

# Xinlun CHENG

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<https://chengxinlun.github.io>

## EDUCATION

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**School of Data Science, University of Virginia**

Jun 2021 – May 2022

➤ MS Data Science (Residential);

**Department of Astronomy, University of Virginia**

Aug 2019 – Present

➤ Astronomy PhD student; Major GPA: 4.0/4.0

**Department of Physics, Tsinghua University**

Aug 2014 – Jul 2018

➤ Bachelor of Science in Physics; Major GPA: 3.7/4.0; Rank: 10<sup>th</sup>/100

## AWARDS & FELLOWSHIPS

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Jefferson Fellowship, Jefferson Foundation, University of Virginia

2022 – 2024

Dean's MS-PhD Fellowship in Data Science, UVa Graduate School of Arts & Sciences

2021 – 2022

## PUBLICATIONS

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Bozsik, S., **Cheng, X.**, Kuncham, M., Mitchell, E. (alphabetical ordering) 2022, IEEE Systems and Information Engineering Design Symposium (SIEDS)

Title: Democratizing Housing Affordability Data: Open Data and Data Journalism in Charlottesville, VA  
Policy Track Best Paper Award

**Cheng, X.**, Choi, Y., Olsen, K., Nidever, D., Majewski, S., Monachesi, A., Besla, G., Muñoz, C., Anguiano, B., Almeida, A., Muñoz, R., Lane, R., Nitschelm, C. 2022, *Astrophysical Journal*, 95, 11

Title: Kinematical Analysis of Substructure in the Southern Periphery of the Large Magellanic Cloud

**Cheng, X.**, Anguiano, B., Majewski, S. R., Hayes, C., Arras, P., Chiappini, C., Hasselquist, S., de Andrade Queiroz, A. B., Nitschelm, C., García-Hernández, D. A., Lane, R. R., Roman-Lopes, A., & Frinchaboy, P. M. 2020, *Astrophysical Journal*, 905, 49

Title: Exploring the Galactic Warp through Asymmetries in the Kinematics of the Galactic Disk

Anguiano, B., Majewski, S. R., Hayes, C. R., Allende Prieto, C., **Cheng, X.**, Bidin, C. M., Beaton, R. L., Beers, T. C., & Minniti, D. 2020, *Astronomical Journal*, 160, 43

Title: The Stellar Velocity Distribution Function in the Milky Way Galaxy

**Cheng, X.** 2020, *Research in Astronomy and Astrophysics*, 20, 2

Title: Search for strong galaxy-galaxy lensing in SDSS-III BOSS

**Cheng, X.**, Liu, C., Mao, S., & Cui, W. 2019, *Astrophysical Journal Letters*, 872, L1

Title: Ripple Patterns in In-plane Velocities of OB Stars from LAMOST and Gaia

## **TALKS & PRESS RELEASES**

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**IEEE Systems and Information Engineering Design Symposium (SIEDS)** Apr 28, 2022

- Presentation of Conference Paper
- Policy Track Best Paper Award

**AAS Press Release** Jan 15, 2021

### **237<sup>th</sup> AAS Meeting**

- Press release of the research on Galactic Warp presented in Cheng et al. (2020) paper.
- Picked up by multiple media around the world in many different languages: phys.org, IFL Science, science springs, SYFY WIRE, Europa Press (Spanish), CanalTech (Brazil), RIA (Russian), etc
- Front page article in the Charlottesville Daily Progress Newspaper, “Galactic smack may have caused Milky Way warp, UVa researchers say” (Mar. 27, 2021)
- Front page article in UVA Today, “A WARP IN THE MILKY WAY LINKED TO GALACTIC COLLISION” (FEB. 4, 2021)

**AAS Talk** Jan 12, 2021

### **237<sup>th</sup> AAS Meeting**

**Science Talk** Oct 26, 2020  
**Institute of Advanced Study, Princeton**

## **RESEARCH EXPERIENCE**

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**Graduate Research Assistant** Jun 2022 – Present

**Advisor: Professor Steve Majewski**

**Department of Astronomy, University of Virginia**

Searching for White Dwarf Main Sequence (WDMS) Binary Systems with Neural Networks

