KWANGMIN OH

Curriculum Vitae

Michigan State University
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Appointments

2023–present **Postdoctoral Research Associate**, *Michigan State University*, USA.
X-ray observation, Globular cluster, X-ray binaries, Compact objects, Black hole

Education

2017–2023 : **PhD, Astronomy & Astrophysics**, *Chungnam National University*, Korea.
X-ray observation, Globular cluster, Compact objects, Black hole, Gravitational wave, Clustering, Machine Learning

2017 **BS, Astronomy & Space Science**, *Chungnam National University*, Korea.

Current Research

2023 – ***Multi-wavelength Studies of Compact Objects in Star Clusters***.
Analyzing the formation and evolutionary pathways of ultra-luminous X-ray sources (ULXs), black hole candidates, and other X-ray binaries in globular and young massive star clusters using long-term X-ray, optical, and radio continuum data.

2021 – ***Dynamical Evolution of Globular Clusters***.
Utilizing N-body and Monte-Carlo simulations to investigate how the dense stellar environment of globular clusters influences the evolution of compact object populations, such as pulsars and cataclysmic variables, and comparing simulation results with observational data.

2021 – ***Gravitational Wave Data Analysis***.
Developing and applying novel signal processing and machine learning techniques, such as autoregressive models, for denoising and detecting gravitational wave signals from astrophysical sources.

Research Experiences

Michigan State University

2023 – present ***Spectral and Timing Analysis of Ultra-luminous X-ray Sources***.
Led a multi-epoch study to constrain the physical nature and accretion mechanisms of ULXs in extragalactic globular clusters. This work involved performing detailed spectral fitting and long-term timing analysis on 15+ years of X-ray data from *Chandra* and *XMM-Newton* to model accretion states and investigate evolutionary pathways. X-ray properties were also correlated with contemporaneous optical data to understand the interplay between the compact object, accretion disk, and donor star.
Advisor: Dr. Stephen E. Zepf, *Professor, Department of Physics & Astronomy*

2024 – present ***Undergraduate Student Mentorship***.
Supervised an undergraduate research project focused on applying machine learning algorithms for the classification of X-ray sources, directly aligning with the development of advanced data analysis techniques.

Chungnam National University

2019 – 2023 ***Computational Modeling of Compact Object Dynamics in Dense Stellar Environments***.
Developed and utilized Monte Carlo N-body simulations to model the dynamical formation and evolution of compact object populations (LMXBs, MSPs, CVs) in globular clusters. The simulation outcomes were then compared with observational X-ray survey data to place constraints on binary interaction channels and the physics of stellar evolution in dense environments.
Advisor: Dr. David Hui, *Professor, Department of Astronomy & Space Science*

2019 – 2023 ***Machine Learning for Astrophysical Data Analysis***.
Designed and implemented a machine learning pipeline for the automated classification of X-ray sources within crowded globular cluster fields. This pipeline leveraged supervised learning algorithms trained on multi-wavelength observational data, significantly improving the efficiency and accuracy of identifying accreting compact objects.

Advisor: Dr. David Hui, *Professor, Department of Astronomy & Space Science*

Gravitational Wave Data Analysis (LIGO-Virgo-KAGRA Collaboration)

2019 – ***Advanced Signal Processing for Time-Series Data***.
Contributed to the LVK collaboration by developing and applying advanced signal processing techniques for noise characterization and reduction in gravitational wave data streams. This experience in time-series analysis and statistical noise modeling is directly applicable to the spectral-timing techniques (e.g., X-ray lags, power-spectra) used in X-ray astrophysics.

