

# Curriculum Vitae

## Alice Cai

Northwestern University  
Department of Physics & Astronomy  
CIERA - Center for Interdisciplinary  
Exploration and Research in Astrophysics

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## Education

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### Astronomy PhD Student, Northwestern University

*Aug 2023 - Present*

2nd-year graduate student in the Department of Physics & Astronomy at Northwestern. Advised by Professor Wen-fai Fong at the Center for Interdisciplinary Exploration and Research in Astrophysics (CIERA).

### Bachelor of Science in Mathematics and Physics & Minor in Astronomy, Case Western Reserve University

*Jan 2020 - May 2023*

GPA: 4.0 | Math and Physics GPA: 4.0

Coursework included: Differential Equations, Linear Algebra, Real Analysis, Complex Analysis | Thermodynamics and Statistical Mechanics, Computational Methods in Physics, Quantum Mechanics I and II, Electricity and Magnetism I and II, Quantum Computing Information and Devices, General Relativity | Stars and Planets, Galaxies and Cosmology, Cosmology and Structure of the Universe

## Awards and Honors

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### Polykarp Kusch Prize, Case Western Reserve University

*2022 - 2023*

Awarded to an outstanding senior in physics for best thesis.

### Donald A. Glaser Award, Case Western Reserve University

*2022 - 2023*

Awarded to an outstanding mathematics and physics student.

### John Schoff Millis Award, Case Western Reserve University

*2020 - 2023*

Best academic record in the College of Arts & Sciences.

### Junior-Senior Scholarship, Case Alumni Association

*2022 - 2023*

Undergraduate scholarship awarded to outstanding juniors and seniors.

Funded by: Labuda Family Endowed Scholarship Fund, Thomas Uhrig Scholarship Endowment Fund, Irving F. Laucks '04 Scholarship Fund

### Merit Scholarship, Case Western Reserve University

*2022 - 2023*

Undergraduate university scholarship awarded on merit to admitted students.

### Recognition as a Piano Soloist

1st place winner of Rondo Young Artist Festival, earning a performance at Carnegie Hall

*2015*

Attained highest award at the high school level in New York state, earning a performance at the

*2015*

NYSSMA All-State Piano Showcase in Rochester

## Conferences/Presentations

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APS Conference for Undergraduate Women in Physics

*Jan 2022*

APS Conference for Undergraduate Women in Physics

*Jan 2023*

CWRU SOURCE Intersections Poster Presentation

*Apr 2023*

*Uncertainty Analysis for the Zooniverse Countertop Dark Matter Search*

## Research Experience

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### **Current Research, Northwestern University**

*Oct 2024 - Present*

*Professor Wen-fai Fong*

I am currently working in optical follow-up of fast radio burst (FRB) hosts, and have joined the CHIME (Canadian Hydrogen Intensity Mapping Experiment) collaboration as well as the Fast and Fortunate for FRB Follow-up collaboration. I am leading an initiative to produce a litany of host galaxy properties for every optical spectrum of an FRB host, as studying them can reveal clues about their progenitors.

### **1st-Year Graduate Research, Northwestern University**

*Jan 2024 - Oct 2024*

*Professor Elena Murchikova*

In my first project, I investigated the amplified emission of H30 $\alpha$  from cool gas around Sagittarius A\* (Sgr A\*), the supermassive blackhole at the center of our galaxy. Since maser theory as we know it does not allow for masing to occur without full line-of-sight, I conducted extensive literature review and looked at possible scattering mechanisms that could lead to this masing-like result.

I then worked on observational project processing radio data from Atacama Large Millimeter Array (ALMA) into a high resolution image of the Galactic Center to identify component species and probe the kinematics and structure of the interstellar medium surround SgrA\*.

### **Senior Research Project, Case Western Reserve University**

*Aug 2022 - Apr 2023*

*Professor Glenn Starkman*

The project is a search for evidence of macroscopic dark matter in granite slabs, such as those for kitchen countertops. We successfully launched the beta phase of this project (Countertop Dark Matter) in spring of 2023 on Zooniverse to crowd-source classification data through public outreach. I performed uncertainty analysis on our user confusion matrices, used to determine subject retirement and promotion. This project will help place preliminary limits on the size and mass of dark matter macros.

