




YICHEN LIU

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EDUCATION

University of Illinois at Urbana-Champaign | College of Liberal Arts & Sciences **Aug 2022 - Present**
• Bachelor of Science (**Honor**) in **Astrophysics** and **Mathematics**, expected May 2024 **4.00/4.00**
• Minor in **Physics, Computer Science, and Chemistry**
University of Macau | Faculty of Science and Technology **Aug 2019 - May 2022**
• Completed Junior Year of **Applied Physics and Chemistry (Honour)**

PUBLICATIONS AND ABSTRACTS

- (YL:) **Yichen Liu**, et al., "Black hole - host galaxy relations of variable AGNs in DES C3, X3, and E2 fields up to $z \sim 4$ ", In prep.
- Yichen Liu**, Colin J. Burke, Charlotte A. Ward, Xin Liu, Priya Natarajan, "Host galaxy properties of HSC-SSP variable AGNs in the COSMOS field and expectations for Rubin Observatory", American Astronomical Society Meeting #243, id. 3936
- Grant Merz, **Yichen Liu**, Colin J. Burke, Patrick D. Aleo, Xin Liu, Matias Carrasco Kind, Volodymyr Kindratenko, Yufeng Liu, "Detection, Instance Segmentation, and Classification for Astronomical Surveys with Deep Learning (DeepDISC): Detectron2 Implementation and Demonstration with Hyper Suprime-Cam Data," MNRAS 526, 1122 (2023)
- Yichen Liu**, Peixia Zheng, and Hong-Chao Liu, "Anti-loss-compression image encryption based on computational ghost imaging using discrete cosine transform and orthogonal patterns," Optics Express 30, 14073 (2022)
- Peixia Zheng, **Yichen Liu**, and Hong-Chao Liu, "Single-pixel imaging and metasurface imaging," Infrared and Laser Engineering 50, 20211058-1 (2022)

RESEARCH EXPERIENCES

Research Assistant (advisor: **Professor Xin Liu**), *Department of Astronomy* **Sep 2022 - Present**

- Project 1 - instance segmentation in astronomical surveys using machine learning (NCSA SPIN internship)
 - Evaluated and optimized source extraction pipelines for **DeepDISC** and **Astro R-CNN** using **Sep** and **Scarlet** frameworks
 - Orchestrated simulations employing diverse models and configurations on PhoSim data via **HAL cluster** with **Detectron2**
 - Enhanced the pipeline by incorporating Transformer models, MViT and VitDet, to improve instance segmentation
- Project 2 - DES SED fitting
 - Performed SED fitting on sources cataloged in DES and WISE using the **CIGALE** toolkit
 - Developed selection criteria and identified AGN candidates from extensive source catalogs
- Project 3 - host galaxy properties of variable AGNs
 - Cross-referenced dwarf AGN candidates between HSC DR2 and subsequent catalogs (DR3, SIMBAD, DESI, and COSMOS2020)
 - Created scripts for batch downloading of optical spectra from various sources such as SDSS, zCOSMOS, Magellan, DEIMOS, among others, and reconciled discrepancies in redshift data across different databases
 - Determined black hole mass - host galaxy mass relation through SED fitting
 - Investigated star formation main sequence using **PyQSOFit** toolkit
- (YL:) Project 3.1 - Add DES, which will be another paper
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 - (YL:) Add DES, which will be another paper
- Project 4 - redshift estimation in astronomical surveys using machine learning (NCSA SPIN internship)
 - (YL:) Will resolve issues in DeepDisc in LINCC branch

Summer Research Internship (advisor: **Professor Chaojian Wu**), *National Observatory of China* **Jun 2022 - Aug 2022**

- Project - meteor slitless spectrum
 - Analyzed the spectral data of 2021 Gemini meteors captured with DSLR cameras equipped with diffraction gratings
 - Employed Python to dissect the intensities of Sodium and Magnesium lines
 - Developed machine learning algorithms for the automated detection and photometric assessment of meteor recordings

Research Assistant (advisor: **Professor Hongchao Liu**), *Institute of Applied Physics & Materials Engineering* **Aug 2019 - May 2022**

- Project 1 - ghost imaging in complex environment
 - Conducted a comprehensive review of contemporary ghost imaging and single-pixel imaging research
 - Assessed the quality of ghost imaging across various setups using MATLAB, producing reports and comparative analyses
 - Investigated the reflection patterns from distorting mirrors, contrasting them with standard mirror reflections to inform imaging technique improvements
- Project 2 - anti-loss image encryption based on ghost imaging
 - Executed experimental research into ghost imaging, investigating the potential of metamaterials and metasurfaces
 - Created Python algorithms leveraging compressive sensing and gradient descent methodologies.
 - Managed and fine-tuned computational imaging simulations on **PyTorch** with high-performance GPUs
 - Published a first-authored research paper as the first undergraduate student in the department, and **exposed by local media**
- Project 3 - ghost imaging using recurrent neural network
 - Collaborated with a team of postgraduate students in managing laser equipment for experimental setups
 - Validated existing ghost imaging techniques incorporating neural networks
 - Developed Python pipelines integrating recurrent and convolutional neural network architectures for ghost imaging

