

# ANTONIO TANG

Department of Physics

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## EDUCATION

### Yunnan University

Kunming, China

#### Bachelor of Science in Physics

Sept. 2020 – June 2024

- GPA: Major: 3.9/4.0 Upper Division: 3.9/4.0 Cumulative: 3.7/4.0 (rank: 1/50)

### Fudan University

Shanghai, China

#### Joint-Cultivated Undergraduate Program

Sept. 2021 – April 2022

- Expected to finish in June 2023, but withdrew due to the 2022 Shanghai Spring Lockdown

### University of Notre Dame

Notre Dame, IL, US

#### International Summer Undergraduate Research Experience (iSURE)

July 2023 – Aug. 2023

- Understanding the origin of the cluster population in the M33 galaxy

### University of California, Santa Barbara

Santa Barbara, CA, US

#### International visiting student

Jan. – Mar., Sept. 2024 – Present

- GPA: 3.8/4.0
- Graduate Courses: High Energy Astrophysics, Classical Mechanics

## RESEARCH EXPERIENCE

### ♦ Theory and Simulation Projects

#### Nuclear burning in an accretion flow around a stellar-mass black hole embedded within an AGN disk

Supervisor: Prof. Yang Luo, Yunnan University

May 2023 – Nov. 2024

A new type of fast accretion black hole (accretion-modified star, AMS) could form in the disk of an AGN. The AMS could collapse to a SMBH at the end stage of stealer evolution. It accretes very fast and may bring some new features.

- Solved the structure of the accretion disks with Eddington ratio around  $10^6 - 10^9 \dot{M}_{\text{edd}}$  using the 4th-order Runge-Kutta Method.
- Simulated the nuclear network reactions in the fast accretion disk onto SMBH using an open-source FORTRAN code (the workhorse of MESA)
- The simulation result showed a significant burning of  $^{12}\text{C}$  and  $^3\text{He}$  and a rise in the mass ratio of O/C and N/C. This may be interpreted as an indication of super-solar metallicity in the broad line region.
- This work has led to Tang, Z., Luo, Y., & Wang, J.-M. (2024). *MNRAS*, 535(4), 3050–3058.

#### Simulation and Visualization of Phase Transitions in the 2D Ising Model

May 2023 – July 2023

Supervisor: Distinguished Prof. Bo Zheng, Zhejiang University

Implemented Monte-Carlo methods to simulate the Paramagnetism-Ferromagnetism phase transition in the 2D Ising model as temperature varies.

- Simulated the phase transition of the system using the Wolff Algorithm and Metropolis Algorithm, and calculated thermodynamic parameters and order parameters
- The simulation results showed that the cluster-flip strategy of the Wolff Algorithm brought a much faster convergence in computing and closer to the theoretical predictions
- Created a GIF animation for the evolution process of the 2D Ising model to illustrate the system's condensing process in the same spin direction (symmetry breaking)

### ♦ Experimental Research for Freshmen

#### Measuring Minuscule Elongation: a project for Chinese Undergrad Physics Experiment Competition (CUPEC)

May 2020 – Oct. 2020

Used the principle of diffraction to measure the elongation of metal wires and calculate its Young's Module.

- Set up an optical path in the perpendicular direction of a metal wire; utilized a narrow slit attached to the wire to create the conditions for single-slit diffraction.
- Measured the positions of dark fringes before and after elongation by an optical power meter to calculate Young's Module of metal wires; applied method of successive differences for data processing to reduce measurement errors
- Led the three-person team to win the First Prize of YNU and the National Second Prize

## ◆ Application Developments

### Development of a 24-Point Game Based on LabVIEW

May 2022 – July 2022

Used LabVIEW to develop a Poker game that requires the user to input a solution that solves the four given numbers to 24 and automatically provides hints based on the user's input

- Utilize the visualization of LABVIEW to show the game in the front panel. A group of numbers are randomly picked. The user inputs the answer to solve the equation to 24. The program will judge the user's input and give corresponding prompts.
- To compensate for the deficiency of LabView in processing string data, the Python node was used to call the external Python program to calculate the user input in real time and give the reference answer.