### **Physics REU Student, University of Notre Dame**

*May 2022 - Jul 2022*

*Professor Evan Kirby*

I analyzed the spectra of stars in globular cluster M15, taken from the Keck Observatory Archive, to calculate and compare the abundances of light and heavy elements. The analysis investigated a strangely large dispersion in rapid neutron capture elements, and employed python, IDL, and MOOG. In mid-August of 2022, I joined Professor Kirby in remotely observing using the Keck telescope to gather more data for this project. There is currently a paper in prep.

### **Lab Assistant, Case Western Reserve University**

*Jan 2022 - May 2022*

*Professor Xuan Gao*

I assisted one of Professor Gao's graduate student's research and created, measured, and analyzed 2D semiconductor devices using materials such as GaS, InSe, and graphene. My work in this lab led to a co-authored paper that was just submitted.

### **Lab Intern, National Taiwan University**

*Aug 2019 - Dec 2019*

*Professor Jiun-Yun Li*

At the Quantum Electronics Laboratory, I measured and analyzed transistors at both room and low (4K) temperatures, and conducted a measurement of the hall effect. I gained experience in working with Origin, probe stations, vacuum systems, wire bonding, and cryogenic measurements.

## Publications

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*Modulation Doping and Reduced Hysteresis in Monochalcogenide InSe/GaS Heterostructure 2D Field Effect Transistors.* Deagueros, E., Gao, M., **Cai, A.**, Ulaganathan, R. K., Mani, S., Sankar, R. and Gao, X.. ACS Applied Materials & Interfaces (submitted)

## Outreach

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### **Adler Planetarium Volunteer, Chicago**

*Nov 2024 - Present*

I volunteer as a presenter as part of the Adler Planetarium's Astronomy Conversations program and interact with the public in the Adler's Space Visualization Laboratory.

### **REACH Further Mentor, CIERA**

*Jul 2024*

REACH (Research Experiences in Astronomy at CIERA for High School Students) is a 3-week program for high school students to experience astronomy research, where they gain an intro to necessary research skills, including python and a background in astronomy. I mentored a student in the optional extension of REACH called REACH Further, leading a project on exoplanet detection via the radial velocity method.

### **Astronomy Night Out Volunteer, CIERA**

*May 17, 2024*

I volunteered to help with CIERA's 3rd annual Astronomy Night Out, a public lecture by a CIERA Astronomer followed by family activities and telescope observing at Northwestern campus' Dearborn Observatory. I helped with the initial set up and then led groups to and from the observatory.

## Teaching Experience

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### **Math and Science Tutor, self-employed**

*Jul 2020 - Present*

I tutor middle and high school students in Taiwan, with class sizes ranging between 4 to 10, though I've recently also held 1-on-1 sessions. Topics include math, chemistry, and physics, and I've also held supplementary classes to specifically prepare them for AMC. Typically for each class, I create detailed lecture slides, notes, and homework.

### **Teaching Assistant, Northwestern University**

*Fall 2024 and Spring 2025*

ASTRON 120 Highlights of Astronomy, ASTRON 111 Introduction to Astrobiology:  
Along with grading and holding office hours, I lead weekly tours at the campus observatory.

## Leadership

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Secretary for the Case Quantum Computing Club (Case Western Reserve University)

*Sep 2022 - May 2023*

Co-founder of the Togetherness Committee in Northwestern's Physics and Astronomy Graduate Student Council (PAGSC), aiming to reunify astronomy and physics students.

*Oct 2023 - Jun 2024*

Co-chair of the Social Committee of PAGSC, leading the organization of social events for the Physics and Astronomy Department to foster inclusivity and camaraderie.

*Sep 2024 - Present*

## Skills

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**Programming/Computer Skills:** Python (astropy, numpy, pandas, scipy, specutils, matplotlib), Java, Javascript, Matlab, LaTeX, Origin

**Soft Skills:** Presentation skills, organization, leadership, teamwork, time management, work ethic

**Languages:** English (native), Mandarin Chinese (fluent), Shanghainese (fluent)