OBSERVATION EXPERIENCE

- Cerro Tololo Inter-American Observatory, Blanco 4m / DECam: 3 nights observation Jan 2023 - Apr 2023
- Personal remote observatory, BKP250 / QHY9sm: [astrophotography](#) and photometry Jul 2019 - Aug 2022

SYNERGISTIC ACTIVITIES

- Presentations: AAS 243rd Meeting, **Oral presenter**, Scheduled Jan 2024, LA, US
STEM Career Exploration and Symposium, **Poster Presenter**, Jul 2023, IL, US
NCSA lightning talk, **Oral presenter**, Jul 2023, IL, US
EU Contest for Young Scientists, **Poster Presenter**, Sep 2019, Sofia, Bulgaria
- Summer schools: University of California Berkeley (4.000/4.000), 2022
Shanghai Jiao Tong University (4.00/4.00), 2021
- Membership: LSST Dark Energy Science Collaboration

AWARDS AND GRANTS

- University of Illinois Dean's Honor List (2022-2023) Jul 2023
- Smart Star Sponsorship for studies at University of California, Berkeley Jun 2022
- University of Macau Dean's Honour List (2020 and 2022) Aug 2022
- Residential College Summer Programme Sponsorship for studies at Shanghai Jiao Tong university May 2021
- Third Prize, China Undergraduate Physics Tournament Oct 2020
- National Team Leader at the 2019 European Union Contest for Young Scientists Sep 2019
- University of Macau Full Scholarship (2019-2021) Aug 2019
- Bronze Medal, International Olympiad of Astronomy and Astrophysics Nov 2018
- First Prize, China Adolescents' Science and Technology Innovation Contest Aug 2018

TEACHING EXPERIENCE

Undergraduate Tutor of Department of Astronomy Jan 2023 - May 2023

- Designed and led interactive tutoring sessions for undergraduates majoring in Astronomy, covering foundational concepts in thermal physics, quantum physics, and astrophysics to supplement their introductory courses

Physics and Mathematics Educator on Youtube/Bilibili Sep 2021 - Present

- Produced and broadcasted educational content on physics and mathematics to a wide audience on the Bilibili platform, with a focus on undergraduate topics and self-study materials, notably complex variables.
- Achieved widespread outreach with [the most viewed video](#) surpassing 160,000 views, contributing to the public understanding of scientific concepts

Organizer and Lecturer of Seminar of Physics at the University of Macau Feb 2022 - May 2022

- Founded and co-organized a series of informal but comprehensive lectures with my peer, [Jiheng Duan](#), to provide advanced mathematical and physical concepts beyond the University of Macau's curriculum
- Addressed gaps in the theoretical understanding necessary for future research in physics, covering topics such as classical mechanics and partial differential equations for Department of Physics and Chemistry students
- Authored a comprehensive guide for freshmen at the Department of Physics and Chemistry, providing a roadmap for academic development and graduate study preparation.
- Regularly conducted sessions bi-weekly throughout the semester, maintaining a consistent and rigorous teaching schedule
- Personally developed and delivered *SPUM 102 The tools of physical tools*, a lecture series encompassing topics such as complex variables, gamma functions, integral transforms, delta functions, and Green's functions, with a detailed [syllabus](#) provided
- Made lecture recordings accessible to the public on [Youtube](#), extending the reach of these resources beyond the classroom

EXTRACURRICULAR EXPERIENCES

Director of Physics Society, University of Macau (Macau SAR, China) Aug 2020 - Feb 2021

- Established and expanded the Physics Society, leading promotional efforts and significantly growing its membership
- Guided undergraduates through the China Undergraduate Physics Tournament, enhancing the society's academic community

Student Helper at Department of Physics and Chemistry, University of Macau (Macau SAR, China) Jul 2020 - Oct 2020

- Handled equipment procurement processes and managed budget recommendations, streamlining the department's operations

Organizer of Beijing Astronomy and Astrophysics Olympiad (Beijing & Guangdong, China) Jan 2018 - Apr 2018

- Orchestrated the logistical planning of the 2018 Olympiad, liaising with high schools nationwide for participation
- Composed the Olympiad's examination materials, orchestrated material procurement, and supported the judging panels

President of Beijing Youth Astronomy Union (Beijing, China) Aug 2017 - Aug 2018

- Conducted educational series on astrophysics, providing Olympiad candidates with additional training resources
- Organized public stargazing events adjacent to Beijing's Olympic Park to foster community engagement in astronomy
- Managed the WeChat account "北京市中学生天文联盟", achieving widespread readership with posts exceeding 100,000 views

TECHNICAL SKILLS

- Programming: Python, \LaTeX , MATLAB, Git, Arduino, Shell Bash/Zsh, C/C++, Mathematica, Julia, docker, SQL, and Java
- Softwares: MaxIm DL, COMSOL, Altium Designer, KiCAD, Solidworks, Cinema 4D, and SPSS
- Python Packages: [AstroPy](#), [Scarlet](#), [PyTorch](#), [Detectron2](#), [CIGALE](#), and [PyQSOFit](#)
- Machine Learning: Neural (RNN, Mask R-CNN, ResNet, and Transformer)