

# Sang-Hyun (“Maverick”) Oh

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## PERSONAL DETAILS

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<i>Legal Name</i>	Sang-Hyun Oh
<i>Preferred Name</i>	Maverick Oh
<i>E-mail</i>	soh39@ucmerced.edu, maverick.sh.oh@gmail.com
<i>Based In</i>	Rockville, MD 20850

## EDUCATION

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**University of California, Merced**  
(Merced, California, the United States)  
*Graduate*

AUG. 2020 - PRESENT

- Ph.D. in Physics  
Ph.D. Candidate. Currently on an approved leave of absence for AY 2024–2025 due to personal circumstances.  
Research topic: large-scale dark matter structure analysis using gravitational lensing.  
GPA: 3.953/4.000
- M.S. in Physics  
Awarded December 2023 as a part of Ph.D. studies.  
Research proposal: *Impact of having extended arcs and multipole terms on measurement of dark matter halo macromodel*

**Gwangju Institute of Science and Technology (GIST)**  
(Gwangju, South Korea)  
*Undergraduate*

MAR. 2015 - AUG. 2020

- B.S. in physics. Cum laude.  
Thesis: *Graphical Notation for Vector Calculus and Its Generalization*  
Includes exchange programs to University of California, Berkeley (Summer 2016) and California Institute of Technology (Fall 2019).  
GPA: 3.97/4.5

## RESEARCH EXPERIENCE

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**Dark Matter Analysis with Quadruply Lensed Quasars**

DOCTORAL THESIS PROJECT

**SUPERVISOR** | Prof. Anna Nierenberg, UC Merced (California, US)  
**ABOUT** | Working on modeling and analysis of gravitationally lensed quasar systems to understand and constrain dark matter properties, using the data from Hubble Space Telescope to statistically constrain the large-scale structure of dark matter halos and its impact on small-scale structure inference, which is related to the fundamental properties of dark matter.  
**PUBLICATION** | [1, 2, 3]    **TALK** | [13, 14]

**Graphical Notation of Tensor Calculus**

*Quantum Field and Gravity Theory Group*

**SUPERVISOR** | Prof. Keun-Young Kim, GIST (Gwangju, South Korea)  
**ABOUT** | Studied the graphical notation of tensorial identities and equations (Penrose graphical notation, etc.), and wrote a pedagogical paper to spread the use of the graphical notation in vector calculus and

undergraduate physics.

**PUBLICATION** | [4, 5]      **TALK** | [10, 11]      **ON MEDIA** | [15]

### Machine Learning on AdS/CFT

*Quantum Field and Gravity Theory Group*

**SUPERVISOR** | Prof. Keun-Young Kim, GIST (Gwangju, South Korea)

**ABOUT** | Worked on reproducing the machine learning techniques and framework for AdS/CFT correspondence, as proposed by Koji Hashimoto. Taught two other internship students who joined later. **PUBLICATION** | [6]

### Astrophysics Simulation Result Analysis

*Theoretical Astrophysics Including Relativity and Cosmology Group (TAPIR)*

**SUPERVISORS** | Prof. Philip Fajardo-Hopkins and Dr. Coral Wheeler, Caltech (California, US)

**ABOUT** | Analyzed galaxy formation history from GIZMO Feedback In Realistic Environment (FIRE) simulations with different reionization period using Python.

### X-ray Diffraction Simulation and Data Analysis

*X-ray Laboratory for Nanoscale Phenomena*

**SUPERVISOR** | Prof. Do Young Noh, GIST (Gwangju, South Korea)

**ABOUT** | Simulated X-ray diffraction (XRD) patterns with diffraction gratings and analyzed XRD data for single-pulse emission spectroscopy using MATLAB. Tasks included data preprocessing, curve fitting, and numerical studies on spectroscopy correlations.

**PUBLICATION** | [7]

### Poetics Research on Early Korean Science Poems by Yi-Sang

**SUPERVISOR** | Prof. Soo Jong Lee, GIST (Gwangju, South Korea)

**ABOUT** | Deciphered the complex poems of Yi-Sang, written in the 1930s, which incorporate themes from the contemporary physics of the time, such as Einstein's theory of relativity. My work involved unraveling the scientific concepts embedded in these enigmatic literary works.

**PUBLICATION** | [8, 9]      **TALK** | [12]      **ON MEDIA** | [16, 17]

## TEACHING EXPERIENCE

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### Physical Science I

FEB. - MAY. 2025

*Montgomery College*

Instructor of record for an introductory Physical Science course, covering fundamental concepts in physics and astronomy. Developed and delivered lectures, created assessment materials, and coordinated hands-on laboratory activities.

