Chang **Liu**

Bachelor of Science, Astronomy

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"Explore the universe, benefit the society."

Education

Peking University — *Beijing, China*

Bachelor of Science (Hon), Astronomy — *Sep 2016 - Jun 2020*

- GPA 3.83/4, Rank 1/28

Northwestern University — *Evanston, US*

PhD Student, Astronomy — *Sep 2021 -*

Skills

Programming Python, Shell/Zsh, Fortran, Git

Languages Chinese, English

Research Experience

Department of Astronomy, Peking University — *Beijing, China*

Impact of an Active Sgr A* on the Synthesis of Molecular Species Throughout the Milky Way — *Jul 2018 - Nov 2019*

Mentors: Xian Chen & Fujun Du

- *Undergraduate Research & Training Program - National Innovation Training Program*
- Investigated the impacts of an AGN on the synthesis of prebiotic/organic molecules to indicate the potential correlation between an active supermassive black hole and both the origin and the evolution of life.
- Calculated the ionization rates of electromagnetic radiation caused by accretion of the supermassive black hole in the Milky Way with Galactic absorption considered.
- Completed the classic gas-phase network `osu_01_2007` by adding X-ray ionization and necessary grain processes important for synthesis of complex species.
- Simulated the chemical evolution of crucial precursors for interstellar prebiotic molecules with `KROME`, with the discovery of observable change in distribution for important molecules.

Astronomy Department, Caltech — *Pasadena, US*

A Systematic Search For Periodic White Dwarfs Using ZTF Data — *Jun 2019 - Aug 2019*

Mentor: Shrinivas R. Kulkarni

- *Summer Undergraduate Research Fellowship (SURF)*
- Explored the potential of the state-of-the-art time-domain facility - Zwicky Transient Facility (ZTF) by conducting a systematic search for periodic white dwarfs with periods lying within 1-3 hr.
- Conducted a cross match between *Gaia* and ZTF, selecting $\sim$ 90,000 *Gaia* sources with enough ZTF records.
- A number of 81 sources stood out as periodic under a well-designed periodogram based on Lomb-Scargle method.
- Analyzed the shapes of light curves derived from ZTF as well as color information from *Gaia* and PanSTARRS.
- Discovered various sources of interest including an unusual strongly ellipsoidal-modulated double white dwarfs system with an extremely low-mass (ELM) component.

Department of Astronomy and Astrophysics, UC Santa Cruz — *Santa Cruz, US*

The Hydrodynamics of Binary Mass Transfer in Compact Binaries — *Oct 2019 - Jun 2020*

Mentor: Enrico Ramirez-Ruiz

- *Undergraduate thesis*
- Studied the stability of mass transfer in a direct impact mass transfer white dwarf binary with hydrodynamical simulation.
- Built a 3-body integrator in Fortran to calculate the ballistic trajectory of a particle in Roche lobe overflow in a binary system.
- For the very first time, shed light on a fully hydrodynamical understanding on the rather complicated ultra-compact white dwarf binaries.
- Visualized and quantified the feedback of torques of the accreted materials on the orbital evolution of double white dwarfs with the open source Python package `yt`.

Department of Astronomy and Astrophysics, UC Santa Cruz *Santa Cruz, US (Remote)*

THE FLARE STRUCTURE OF REPEATING TDES *Oct 2020 -*

Mentor: Enrico Ramirez-Ruiz

- Systematically studied the unique phase space in terms of light curve morphology for repeating tidal disruption events (TDEs) in an eccentric orbit around SMBHs.
- With analytical arguements and fully hydrodynamical simulations, proved the similarity of the binding energy distribution in the tidally disrupted stellar debris in either periodic or parabolic orbit.
- Generalized the `STARS`, a mass fallback rate library based on 3D hydrodynamical simulations using realistic stellar models, to construct a library for light curves in repeating TDEs.
- Proposed a critical timescale of a single flare in a TDE, under which the flares are highly likely to repeat.
- For the first time, performed a case study for a candiate repeating TDE: ASASSN-14ko, and provided constraint on the orbital and stellar parameters.

