-Energy Messenger Astrophysics Workshop, University of Kyoto, Japan (virtual)** *"High-energy neutrino emission subsequent to gravitational wave radiation from SMBH mergers"*

06/2019 **IGC@25: Multimessenger Universe Workshop** *"Neutrino and Secondary Electromagnetic Emissions from Galaxy Mergers"*

08/2015 **Penn State Astronomy Lunch Talk** *"High-Redshift Star-Forming Galaxies as Hidden Neutrino Sources"*

Contributed conference talks & posters

08/2024 **TeVPA 2024, Chicago, USA** *"Neutrino and Electromagnetic Signals from TDE Isotropic Winds and Relativistic Jets"*

09/2023 **TeVPA 2023, Napoli, Italy** *"Neutrino and electromagnetic cascade models for tidal disruption events"*

07/2021 **EPS Conference on High Energy Physics** *"Jet-induced high-energy neutrino and electromagnetic counterparts of supermassive black hole mergers "*

04/2021 **APS April meeting (virtual)** *"Jet-induced high-energy neutrino and electromagnetic counterparts of supermassive black hole mergers"*

02/2021 **Institute for Gravitation and the Cosmos (IGC), Penn State (virtual)** *"High-energy neutrino emission subsequent to gravitational wave radiation from SMBH mergers"*

07/2019 **Poster: 36th International Cosmic Ray Conference (ICRC), Madison, WI** *"A Multimessenger Picture of Galaxy Mergers: Neutrinos and Electromagnetic Emissions"*

04/2018 **APS April meeting, Columbus, OH** *"Cumulative Neutrino and Gamma-ray Backgrounds from Halo and Galaxy Mergers"*

Software

Astrophysical Multi-Messenger Modeling (AM^3)

An open-source tool for time-dependent lepto-hadronic modelling of astrophysical sources

- **Documentation** - `https://am3.readthedocs.io/`
- **Developers:** Shan Gao, Marc Klinger, Annika Rudolph, Xavier Rodrigues, Chengchao Yuan, Gaëtan Fichet de Clairfontaine, Anatoli Fedynitch, Walter Winter, Martin Pohl
- **Contribution:** core developer; radiating blob expansion implementation; TDE examples; code tests; C++ documentation.

Programming Skills

- Programming languages: C++, Python, Mathematica and Fortran
- Extensive experience in using AM^3 and `CRpropa`

Mentoring

PhD Students

2023 - **Karlijn Kruiswijk**, Université catholique de Louvain '22, "GeV neutrinos from GRBs", co-mentored with Dr. Walter Winter and Prof. Gwenhaël de Wasseige

Master and Undergraduate Students

2024 **Andre Neubauer**, Humboldt-Universität zu Berlin (MSc, '23), "Multi-messenger emissions from collimated astrophysical jets"

2023 **Federico Testagrossa**, University of Padova (MSc, '22), DESY Summer School

2023 **David Raudales**, National Autonomous University of Honduras (BSc, '20), DESY Summer School

Teaching Experience

Oxford-Berlin Neutrino Physics Lecturer (Berlin, Germany, 2024)

Lecture Course on Neutrino Physics between Oxford University and Humboldt University Berlin

- Gave a lecture on time-dependent multi-messenger modeling using AM^3 software

DESY Summer School Lecturer (Zeuthen, Germany, 2023)

DESY Summer School on Astroparticle Physics for Undergraduate and Master Students

- Gave a lecture on the physics of GRBs and on the radiation processes in astroparticle physics
- Guided students to complete the analytical/numerical modeling of GRB afterglow emissions

Graduate Teaching Assistant (State College, PA, USA, 2016–2022)

Coordinating experiments/labs, grading assignments, offering office hours, and proctoring exams for graduate (G) and undergraduate (UG) courses in the Physics Department

- Laboratory coordinator and lecturer: Electromagnetism (UG), Introductory Physics (UG)
- Grader and office hour leader: Quantum Mechanics (G), Special and General Relativity (UG), Methods of Theoretical Physics (G)

Professional and Outreach Activities

Referee	**MNRAS, MNRAS Letters (since 2023); ApJ, ApJL (since 2024)**
2024	Organizing Committee Member for the 3rd Numerical Lepto-Hadronic Modeling Workshop
2023	Organizing Committee Member for the DESY Astroparticle Division Retreat
2022 -	DESY Theoretical Astroparticle Seminar Organizer
2021	Abstract Sorting Committee of AAS 239th Annual Meeting
2021	Journal Club Organizer for the Center of Multimessenger Astrophysics
2017 - 2022	Guest Lecturer and co-organizer for the AstroFest (4-night outreach, 2500+ visitors)
2018	Astropy Demonstrator at K-12 Educators - Bring Cutting-Edge STEM Research into Classroom (2-day outreach, 100+ high-school teachers)

