YICHEN LIU

0000-0003-4247-0169
Chisen-Lupus
Yichen Liu
tel +1-(447) 902-2638
web https://yliu.fit
e-mail yl127@illinois.edu

EDUCATION

University of Illinois at Urbana-Champaign | College of Liberal Arts & Sciences **2022/08 - Expected 2024/05**
- Bachelor of Science (**Honor**) in **Astrophysics** and **Mathematics** **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**)

RSEARCH EXPERIENCES

Research Assistant (advisor: Professor Xin Liu), *Department of Astronomy* **2022/09 - Present**
- **Project 1: instance segmentation in sky surveys with deep 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: SED fitting and AGN selection of DES sources in Stripe 82 field**
  - Performed SED fitting on the Stripe 82 sample from DES varying assumptions about inclinations and AGN contributions
  - Developed selection criteria using χ^2 values and WISE phtotometries to identify AGN candidates from stars and galaxies
- **Project 3: host galaxy properties of variable AGNs in HSC COSMOS field**
  - Cross-referenced redshifts of 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 reconciled discrepancies in spectral data across databases by plotting and analyzing optical spectra
  - Investigated emission lines and continuum using `PyQSOFit` toolkit, generating a congruent finding as previous studies
  - Planned photometric studies such as host extraction ahead and present preliminary findings at AAS 243rd meeting
- **Project 4: black hole - host galaxy relation of AGNs in DES deep fields (leading)**
  - Updated photometric redshifts of dwarf AGN candidates in the DES C3, X3, and E2 fields to spectroscopic redshifts
  - Assembled publicly accessible spectra and displayed observations from Spitzer, VIMOS, VVDS, GAMA, MMT, and OzDES
  - Determined and visualized black hole mass - host galaxy mass relation through SED fitting using `CIGALE` toolkit
- **Project 5: redshift estimation of distant galaxies with deep learning** (NCSA SPIN internship)
  - Cooperated with graduate colleagues from LINCC institutes to incorporate `Rail` into the framework built upon Project 1

Summer Research Internship (advisor: Professor Chaojian Wu), *National Astronomical Observatory of China* **2022/06 - 2022/08**
- **Project: meteor slitless spectrum analysis captured by DSLR camera (leading)**
  - Analyzed the photos of 2021 Geminid meteor shower captured by commercial camera equipped with gratings
  - Dissected the intensities of Sodium and Magnesium lines using Python, adressing sodium variation in Geminid meteoroids
  - Developed machine learning algorithms for 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: stability of ghost imaging in varied environment conditions**
  - Conducted a comprehensive review of current studies in ghost imaging to understand the state-of-the-art in this field
  - 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: image encryption based on computational ghost imaging (leading)**
  - Executed experimental research into ghost imaging, investigating the potential of metamaterials and metasurfaces
  - Developed Python algorithms employing compressive sensing and gradient descent to optimize encryption efficiency
  - Optimized simulations utilizing high-performance GPUs on the `PyTorch` platform for enhanced processing capabilities
  - Published a first-authored research paper as the first undergraduate student in the department and exposed by local media
- **Project 3: Advancement in ghost imaging through neural network (leading)**
  - Collaborated with graduate students in managing digital micromirror device and laser equipmeent for experimental setups
  - Assessed existing ghost imaging techniques, integrating diverse neural network models for improved technique verification
  - Developed Python pipelines integrating recurrent and convolutional neural network architectures for ghost imaging

PUBLICATIONS AND ABSTRACTS

1. **Yichen Liu**, Xin Liu, et al., "Black hole - host galaxy relations of dwarf AGNs in DES supernova field up to $z \sim 3.4$", In prep.
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)

SYNERGISTIC ACTIVITIES

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

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
- Third Prize, China Undergraduate Physics Tournament 2020/10
- 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
- First Prize, China Adolescents' Science and Technology Innovation Contest 2018/08
- Second Prize, China National Astronomy Olympiad 2018/05

TEACHING EXPERIENCES

Undergraduate Tutor, *Department of Astronomy, University of Illinois at Urbana-Champaign (IL, US)* **2023/01 - 2023/05**
- Crafted and facilitated engaging tutorial workshops for undergraduate astronomy and physics majors, encompassing core principles in thermal physics, quantum physics, mechanics, and astrophysics, to enhance their foundational course understanding

Physics and Mathematics Video Creator on Bilibili *(Remote)* **2021/09 - 2022/08**
- Developed and disseminated instructional material in physics and mathematics for a broad audience on the Bilibili platform, focusing on undergraduate-level topics and autonomous learning resources, such as the computation of the zeta function
- Achieved widespread outreach with the most popular video surpassing 160,000 views, contributing to the public education

Organizer and Lecturer of Seminar of Physics, *University of Macau (Macau SAR, China)* **2022/02 - 2022/05**
- established and coordinated a comprehensive lecture series at the University of Macau with my peer, Jiheng Duan, delivering in-depth explorations of advanced mathematical and physical concepts that went beyond the standard curriculum
- Bridged the theoretical knowledge gaps crucial for advanced research in physics by covering an array of subjects from classical mechanics to partial differential equations, and essential tools like LaTeX and Git, for the benefit of physics students
- Authored a comprehensive guide for freshmen, providing a roadmap for academic development and graduate study preparation
- Developed and delivered *SPUM 102 The tools of physical tools*, a weekly 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 10-Inch Remote Observatory (Hebei, China)* **2019/08 - 2022/08**
- Sourced and developed a 2×2-meter unattended 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

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**
- 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/Jupyter, LaTeX, MATLAB, Git, Arduino, 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)