- Search through millions of low resolution stellar spectra from Gaia Data Release 3
- ~700 confirmed WDMS systems with both high and low resolution spectra as training sample
- Data augmentation with synthetic training data
- Developing a two-headed neural network to classify WDMS systems and fit orbital parameters
- Interpreting the decision-making process of the trained model through visualization methods

**Graduate Research Assistant** May 2022 – Present

**Advisor: Professor Stephen Baek**

**School of Data Science, University of Virginia**

Accelerating Spin Dynamics Numerical Simulation with Physics-Aware Neural Networks

- Accelerating quantum mechanics simulation with neural networks
- Developing a neural network for inference of force that would preserve  $SO(3)$  rotational symmetry in the underlying physics system
- Developing a physics-aware neural network that could replace the traditional FEM numerical solver

for the spin dynamics problem

**Graduate Research Assistant**

Sep 2021 – Apr 2022

**Advisor: Professor Jonathan Kropko**

**School of Data Science, University of Virginia**

Democratizing Housing Affordability Data: Open Data and Data Journalism in Charlottesville, VA

- Combing multiple data sources, including Census, Charlottesville Open Data Portal and Bureau of Labor Statistics
- Coding and hosting an interactive dashboard to visualize the dataset
- Experience with UI design and user testing

**Graduate Research Assistant**

May 2020 – Mar 2022

**Advisor: Professor Steven Majewski**

**Department of Astronomy, University of Virginia**

Kinematical Analysis of Substructure in the Large Magellanic Cloud

- Millions of stars from Gaia Early Data Release 3
- Examined kinematical substructures in the periphery of the Large Magellanic Cloud
- Collaboration with research group from NMSU, STScI and NOAO
- Lead author paper published in the *Astrophysical Journal*

**Graduate Research Assistant**

Mar 2020 – Present

**Advisor: Professor Steven Majewski**

**Department of Astronomy, University of Virginia**

Density Map of the Milky Way Galaxy

- Millions of stars from Gaia Data Release 3
- Computed intrinsic velocity dispersions by removing the contribution from uncertainty of individual stars
- Combined Jeans Equation and Poisson Equation to measure the surface density of any given point in our Galaxy
- Compared to models of visible matter to extract the distribution of dark matter
- Paper in preparation for publication

**Graduate Research Assistant**

Aug 2019 – Dec 2020

**Advisor: Professor Steven Majewski**

**Department of Astronomy, University of Virginia**

Exploring asymmetries in the kinematics of the Galactic disk with Gaia and APOGEE

- SDSS-IV Project 0722
- Converted observables to phase-space information
- Compared observation results to existing numerical simulation
- Built a simple warp model with Jeans equation
- Paper published in the *Astrophysical Journal*

**Research Assistant**

May 2018 – Mar 2019

**Advisor: Professor Chao Liu**

**National Astronomical Observatory of China**

Galactic kinematics with OB stars from LAMOST-Gaia dataset

- Coded adaptive kernel density estimation (KDE) in Python
- Extracted kinematics structure from dataset with various methods
- Determined most possible theoretical explanation for observed ripples in radial velocity
- Paper published in *Astrophysical Journal Letters*

**Research Assistant**

Sep 2017 – Jul 2019

**Advisor: Professor Shude Mao**

**Department of Physics, Tsinghua University**

Confirmation of strong lensing candidates using CFHT Megacam

- Refined the candidate list from previous research experience during June 2017 - September 2017
- Wrote observational proposal and designed details (exposure time, sequence of observation, etc.) of observations
- Applied and approved for CFHT Megacam observation (18BS06) in September 2018 as the Principal Investigator
- Processed Megacam imaging data (coadding, psf, photometry and foreground removal)
- Paper published in *Research in Astronomy and Astrophysics*

**Undergraduate Research Assistant**

Jun 2017 – Sep 2017

**Advisor: Professor Jean-Paul Kneib**

**École Polytechnique Fédérale de Lausanne**

Searching for galaxy-galaxy strong lensing candidates in SDSS-III BOSS

- Improved previous spectroscopic searching method
- Data-processing code exceeds 10 thousand lines of Python
- Searched through the entire database (~1.5 million galaxies) within 12 hours
- Compiled a list of most possible strong lensing candidates