Advisor: Dr. David Hui, *Professor, Department of Astronomy & Space Science*

Fellowships & Awards

2022 – 2023 ***Research Subsidies for Ph.D. Fellowship*** of National Research Foundation of Korea, Government of Korea, as a PhD research scholar, (40K USD)

2019 – 2022 ***Global Ph.D. Fellowship*** of National Research Foundation of Korea, Government of Korea, as a PhD research scholar, (100K USD)

2019 ***BK21 Plus Graduate Fellowship***, Chungnam National University, Korea ($7K)

Feb, 2022 ***Research Fair Award***, Chungnam National University, Korea

Aug, 2021 ***Excellence Research Award***, Chungnam National University, Korea

2019 – 2021 ***Research Assistant & Merit Scholarships***, Chungnam National University, Korea

2019 ***Academic Excellence Scholarship***, Chungnam National University, Korea

2017 ***Academic Excellence Scholarship***, Chungnam National University, Korea

Research Skills and Expertise

Languages Python, R, IDL, IRAF, CIAO, HEASoft, extensive experience in Linux-based scripting for scientific computing and data analysis.

Machine Learning Skilled in auto-regressive modeling and machine learning algorithms (scikit-learn, Keras) for data classification and prediction.

Data Analysis X-ray spectroscopy, imaging, and timing analysis **(Chandra, XMM-Newton)**; Optical and Ultraviolet spectroscopy **(SOAR, GEMINI, MAGELLAN)**, Gamma-ray binned likelihood analysis **(Fermi/LAT)**.

Simulation Modeling Proficient in Monte-Carlo N-body cluster simulation using **MOCCA** for studying dynamical processes and cluster evolution. Experienced in **CLOUDY** model simulations for analyzing the physical conditions and spectra of ionized gases surrounding stars.

Teaching Experience

2017–2023 ***Introductory Astronomy for Non-Majors***, *Teaching Assistant*, Department of Astronomy & Space Science, Chungnam National University.

2018 ***Astronomical Instruments***, *Teaching Assistant*, Department of Astronomy & Space Science, Chungnam National University.

2017 ***Astronomical Observation & Practice***, *Teaching Assistant*, Department of Astronomy & Space Science, Chungnam National University.

2017 ***Research Assistant***, Department of Statistics, Chungnam National University.

Conferences & Presentations

2025 Poster, *Influences of dynamical disruptions on the evolution of pulsars in globular clusters*, IAU Symposium 398 & MODEST-25, 16–20 June 2025, Seoul National University, Seoul, Korea

2025 Seminar talk, *Influence of Dynamics and Evolution of X-ray Sources in Globular Cluster*, Research Seminar, June, 5th, 2025, Chungnam National University, Daejeon, Korea

2024 Seminar talk, *Dynamical Effects in Globular Clusters and the Formation of X-ray Sources*, Research Seminar, October, 9th, 2024, Michigan State University, East Lansing, MI, USA

2024 Oral presentation, *Probing Intracluster Dynamics and Evolution of Globular Clusters through Cataclysmic Variable Populations*, MODEST24, August, 18th-23rd, 2024, Nicolaus Copernicus Astronomical Center, Warsaw, Poland

2024 Oral presentation, *Probing Intracluster Dynamics and Evolution of Globular Clusters through Cataclysmic Variable Populations*, COSPAR 2024, July 13th-21st, 2024, Korea

2024 Oral presentation, *Intracluster dynamics and evolution via CV populations*, University of Toronto, Globular Clusters and Their Tidal Tails, May 28th-31st, 2024, Toronto, Canada

2024 Poster, *Influences of dynamical disruptions on the evolution of pulsars in globular clusters*, AAS 243, 243rd meeting of American Astronomical Society, 7–11 Jan 2024, New Orleans, Louisiana, USA

2023 Seminar talk, *Unveiling Interaction in Globular Clusters and their Impact on Compact Binary Evolution*, Research Seminar, 27, July, The University of Hong Kong, Hong Kong

2022 Invited talk, *Unveiling Impacts of Dynamical Effects on the Compact Binaries in Globular Clusters*, 67th Workshop on Gravitational waves and Numerical Relativity, 26-27, Oct, APCTP Headquarter, Korea

2021 Oral presentation, *Classifying X-ray sources in globular clusters by ensemble learning*, 5th Center for High-Energy Astrophysics Workshop, 29-30 Oct, 2021, Korea

2020 Oral presentation, *Adopting Machine Learning Techniques X-ray Source Classification in Globular Cluster*, 2020 7th SGPF conference, 14 Nov, 2020, National Research Foundation of Korea, Korea

