YICHEN LIU

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EDUCATION

University of Illinois at Urbana-Champaign | College of Liberal Arts & Sciences **2022/08 - Present**
- Bachelor of Science (**Honor**) in **Astrophysics** and **Mathematics**, expected 2024/05 **4.00/4.00**
- Minor in **Physics**, **Computer Science**, and **Chemistry**

University of Macau | Faculty of Science and Technology **2019/08 - 2022/05**
- Completed Junior Year of **Applied Physics and Chemistry (Honour)**

PUBLICATIONS AND ABSTRACTS

1. (YL:) **Yichen Liu**, et al., "Black hole - host galaxy relations of dwarf AGNs in DES C3, X3, and E2 fields up to $z \sim$???", In prep. (It might takes 2 lines)
2. **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
3. 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)
4. **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)
5. Peixia Zheng, **Yichen Liu**, and Hong-Chao Liu, "Single-pixel imaging and metasurface imaging," Infrared and Laser Engineering 50, 20211058-1 (2022)

RSEARCH EXPERIENCES

Research Assistant (advisor: Professor Xin Liu), *Department of Astronomy* **2022/09 - 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 in the COSMOS field**
  - Cross-referenced variability-selected AGNs from HSC DR2 to subsequent 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 econciled discrepancies in spectral 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: Black hole - host galaxy relations of dwarf AGNs in DES field**
  - (YL:) Matched dwarf AGN candidates in the DES C3, X3, and E2 fields to ??? catalogs
  - (YL:) Will perform a simple PyQSOFit pipeline on this dataset
- (YL:) **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 Astronomical Observatory of China* **2022/06 - 2022/08**
- **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* **2019/09 - 2022/05**
- **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
  - Compared the reflection patterns between distorting and standard mirrors 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

SYNERGISTIC ACTIVITIES

Summer schools: University of California Berkeley (4.000/4.000), 2022
Shanghai Jiao Tong University (4.00/4.00), 2021

Presentations: AAS 243rd Meeting, **Oral presenter**, Scheduled Jan 2024, LA, US
STEM Career Exploration and Symposium, **Poster Presenter**, Jul 2023, IL, US
NCSA lighning talk, **Oral presenter**, Jul 2023, IL, US
EU Contest for Young Scientists, **Poster Presenter**, Sep 2019, Sofia, Bulgaria

Membership: LSST Dark Energy Science Collaboration

OBSERVATION EXPERIENCES

- Cerro Tololo Inter-American Observatory, Blanco 4m / DECam: 3 nights observation 2023/01 - 2023/04
- Personal Remote Observatory, BKP250 / QHY9sm: astrophotography and photometry 2019/08 - 2022/08

AWARDS AND GRANTS

- AAS 243rd Meeting Travel Grants from Department of Astronomy 2023/10
- University of Illinois Dean's Honor List (2022-2023) 2023/07
- Smart Star Sponsorship for studies at University of California, Berkeley 2022/06
- University of Macau Dean's Honour List (2020 and 2022) 2022/08
- Residential College Summer Programme Sponsorship for studies at Shanghai Jiao Tong university 2021/05
- National Team Leader at the 2019 European Union Contest for Young Scientists 2019/09
- University of Macau Full Scholarship (2019-2021) 2019/08
- Bronze Medal, International Olympiad of Astronomy and Astrophysics 2018/11

TEACHING EXPERIENCES

Physics and Mathematics Video Creator on Bilibili **2021/09 - 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, such as the zeta function
- Achieved widespread outreach with the most popular video surpassing 160,000 views, contributing to the public education

Undergraduate Tutor of Department of Astronomy **2023/01 - 2023/05**

- 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

Organizer and Lecturer of Seminar of Physics at the University of Macau **2022/02 - 2022/05**

- 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, 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
- 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

Astrophotographer, *Personal 25-centimeter Remote Observatory (Hebei, China)* **2018/01 - 2022/07**

- Sourced and developed a 2×2-meter remote observatory with full internet connectivity and a retractable roof
- Curated and calibrated a suite of astronomical equipment and 3D-printed accessories, which can be fully controlled remotely
- Conducted regular astrophotography sessions, capturing images of emission nebulae, with a selection showcased on my webpage.

Director, *Physics Society, University of Macau (Macau SAR, China)* **2020/08 - 2021/02**

- 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, *Department of Physics and Chemistry, University of Macau (Macau SAR, China)* **2020/07 - 2020/10**

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

President, *Beijing Youth Astronomy Union (Beijing, China)* **2017/08 - 2018/08**

- 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

Organizer, *Beijing Astronomy and Astrophysics Olympiad (Beijing & Guangdong, China)* **2018/01 - 2018/04**

- 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

SUMMARY OF 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)