Maverick Oh

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PERSONAL DETAILS

Legal Name	Sang-Hyun Oh
Preferred Name	Maverick Oh
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EDUCATION

University of California, Merced
(Merced, California, the United States) Aug. 2020 - Present
Graduate

- Ph.D. in physics (in progress)
  GPA: 3.95/4.0
  Currently engaged in research on large-scale dark matter structure and gravitational lensing.
- M.S. in physics (Dec. 2023)
  Awarded during Ph.D. studies.
  Research proposal title: *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) Mar. 2015 - Aug. 2020
Undergraduate

- B.S. in physics. Cum laude. GPA: 3.95/4.5
  Bachelor's thesis title: *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).

RESEARCH

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 technique and framework on AdS/CFT correspondence that was 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 | Worked on computer simulation of X-ray diffraction (XRD) pattern with diffraction grating, and analysis of XRD data for single pulse emission spectroscopy using MATLAB, including data preprocessing, curve fitting and numerical study on spectroscopy correlation.
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]

PUBLICATION

[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.

[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, 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, **M. 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, 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%20Oh_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

[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.

TEACHING

TA: Cosmology Jan. - May. 2024
University of California, Merced
Teaching assistance and grader, assisting Prof. Anna Neirenberg. Leading the discussion session.

TA: Electrodynamics II Jan. - May. 2024
University of California, Merced
Teaching assistance and grader, assisting Prof. Jing Xu. Leading the discussion session.

Physics Using Machine Learning – Pre-College Research Program Aug. 2021, Jan. 2022
Gwangju Institute of Science and Technology
Instructor for Summer/Winter Pre-Undergraduate Research Participation Program (Pre-URP), under the supervision of Prof. Keun-Young Kim. Taught high school studetns the basics of machine learning, software skills (PyTorch), Neural ODE, and their application to classical mechanics problems.

TA: Introductory Physics I for Biological Sciences Jan. - May. 2021
University of California, Merced
Teaching assistance and grader, assisting Dr. Toni Stone. Led discussions of an intro level physics I (mechanics) course for two sessions of bio-major students.

TA: Introductory Physics I for Biological Sciences Lab Aug. - Dec. 2020
University of California, Merced
Teaching assistance and grader, assisting Dr. Kristina Callaghan. Taught three sessions of bio-major students an intro level physics I lab (mechanics) course using Beyond Labz, a simulation-bases virtual laboratory because of 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. Taught undergraduate students the basics of machine learning, software skills (PyTorch) and their application on AdS/CFT.

TA: History of the Universe and Humanity Mar. 2020 - Jun. 2020

Gwangju Institute of Science and Technology

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

TA: Single Variable Calculus and Applications Sep. 2016 - Dec. 2016

Gwangju Institute of Science and Technology

Teaching assistant and grader, assisting Prof. Chi-Ok Hwang. The course mainly covered single-variable calculus, sequence, and series.

SKILLS

Languages	English	(Fluent)
	Korean	(Native)
Programming	Python & PyTorch	(Advanced)
	MATLAB	(Advanced)
	C	(Intermediate)
Other Softwares	LaTeX, 3D CAD (SolidWorks, OnShape), Adobe Photoshop & Illustrator, MS Office	

HONORS

- 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.
- Academic Excellence Scholarship, GIST, 2017–2018
- Scholarship for Study Abroad Program at Caltech, GIST, 2019
- Scholarship for Study Abroad Program at UC Berkeley, GIST, 2016

MEDIA COVERAGE

[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/`.

[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`.

[17] 선한결(Han-Gyeol Seon). 이상 '건축무한육면각체' 물리학으로 풀어..."이과가 이과했다". *한국경제(The Korea Economic Daily)*. Written in Korean. `hankyung.com/it/article/202109230135i`.

OUTREACH

- 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. (2015)