2020 Oral presentation, *Adopting machine learning for identifying X-ray sources in globular cluster*, 4th Center for High-Energy Astrophysics Workshop, 15-16 Jan, 2020, Korea

2019 Poster, *Searching for gravitational waves from core-collapse supernovae using weighted wavelet z-transform and Hilbert-Huang transform*, KAGRA, the 22nd Face to Face meeting, 4-5 Dec, 2019, RESCEU (Research Center for the Early Universe), Tokyo, Japan

2019 Poster, *Multi-Epoch X-ray observations of globular cluster M62* , X-ray Astronomy 2019: Current Challenges and New Frontier in the Next Decade, 8-13 Sep, 2019, CNR/INAF Research Area, Bologna, Italy

2019 Poster, *Searching continuous gravitational waves with an autoregressive approach*, KAGRA, the 23rd Face to Face meeting, Univ of Toyama, 22-24 Aug, 2019, Univ. of Toyama, Japan

2019 Poster, *Searching continuous gravitational waves with an autoregressive approach*, KAGRA, the 22nd Face to Face meeting, 19-21 April, 2019, ICRR, Kashiwa

2019 Oral presentation, *X-ray observation of Globular clusters*, 3rd Center for High-Energy Astrophysics Workshop, 16-17 Jan, 2019, Korea

2018 Poster, *Multi-epoch X-ray observations of globular cluster M62*, MODEST-18 Dense stellar systems in the er of GAIA, LIGO & LISA, 25-29 June, 2018, FIRÁ, Santorini, Greece

2018 Oral presentation, *An X-ray emission from Globular cluster*, CHEA Workshop on High Energy Astrophysics of Compact Objects, 12-13 April, 2018, UNIST, Korea

2018 Oral presentation, *High energy observation of Globular Cluster*, 2nd Center for High-Energy Astrophysics Workshop, 17-18 Jan, 2018, Korea

2017 Oral presentation, *High energy observation of Globular Cluster*, The 7th Fermi Asian Network Workshop, 7-11 Dec 2017, Lijiang, China

2017 Poster, *Re-examining the gamma-Ray Properties of Globular Clusters*, 7th International Fermi Symposium, 15-20 Oct 2017, Congress Center Garmisch-Partenk3irchen

Publications

2025 Kristen C. Dage, Teresa Panurach, **Kwangmin Oh**, Malu Sudha, Montserrat Armas Padilla, Arash Bahramian, Edward M. Cackett, Timothy J. Galvin, Craig O. Heinke, Renee Ludlam, Angiraben D. Mahida, Richard M. Plotkin, Thomas D. Russell, Susmita Sett, Payaswini Saikia, Aaran W. Shaw, Alexandra J. Tetarenko. Radio Continuum Studies of Ultra-Compact and Short Orbital Period X-Ray Binaries, ApJ, August 2025.

2025 **Kwangmin, Oh**, Kristen C. Dage, Alexey Bobrick, Elias Aydi, Arash Bahramian, Adelle J. Goodwin, Daryl Haggard, Jimmy Irwin, Arunav Kundu, Jay Strader, Thomas J. Maccarone, and Stephen E. Zepf. Spectral insights and evolutionary pathways of globular cluster ULX in NGC 1399: a two-decade X-ray and optical study. , volume 537, pages 3884–3894, March 2025.

2025 J. Shin, C. Y. Hui, S. Kim, **Kwangmin, Oh**., and E. R. Owen. A possible GeV-TeV connection in the direction of the globular cluster UKS 1. , volume 696, page L11, April 2025.

2025 Bernard Leal, **Kwangmin, Oh**, Jay Strader, Steve E Zepf, Kristen Dage, S Kim, and C Y Hui. The x-ray source population of the metal-rich globular cluster ngc 6528. *Monthly Notices of the Royal Astronomical Society*, page staf1349, 08 2025.