References

Dr. Walter Winter (walter.winter@desy.de)
Group leader theoret. astroparticle physics
Deutsches Elektronen-Synchrotron (DESY), Zeuthen

Dr. Kohta Murase (murase@psu.edu)
Professor, Physics and Astronomy & Astrophysics
Pennsylvania State University, USA

Dr. Cecilia Lunardini (cecilia.lunardini@asu.edu)
Professor, Department of Physics
Arizona State University, USA

Dr. Péter Mészáros (nnp@psu.edu)
Eberly Chair Professor Emeritus, Astronomy & Astrophysics and Physics
Pennsylvania State University, USA

Publications

Google Scholar | ADS Library | iNSPIRE

1st-author publications: 10

1. **Yuan, C.**, Zhang, B. T., Winter, W., Murase, K., (2024), "Structured Jet Model for Multiwavelength Observations of the Jetted Tidal Disruption Event AT 2022cmc", arXiv: 2401.09320, ApJ in press
2. **Yuan, C.**, Winter, W., Lunardini, C., (2024), "AT2021lwx: Another Neutrino-Coincident Tidal Disruption Event with a Strong Dust Echo?", ApJ 969 136
3. **Yuan, C.,** and Winter, W. (2023), "Electromagnetic Cascade Emission from Neutrino-Coincident Tidal Disruption Events", ApJ 956 30
4. **Yuan, C.**, Murase, K., Guetta, D., Pe'er, A., Bartos, I., & Mészáros, P. (2022) "GeV Signature of Short Gamma-Ray Bursts in Active Galactic Nuclei", *ApJ* 932 80
5. **Yuan, C.**, Murase, K., Zhang, B. T., Kimura, S. S. & Mészáros, P. (2021) "Post-Merger Jets from Supermassive Black Hole Coalescences as Electromagnetic Counterparts of Gravitational Wave Emission", *ApJL*, 911 L15
6. **Yuan, C.**, Murase, K., Kimura, S. & Mészáros, P. (2020) "High-energy neutrino emission subsequent to gravitational wave radiation from supermassive black hole mergers", *Phys. Rev. D* 102, 083013
7. **Yuan, C.**, Murase, K. & Mészáros, P. (2020) "Complementarity of Stacking and Multiplet Constraints on the Blazar Contribution to the Cumulative High-Energy Neutrino Intensity", *ApJ*, 890:1
8. **Yuan, C.**, Murase, K. & Mészáros, P. (2019) "Secondary Radio and X-ray Emissions from Galaxy Mergers", *ApJ*, 878:76
9. **Yuan, C.**, Mészáros, P., Murase K. & Jeong, D. (2018) "Cumulative Neutrino and Gamma-Ray Backgrounds from Halo and Galaxy Mergers", *ApJ*, 857:50
10. **Yuan, C.** & Wang, F. (2015) "Cosmological Test Using Strong Gravitational Lensing Systems", *MNRAS*, 452:3

2nd-to-4th-author publications

11. Klinger, M., **Yuan, C.,** Taylor, A., Winter, W., (2024), "Lepto-Hadronic Scenarios for TeV Extensions of Gamma-Ray Burst Afterglow Spectra", arXiv:2403.13902, submitted to ApJ
    Contribution: model building and results interpretation; neutrino figure production
12. Klinger, M., Rudolph, M., Rodrigues, X., **Yuan, C.,** Fichet de Clairfontaine, G., Fedynitch, A., Winter, W., Pohl, M., Gao, S. (2023), "AM3: An Open-Source Tool for Time-Dependent Lepto-Hadronic Modeling of Astrophysical Sources", arXiv: 2312.13371, submitted to ApJS
    Contribution: code development, tests, and documentation; TDE section writing
13. Zhang, T. B., Murase, K., **Yuan, C**., Kimura, S. S. & Mészáros, P. (2020) "External Inverse-Compton Emission Associated with Extended and Plateau Emission of Short Gamma-Ray Bursts: Application to GRB 160821B", *ApJL* 908 L36

Contribution: model building and results interpretation; GRB code (AMES) developing

5th+-author publications

14. Zhang, B.T., Murase, K., Ioka, K., Song, D., **Yuan, C.**, Meszaros, P. (2023) "External Inverse-Compton and Proton Synchrotron Emission from the Reverse Shock as the Origin of VHE γ-Rays from Hyper-Bright GRB 221009A", ApJL 947 L14
    Contribution: model building and results interpretation