### Cosmology

JAN. - MAY. 2024

*University of California, Merced*

Teaching assistant for Prof. Anna Nierenberg. Led the discussion session and graded student assignments.

### Electrodynamics II

JAN. - MAY. 2024

*University of California, Merced*

Teaching assistant for Prof. Jing Xu. Led the discussion session and graded student assignments. Occasionally, prepared and delivered lectures.

### Physics Using Machine Learning – Pre-College Research Program

AUG. 2021, JAN. 2022

*Gwangju Institute of Science and Technology*

Instructor for the Summer/Winter Pre-Undergraduate Research Participation Program (Pre-URP), under the supervision of Prof. Keun-Young Kim. Planned and designed the overall program, taught high school students the basics of machine learning, software skills (PyTorch), Neural ODE, and their application to classical mechanics problems.

### Introductory Physics I for Biological Sciences

JAN. - MAY. 2021

*University of California, Merced*

Teaching assistant for Prof. Toni Stone. Led two discussion sessions of bio-major students.

### **Introductory Physics I for Biological Sciences Lab**

AUG. - DEC. 2020

*University of California, Merced*

Teaching assistant for Dr. Kristina Callaghan. Taught three sessions of bio-major students using Beyond Labz, a simulation-based virtual laboratory due to COVID-19 restrictions.

### **Machine Learning and Physics – Undergrad Research Program**

JUN. - JUL. 2020

*Gwangju Institute of Science and Technology*

Instructor for GIST Summer Undergraduate Research Fellowship (G-SURF), under the supervision of Prof. Keun-Young Kim. Planned and designed the overall program, taught undergraduate students the basics of machine learning, software skills (PyTorch) and their application on AdS/CFT.

### **History of the Universe and Humanity**

MAR. 2020 - JUN. 2020

*Gwangju Institute of Science and Technology*

Teaching assistant and grader for Prof. Keun-Young Kim. The course covered “big history”, which is the natural & human history from the big bang to the present days.

### **Single Variable Calculus and Applications**

SEP. 2016 - DEC. 2016

*Gwangju Institute of Science and Technology*

Teaching assistant and grader for Prof. Chi-Ok Hwang. Led Q&A sessions during office hours and graded students' homework.

## **OUTREACH EXPERIENCE**

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- Delivered a two-part lecture at my undergraduate institute, discussing personal experiences and lessons from my undergraduate journey in the first session, and detailing my research on the intersection of poetry and physics in the second. (2022)
- Participated in Skype A Scientist program, an outreach program toward the general public including students and families. (2022)
- Actively engaged in science communication initiatives, which included the design of science experiment shows, performing in these shows, and delivering science lectures related to my field of study. (2018-2020)
- Led a hands-on science experiment program for elementary school students as a team of five. (2015)

## **PUBLICATION**

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- [1] **Maverick S. H. Oh**, Anna Nierenberg, Daniel Gilman, and Simon Birrer. Improving flux ratio anomaly precision by measuring gravitational lens multipole moments with extended arcs, 2024. Under review in *Journal of Cosmology and Astroparticle Physics*. Available at arXiv:2404.17124.
- [2] Daniel Gilman, Simon Birrer, Anna Nierenberg, and **Maverick S H Oh**. Turbocharging constraints on dark matter substructure through a synthesis of strong lensing flux ratios and extended lensed arcs. *Monthly Notices of the Royal Astronomical Society*, 533(2):1687–1713, 07 2024.
- [3] Ryan E Keeley, Anna M Nierenberg, Daniel Gilman, Charles Gannon, Simon Birrer, Tommaso Treu, Andrew J Benson, Xiaolong Du, K. N. Abazajian, T. Anguita, V. N. Bennert, S. G. Djorgovski, K. K. Gupta, S. F. Hoenig, A. Kusenko, C. Lemon, M. Malkan, V. Motta, L. A. Moustakas, **Maverick S. H. Oh**, D. Sluse, D. Stern, and R. H. Wechsler. Jwst lensed quasar dark matter survey–ii. strongest gravitational lensing limit on the dark matter free streaming length to date. *Monthly Notices of the Royal Astronomical Society*, 535(2):1652–1671, 2024.
- [4] Joon-Hwi Kim, **Maverick S. H. Oh**, and Keun-Young Kim. Boosting vector calculus with the graphical notation. *American journal of physics*, 89(2):200–209, 2021.
- [5] **Maverick S. H. Oh**. Graphical notation for vector calculus and its generalization. Bachelor Thesis, 2020. [library.gist.ac.kr/storage/thesis/GIST\\_20155110\\_Sang-Hyun%20h\\_20201013103856901.pdf](https://library.gist.ac.kr/storage/thesis/GIST_20155110_Sang-Hyun%20h_20201013103856901.pdf).