2025 Kristen C. Dage, Evangelia Tremou, Bolivia Cuevas Otahola, Eric W. Koch, **Kwangmin, Oh**, Richard M. Plotkin, Vivian L. Tang, Muhammad Ridha Aldhalemi, Zainab Bustani, Mariam Ismail Fawaz, Hans J. Harff, Amna Khalyleh, Timothy McBride, Jesse Mason, Anthony Preston, Cortney Rinehart, Ethan Vinson, Gemma Anderson, Edward M. Cackett, Shih Ching Fu, Sebastian Kamann, Teresa Panurach, Renuka Pechetti, Payaswini Saikia, Susmita Sett, Ryan Urquhart, and Christopher Usher. Detecting the Black Hole Candidate Population in M51's Young Massive Star Clusters: Constraints on Accreting Intermediate-mass Black Holes. , volume 979, page 82, January 2025.

2025 Kristen C. Dage, Eric W. Koch, Evangelia Tremou, **Kwangmin, Oh**, Susmita Sett, Cosima Eibensteiner, Sean T. Linden, Angiraben D. Mahida, Eric J. Murphy, Muhammad Ridha Aldhalemi, Zainab Bustani, Mariam Ismail Fawaz, Hans J. Harff, Amna Khalyleh, Timothy McBride, Jesse Mason, Anthony Preston, Cortney Rinehart, Ethan Vinson, Teresa Panurach, Richard M. Plotkin, and Liliana Rivera Sandoval. Classifying compact radio emission in nearby galaxies: A 10 ghz study of active galactic nuclei, supernovae, anomalous microwave emission, and star-forming regions. *The Astronomical Journal*, volume 170, page 201. The American Astronomical Society, sep 2025.

2024 **Kwangmin, Oh**, Jongsuk Hong, C. Y. Hui, Sangin Kim, and Mirek Giersz. Probing intracluster dynamics and evolution of globular clusters through cataclysmic variable populations. , volume 532, pages 259–269, July 2024.

2024 Sangin Kim, C. Y. Hui, Jianqi Yan, Alex P. Leung, **Kwangmin, Oh**, A. K. H. Kong, L. C.-C. Lin, and Kwan-Lok Li. Autoregressive search of gravitational waves: Denoising. *Phys. Rev. D*, volume 109, page 102003. American Physical Society, May 2024.

2023 **Kwangmin, Oh**, C Y Hui, Jongsuk Hong, J Takata, A K H Kong, Pak-Hin Thomas Tam, Kwan-Lok Li, and K S Cheng. Influences of dynamical disruptions on the evolution of pulsars in globular clusters. *Monthly Notices of the Royal Astronomical Society*, volume 525, pages 4167–4175, 08 2023.

2020 **Kwangmin, Oh**, C Y Hui, K L Li, and A K H Kong. Multi-epoch X-ray imaging of globular cluster M62 with Chandra. *Monthly Notices of the Royal Astronomical Society*, volume 498, pages 292–303, 08 2020.

2020 Sangin Kim, C. Y. Hui, Jongsu Lee, **Kwangmin, Oh**, L. C. C. Lin, and J. Takata. A deep X-ray spectral imaging of the bow-shock pulsar wind nebula associated with PSR B1929+10. *Astron. Astrophys.*, volume 637, page L7, 2020.

2020 C Y Hui, Jongsu Lee, K L Li, Sangin Kim, **Kwangmin, Oh**, Shengda Luo, Alex P Leung, A K H Kong, J Takata, and K S Cheng. Searches for pulsar-like candidates from unidentified objects in the Third Catalog of Hard Fermi-LAT Sources with machine learning techniques. *Monthly Notices of the Royal Astronomical Society*, volume 495, pages 1093–1109, 04 2020.

2017 **Kwangmin, Oh** and C Y Hui. Re-examining the gamma-ray properties of globular clusters. 2017.

Collaboration publications

2025 Virgo Collaboration LIGO Scientific Collaboration and KAGRA Collaboration. Swift-BAT GUANO Follow-up of Gravitational-wave Triggers in the Third LIGO–Virgo–KAGRA Observing Run. , volume 980, page 207, February 2025.

2024 Virgo Collaboration LIGO Scientific Collaboration and KAGRA Collaboration. Ultralight vector dark matter search using data from the KAGRA O3GK run. , volume 110, page 042001, August 2024.