**Undergraduate Research Assistant**

Feb 2016 – May 2017

**Advisor: Professor Charling Tao**

**Department of Physics, Tsinghua University**

Searching for super-Eddington accreting black holes candidates in SDSS-III Reverberation Mapping campaign

- Built spectra decomposition programs from scratch in Python
- Extensive literature reading
- Compared Radius-Luminosity relationship with results from other researchers

## **Teaching**

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**Teaching Assistant**

Jan 2021 – May 2021

**ASTR 3130 Observational Astronomy**

University of Virginia

Course instructor: Professor Steven R. Majewski

**Lab Operator** Sep 2020 – Dec 2020  
**Telescope Observation**  
University of Virginia  
Lab operator for telescope observations at night labs. Due to Covid-19 pandemic, the lab was remote only.

**Teaching Assistant** Sep 2020 – Dec 2020  
**ASTR 1210 Introduction to the Night Sky and Solar System**  
University of Virginia  
Course instructor: Professor Trinh Thuan

**Teaching Assistant** Sep 2020 – Dec 2020  
**ASTR 1210 Introduction to the Night Sky and Solar System**  
University of Virginia  
Course instructor: Professor Ed Murphy

**Teaching Assistant** Jan 2020 – May 2020  
**ASTR 3130 Observational Astronomy**  
University of Virginia  
Course instructor: Professor Mike Skrutskie

**Lab Operator** Sep 2019 – Dec 2019  
**Constellation quiz night-lab**  
University of Virginia  
Lab operator for constellation quiz night-lab. In charge of 10pm-11pm session every Monday and Thursday.

**Teaching Assistant** Sep 2019 – Dec 2019  
ASTR 1210 Introduction to the Night Sky and Solar System  
University of Virginia  
Course instructor: Professor Ed Murphy

**Teaching Assistant** Sep 2019 – Dec 2019  
ASTR 1210 Introduction to the Night Sky and Solar System  
University of Virginia  
Course instructor: Professor Zhi-Yun Li

## **Public Outreach**

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**Telescope Operator** Nov 2020  
**Dark Skies-Bright Kids star party**  
University of Virginia  
Took part in star party organized by Dark Sky Bright Kids (DSBK) on Nov 14. In charge of operating the Celestron 14-inch telescope and live-streaming to DSBK Facebook.

**Telescope Operator** Nov 2019  
**McCormick Public Night**  
Took part in McCormick public night on Nov 3. In charge of operating 6-inch Alvin-Clack telescope and Meade 14-inch LX200, and observation target selection for the night.

**Constellation Tour Guide** Oct 2019  
**DSBK star party**  
Took part in star party organized by Dark Sky Bright Kids (DSBK) on Oct 28. In charge of giving constellation tour to about 500 audiences. Also helped with telescope setting-up.

**Member** Sep 2019 – Present  
**Dark Sky Bright Kids (DSBK)**  
Member of outreach group Dark Sky Bright Kids.

- Operated telescopes during star party
- Planned weekly outreach activity during planning meeting

**Kernel Member** Jan 2015 – Present  
**Tsinghua Student Astronomy Association**  
Kernel member of Tsinghua Student Astronomy Association

- Operated the Association with other kernel members in the Management Council
- Organized on-campus and off-campus stargazing/telescope observations
- Led groups of students through multiple stargazing trips
- Organized public night for university observatory
- Shared stargazing and astrophotography knowledge with members and general public through online tutorials and offline lectures

## **SKILLS AND OTHERS**

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**Programming:** Experience in both scientific computation and data science

- MSDS: familiarity with data mining, Bayesian machine learning, deep learning with both Tensorflow/Keras and PyTorch, can work in Python and R
- Multiple programming languages: Python, R, C++, Fortran, Java, Linux bash
- Developed reservation and check-in program for campus observatory
- Developed course selection helper program for better chance of obtaining hot courses
- Currently maintaining a planetarium software on Android, Stellarium

### **Astrophotography**

- Planets, nebulae, and galaxies
- Star-trails

### **Language Skills**

- Chinese (native), English (fluent)