### Development of simulating Light Diffraction Based on PyQt Module

Oct. 2021 – Jan. 2022

- Used the PyQt5 module to simulate the diffraction of light passing through various optical objects, such as single slits and gratings, and display the penetrated light intensity distribution. The user can change the parameters, such as the width of the slit and the distance from the slit to the light source, to get a real-time change in the intensity.
- This program is practical in multimedia teaching. It can help students directly perceive the impact of changes in various parameters on light transmission.

## PUBLICATION

- **Tang, Z.-F.,** Luo, Y., & Wang, J.-M. (2024). Nuclear burning in an accretion flow around a stellar-mass black hole embedded within an AGN disc. *MNRAS*, 535(4), 3050–3058. <https://doi.org/10.1093/mnras/stae2557>

## WORKSHOPS AND CONFERENCES

<b>Advanced Topics in Quantum Mechanics</b> Summer School in Peking University	Beijing, China July 7 <sup>th</sup> –Aug. 3 <sup>rd</sup> , 2022
<b>The 2<sup>nd</sup> Workshop on Astrophysical Phenomena of Accretion Modified Stars in the AGN disk</b> <a href="https://astro.hust.edu.cn/info/1097/2240.htm">https://astro.hust.edu.cn/info/1097/2240.htm</a>	Wuhan, China May 10–13 <sup>th</sup> , 2024
<b>The Frontier of Machine Learning and Statistical Physics: A Workshop in Fall</b> <a href="https://conferences.koushare.com/spcsc2023/custom/584">https://conferences.koushare.com/spcsc2023/custom/584</a>	Kunming, China July 7 <sup>th</sup> –Aug. 3 <sup>rd</sup> , 2023
<b>The 7th Conference on Statistical Physics and Complex Systems</b> <a href="https://conferences.koushare.com/spcsc2023/custom/584">https://conferences.koushare.com/spcsc2023/custom/584</a> (Concurrently held with the Workshop)	Kunming, China July 19 <sup>th</sup> –Aug. 1 <sup>st</sup> , 2023
<b>The 18th Peng Huanwu Theoretical Physics Forum</b> <a href="https://itp.cas.cn/llw/zk/zxw/202305/t20230518_6758627.html">https://itp.cas.cn/llw/zk/zxw/202305/t20230518_6758627.html</a>	Kunming, China May 10–15 <sup>th</sup> , 2023

## AWARDS AND HONORS

- **First Prize Scholarship at Yunnan University** (annually awarded to top 2 undergraduates in the college) Sept. 2021
- National Second Prize of the China Undergraduate Physics Experimental Competition (CUPEC) Nov. 2021

## SERVICE AND OUTREACH

- **POLITICAL PROTEST:** Led students to participate in the “**White Paper Protests**” and opposed the Chinese Communist Party government's harsh lockdowns and restrictions on individual freedoms during the pandemic Sept.–Dec. 2022

- On-campus job position: worked at the International Student Exchange Office at Yunnan University, successfully facilitated the establishment of Yunnan University's first undergraduate English transcript system. May–Nov. 2023
- Red Cross Member at Fudan University: Served as an aidman in the University's basketball team 2021–2022
- Electronic Sports: Leader of the *Three Kingdoms Kill* team under the Fudan University Starry Sky Board Game Alliance 2021–2022
- Founder of the Fudan University Joint-Cultivated Student Union: We searched stories, shared the experiences at Fudan, and offered advice and support to students from other universities studying at Fudan, helping these under-representatives adapt to academic and campus life 2021–2024

#### ADDITIONAL INFORMATION

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- **Programming:** Python, Linux Shell, FORTRAN, C/C++
- **Software:** Mathematica, MATLAB, LabVIEW, Arduino
- **Standardized tests:** GRE 315 (Quantitative Reasoning: 163, Verbal Reasoning: 152); GRE-Physics (810)
- **Interests:** Basketball, Road Cycling, Bike Modification, Car Racing
- Personal website: <https://anatole12138.github.io>