2024 Virgo Collaboration LIGO Scientific Collaboration and KAGRA Collaboration. Swift-BAT GUANO follow-up of gravitational-wave triggers in the third LIGO-Virgo-KAGRA observing run. *arXiv e-prints*, page arXiv:2407.12867, July 2024.

2024 Virgo Collaboration LIGO Scientific Collaboration and KAGRA Collaboration. Search for gravitational waves emitted from SN 2023ixf. *arXiv e-prints*, page arXiv:2410.16565, October 2024.

2024 Virgo Collaboration LIGO Scientific Collaboration and KAGRA Collaboration. Observation of Gravitational Waves from the Coalescence of a 2.5–4.5 $M_\odot$ Compact Object and a Neutron Star. , volume 970, page L34, August 2024.

2024 Virgo Collaboration LIGO Scientific Collaboration and KAGRA Collaboration. A search using GEO600 for gravitational waves coincident with fast radio bursts from SGR 1935+2154. *arXiv e-prints*, page arXiv:2410.09151, October 2024.

2023 The LVK Collaboration. Search for subsolar-mass black hole binaries in the second part of Advanced LIGO's and Advanced Virgo's third observing run. *Monthly Notices of the Royal Astronomical Society*, volume 524, pages 5984–5992, 02 2023.

2023 The LVK Collaboration. Search for gravitational-lensing signatures in the full third observing run of the LIGO-Virgo network. *arXiv e-prints*, page arXiv:2304.08393, April 2023.

2023 The LVK Collaboration. Population of Merging Compact Binaries Inferred Using Gravitational Waves through GWTC-3. *Physical Review X*, volume 13, page 011048, January 2023.

2023 The LVK Collaboration. Open Data from the Third Observing Run of LIGO, Virgo, KAGRA, and GEO. , volume 267, page 29, August 2023.

2023 The LVK Collaboration. Constraints on the Cosmic Expansion History from GWTC-3. , volume 949, page 76, June 2023.

2023 The LVK Collaboration. A Joint Fermi-GBM and Swift-BAT Analysis of Gravitational-Wave Candidates from the Third Gravitational-wave Observing Run. *arXiv e-prints*, page arXiv:2308.13666, August 2023.

2023 The LVK Collaboration. *arXiv e-prints*, page arXiv:2308.03822, August 2023.

2023 KAGRA collaboration. Overview of KAGRA : Data transfer and management. *Progress of Theoretical and Experimental Physics*, volume 2023, page 10A102, 09 2023.

2023 KAGRA collaboration. Correction to: Input optics systems of the KAGRA detector during O3GK. *Progress of Theoretical and Experimental Physics*, volume 2023, page 059301, May 2023.

2022 Virgo Collaboration LIGO Scientific Collaboration and KAGRA Collaboration. Searches for gravitational waves from known pulsars at two harmonics in the second and third ligo-virgo observing runs. *The Astrophysical Journal*, volume 935, page 1. The American Astronomical Society, may 2022.

2022 Virgo Collaboration LIGO Scientific Collaboration and KAGRA Collaboration. Search for subsolar-mass binaries in the first half of advanced ligo's and advanced virgo's third observing run. *Phys. Rev. Lett.*, volume 129, page 061104. American Physical Society, Aug 2022.

2022 Virgo Collaboration LIGO Scientific Collaboration and KAGRA Collaboration. Search for intermediate-mass black hole binaries in the third observing run of Advanced LIGO and Advanced Virgo. , volume 659, page A84, March 2022.

2022 Virgo Collaboration LIGO Scientific Collaboration and KAGRA Collaboration. Search for gravitational waves from Scorpius X-1 with a hidden Markov model in O3 LIGO data. *arXiv e-prints*, page arXiv:2201.10104, January 2022.

2022 Virgo Collaboration LIGO Scientific Collaboration and KAGRA Collaboration. Search for gravitational-wave transients associated with magnetar bursts in Advanced LIGO and Advanced Virgo data from the third observing run. *arXiv e-prints*, page arXiv:2210.10931, October 2022.

2022 Virgo Collaboration LIGO Scientific Collaboration and KAGRA Collaboration. Search for continuous gravitational waves from 20 accreting millisecond x-ray pulsars in o3 ligo data. *Phys. Rev. D*, volume 105, page 022002. American Physical Society, Jan 2022.