- [6] Mugeon Song, **Maverick S. H. Oh**, Yongjun Ahn, and Keun-Young Kim. AdS/deep-learning made easy: simple examples. *Chinese Physics C*, 45(7):073111, jul 2021.
- [7] Muhammad Ijaz Anwar, Sung Soo Ha, Byung-Jun Hwang, Seonghyun Han, **Maverick S. H. Oh**, Mohd Faiyaz, Do Young Noh, Hyon Chol Kang, and Sunam Kim. Hard x-ray von hamos spectrometer for single-pulse emission spectroscopy. *Journal of the Korean Physical Society*, 75(7):494–497, Oct 2019. doi.org/10.3938/jkps.75.494.
- [8] **Maverick S. H. Oh** and Soo Jong Lee. Design and construction in four-dimensional space-time in yi-sang’s poems :the connection between three-dimensional angle blueprint and building infinite-hexahedral-angle bodies, and dimension expansion (이상 시의 4차원 시공간 설계 및 건축 : 삼차각설계도와 건축무한육면각체의 연결, 그리고 차원 확장). *Journal of Korean Culture (JKC)*, 54:107–156, 2021. Written in Korean.
- [9] **Maverick S. H. Oh** and Soo Jong Lee. Periodic boundary condition of yi-sang’s poems 1 – 「building infinite-hexahedral-angle bodies - diagnosis 0:1」 decryption (이상 시의 주기경계조건 1– 「건축무한육면각체 - 진단 0:1」의 파해). *YiSang Review (이상리뷰)*, (18):1–32, 2022. Written in Korean.

## TALKS

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- [10] Vector identity proofs for everyone with diagrams. The 3rd P&P Holics Math & Physics Seminar at GIST, Gwangju, South Korea, 2018.
- [11] Graphical notation seminar. Independently arranged seminar at GIST, Gwangju, South Korea, 2020.
- [12] Introduction to yi-sang’s poems for physicists. Invited talk for a special session of Asia Pacific Center for Theoretical Physics (APCTP) Topical Research Program (online), 2021.
- [13] Enhancing jwst detection of low-mass halos in quadruply lensed quasars with hst imaging of extended arcs (etalk). International Astronomy Union General Assembly (IAUGA), Busan, South Korea, 2022.
- [14] Quads+arc images can tell you about dark matter models. UC Merced Cosmo-Gal Astrophysics Research Symposium (online), 2022.

## SKILLS

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<i>Languages</i>	English Korean	(Fluent) (Native)
<i>Programming</i>	Python (including PyTorch) MATLAB	(Advanced) (Advanced)
<i>Data &amp; Computing</i>	Git, SQL, Cluster Computing (Slurm)	
<i>Design Software</i>	SolidWorks, Blender, Adobe Photoshop & Illustrator	
<i>Teaching Software</i>	Canvas Learning Management System, Beyond Labz Virtual Lab	
<i>Other Software</i>	L <sup>A</sup> T <sub>E</sub> X, Microsoft Office	

## HONORS

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- National scholarship to pursue B.S. in GIST, Korea Student Aid Foundation, 2015–2019
- Selected as one of the Top 10 Finalists in FameLab Korea, a three-minute science talk competition, 2018.
- Appointed as a Science Communicator by the Ministry of Science and ICT (MSIT) and the Korea Foundation for the Advancement of Science and Creativity (KOFAC), South Korea, 2018.
- Awarded academic Excellence Scholarship, GIST, 2017–2018
- Awarded GIST Study Abroad Scholarship to Study at Caltech, 2019
- Awarded GIST Study Abroad Scholarship to Study at UC Berkeley, 2016

## MEDIA COVERAGE

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- [15] Emerging Technology from the arXiv. How to turn the complex mathematics of vector calculus into simple pictures. *MIT Technology Review*, Nov 2019. [technologyreview.com/s/614704/](https://technologyreview.com/s/614704/).
- [16] 한소범 (So-Beom Han). ‘수포자’ 교수와 문학은 1도 모르던 물리학도, 천재시인 이상의 비밀을 풀다. *한국일보(Hankook Ilbo)*. Written in Korean. [hankookilbo.com/News/Read/A2021100515390000378](https://hankookilbo.com/News/Read/A2021100515390000378).
- [17] 선한결(Han-Gyeol Seon). 이상 '건축무한육면각체' 물리학으로 풀어... "이과가 이과했다". *한국경제(The Korea Economic Daily)*. Written in Korean. [hankyung.com/it/article/202109230135i](https://hankyung.com/it/article/202109230135i).