The Kavli Instititute for Astronomy and Astrophysics, Peking University *Beijing, China*

A SEARCH FOR STELLAR-MASS BLACK HOLES IN MICROLENSING EVENTS *Sep 2020 - Aug 2021*

Mentor: Subo Dong

- *Research Assistant*
- Built a pipeline which automatically select microlensing candidates in Gaia Alerts and gather prerequisite knowledge for follow-up observations.
- Monitored and modeled several long-timescale microlensing candidates.
- Estimated the event rate of stellar-mass black holes based on an analytical Galactic model.

Honors & Awards

Oct 2020	**First prize & Lin-bridge Prize for Excellent Undergraduate Research**, 2020 PKU-DoA Undergraduate Astronomy Symposium
May 2020	**Outstanding graduates**, College Graduate Excellence Award of Beijing
May 2020	**Outstanding graduates**, College Graduate Excellence Award of Peking University
Oct 2019	**Merit Student**, Annual honor of 2018-2019, School of Physics, Peking University
Oct 2019	**PKU Scholarship**, Annual scholarship of 2018-2019, School of Physics, Peking University
Jun 2019	**PKU Scholarship in Physics**, School of Physics, Peking University
May 2019	**National Innovation Training Program**, Undergraduate Research & Training Program
Oct 2018	**Merit Student**, Annual honor of 2017-2018, School of Physics, Peking University
Oct 2018	**Weilin Scholarship**, Annual scholarship of 2017-2018, School of Physics, Peking University
Oct 2017	**Merit Student Pacesetter (the Highest Annual Accolade)**, Annual honor of 2016-2017, School of Life Sciences, Peking University
Oct 2017	**Arawana Scholarship**, Annual scholarship of 2016-2017, School of Life Sciences, Peking University
Sept 2017	**Third Prize**, The Alumni Cup for Summer Social Practice, School of Life Sciences, Peking University
Sept 2017	**Excellent Student Union Member**, Annual honor of 2016-2017, Student Union of School of Life Sciences of Peking University

Publications

- **Liu, C.**, Chen, X. & Du, F., *Impact of an Active Sgr A* on the Synthesis of Water and Organic Molecules Throughout the Milky Way*, 2020, ApJ, 899, 2.

Presentation

The Project Presentation for the SURF Program, Caltech *Pasadena, US*

A SYSTEMATIC SEARCH FOR PERIODIC WHITE DWARFS *Aug. 2019*

PKU-DoA Undergraduate Astronomy Symposium *Beijing, China*

THE CHEMICAL IMPACT OF AN ACTIVE SGR A* THROUGHOUT THE MILKY WAY *Sep. 2020*

Extracurricular Activity

Summer Camp of Astronomy for Outstanding Senior Students (Peking University) *Beijing, China*

VOLUNTEER *Jul. 2018*

- Helped prepare for the welcome day, offered guidance and service to campers

Investigation Group on Bike-sharing in Xiamen (School of Life Science) *Xiamen, China*

CORE MEMBER *Jul. 2017*

- Investigated the present condition and analyzed the future development of several brands of shared bikes in Xiamen, China
- In charge of organizing the draft of both our investigation proposal and the report

Department of Daily Life, Student Union (School of Life Science) *Beijing, China*

MEMBER *Sept. 2016 - Jun. 2017*

- Organized various activities to improve the life quality including organizing social mixers and designing games for the New Year Party
- Helped design a questionnaire and conducted a census on the current living and studying conditions of students in School of Life Sciences, reflected the problems to the dean and negotiated possible solutions
- In charge of *Calendar of Species* program of the WeChat public account of the Student Union; conducted popular science promotion about various plants in literary essays

References

Prof. Xian Chen *Beijing, China*

XIAN.CHEN@PKU.EDU.CN *The Kavli Institute for Astronomy and Astrophysics, Peking University*

Prof. Shrinivas R. Kulkarni *Pasadena, US*

SRK@ASTRO.CALTECH.EDU *Astronomy Department, California Institute of Technology*

Prof. Enrico Ramirez-Ruiz *Santa Cruz, US*

ENRICO@UCOLICK.ORG *Department of Astronomy and Astrophysics, UC Santa Cruz*

Prof. Subo Dong *Beijing, China*

DONGSUBO@PKU.EDU.CN *The Kavli Institute for Astronomy and Astrophysics, Peking University*