2022 Virgo Collaboration LIGO Scientific Collaboration and KAGRA Collaboration. Search for continuous gravitational wave emission from the Milky Way center in O3 LIGO-Virgo data. , volume 106, page 042003, August 2022.

2022 Virgo Collaboration LIGO Scientific Collaboration and KAGRA Collaboration. Performance of the KAGRA detector during the first joint observation with GEO 600 (O3GK). *arXiv e-prints*, page arXiv:2203.07011, March 2022.

2022 Virgo Collaboration LIGO Scientific Collaboration and KAGRA Collaboration. Narrowband Searches for Continuous and Long-duration Transient Gravitational Waves from Known Pulsars in the LIGO-Virgo Third Observing Run. , volume 932, page 133, June 2022.

2022 Virgo Collaboration LIGO Scientific Collaboration and KAGRA Collaboration. Model-based cross-correlation search for gravitational waves from the low-mass X-ray binary Scorpius X-1 in LIGO O3 data. *arXiv e-prints*, page arXiv:2209.02863, September 2022.

2022 Virgo Collaboration LIGO Scientific Collaboration and KAGRA Collaboration. First joint observation by the underground gravitational-wave detector KAGRA with GEO 600. *Progress of Theoretical and Experimental Physics*, volume 2022, 04 2022. 063F01.

2022 Virgo Collaboration LIGO Scientific Collaboration and KAGRA Collaboration. All-sky search for gravitational wave emission from scalar boson clouds around spinning black holes in ligo o3 data. *Phys. Rev. D*, volume 105, page 102001. American Physical Society, May 2022.

2022 Virgo Collaboration LIGO Scientific Collaboration and KAGRA Collaboration. All-sky search for continuous gravitational waves from isolated neutron stars using Advanced LIGO and Advanced Virgo O3 data. *arXiv e-prints*, page arXiv:2201.00697, January 2022.

2022 Virgo Collaboration LIGO Scientific Collaboration and KAGRA Collaboration. All-sky, all-frequency directional search for persistent gravitational waves from advanced ligo's and advanced virgo's first three observing runs. *Phys. Rev. D*, volume 105, page 122001. American Physical Society, Jun 2022.

2022 KAGRA Collaboration LIGO Scientific Collaboration, Virgo Collaboration and CHIME/FRB Collaboration. Search for Gravitational Waves Associated with Fast Radio Bursts Detected by CHIME/FRB During the LIGO–Virgo Observing Run O3a. *arXiv e-prints*, page arXiv:2203.12038, March 2022.

2022 KAGRA collaboration. Performance of the KAGRA detector during the first joint observation with GEO600 (O3GK). *Progress of Theoretical and Experimental Physics*, volume 2023, page 10A101, 06 2022.

2022 KAGRA collaboration. Noise subtraction from KAGRA O3GK data using Independent Component Analysis. *arXiv e-prints*, page arXiv:2206.05785, June 2022.

2022 KAGRA collaboration. Input optics systems of the KAGRA detector during O3GK. *arXiv e-prints*, page arXiv:2210.05934, October 2022.

2022 KAGRA collaboration. The current status and future prospects of kagra, the large-scale cryogenic gravitational wave telescope built in the kamioka underground. *Galaxies*, volume 10, 2022.

2021 Virgo Collaboration LIGO Scientific Collaboration and KAGRA Collaboration. Tests of General Relativity with GWTC-3. *arXiv e-prints*, page arXiv:2112.06861, December 2021.

2021 Virgo Collaboration LIGO Scientific Collaboration and KAGRA Collaboration. Constraints from ligo o3 data on gravitational-wave emission due to r-modes in the glitching pulsar psr j0537–6910. *The Astrophysical Journal*, volume 922, page 71. The American Astronomical Society, nov 2021.

2021 KAGRA collaboration. Vibration isolation systems for the beam splitter and signal recycling mirrors of the kagra gravitational wave detector. *Classical and Quantum Gravity*, volume 38, page 065011. IOP Publishing, mar 2021.