

HAI N. NGO

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Astronomy Ph.D. Application

EDUCATION

M.Sc. in Theoretical & Mathematical Physics

Expected 2026

University of Science, Vietnam National University

Cumulative GPA: 8.54/10 (or 3.89/4.0).

Thesis: “*Measuring the Supermassive Black Hole Mass of NGC 7052 Using High Spatial Resolution Molecular Gas Observed with ALMA*”.

Supervisor: Dr. Dieu D. Nguyen.

B.Sc. in Chemistry

2016 - 2021

University of Science, Vietnam National University

Thesis point: 9.5/10 (or 4.0/4.0).

RESEARCH INTERESTS

- Black Hole Formation and Growth
- Massive Back Holes Across Mass Spectrum (i.e., Intermediate-mass Black Holes and Supermassive Black Holes)
- Black Hole and Galaxy Coevolution
- Black Hole Scaling Relations and Their Evolutions
- Stellar/Gas Kinematics and Galaxy Dynamics
- Computational Astrophysics, Simulations, and Modelings

SKILLS

Programming: Python (numpy, matplotlib, pandas, astropy) and Matlab.

Software:

- Multi-Gaussian Expansion Fitting (MGEfit)
- Jeans Anisotropic Modelling (JAM).
- Penalized Pixel-Fitting (pPXF).
- Image Reduction and Analysis Facility (IRAF).
- The HARMONI SIMulator (HSIM).
- Simulator for MICADO (Simcado).
- KINematic Molecular Simulation (KinMS).

Space-based data: JWST/NIRSpec & NIRCams and HST Imaging.

Ground-based data: ALMA, Keck/OSIRIS, VLT/MUSE, and ELT/HARMONI & MICADO.

RESEARCH EXPERIENCE

Measuring Massive Black Hole Mass Across Mass Spectrum

1. JWST/NIRSpec & NIRCams

- Developing a Python pipeline to separate AGN continuum from stellar light for accurate kinematic extraction.
- Leading measuring supermassive black holes (SMBHs) masses in NGC 4258 and M87.

2. ALMA

- Modelling ALMA datacube with KinMS.
- Determining the SMBH masses in NGC 7052, NGC 4061, NGC 2513, and Circinus.

Simulations with Extremely Large Telescope (ELT) Instruments: HARMONI & MICADO

1. Intermediate-mass black holes (IMBHs) in dwarf galaxies & star clusters (nuclear star cluster & globular cluster)

- Simulating mock observations of HARMONI IFS datacubes and MICADO imaging data.
- Deriving stellar/gas kinematics from mock HARMONI and MICADO.
- Recovering IMBH masses from mock observations and dynamical modelling.

- Designing observational strategies to find IMBH kinematic signatures with HARMONI within 20 Mpc.
- Investigating limitations of HARMONI in detecting IMBHs.

2. SMBHs in giant elliptical galaxies

- Simulating dynamical SMBH mass measurements beyond 100 Mpc.
- Investigating the HARMONI's capacity in SMBH mass measurements at the edge of Cosmic Noon.

PUBLICATIONS

Submitted papers

1. Dieu D. Nguyen, **Hai N. Ngo** ([main contributor](#)), Michele Cappellari, Tinh Q. T. Le, Tien H. T. Ho, Tuan N. Le, Elena Gallo, Fan Zou, Niranjana Thatte, Michele Perna, and Miguel Pereira-Stantaella. [arXiv:2509.20519](#). *Measuring the Central Dark Mass in NGC 4258 with JWST/NIRSpec Stellar Kinematics*. **Submitted to ApJ**.
2. Dieu D. Nguyen, Tuan N. Le, Michele Cappellari, **Hai N. Ngo**, Tinh Q. T. Le, Tien H. T. Ho, Elena Gallo, Fan Zou, Niranjana Thatte, Michele Perna, and Miguel Pereira-Stantaella. *The Supermassive Black Hole in the Nearby Spiral Galaxy M81: A Robust Mass from JWST/NIRSpec Stellar Dynamics*. **Submitted to ApJ**.
3. Tinh Q. T. Le, Dieu D. Nguyen, **Hai N. Ngo**, Tien H. T. Ho, Tuan N. Le, and Long Q. T. Nguyen. [2025 Universe-4039749](#). *Probing the variation of the inner surface-brightness profile of nuclear star clusters on the intermediate-mass black hole mass measurements using high-spatial-resolution ELT/MICADO images and HARMONI integral-field stellar kinematics*. **Submitted to Universe**.
4. Dieu D. Nguyen, Long Q. T. Nguyen, **Hai N. Ngo** ([main contributor](#)), Tinh Q. T. Le, Tuan N. Le, Tien H. T. Ho, Elena Gallo, Fabio Pacucci, and Que T. Le. *Dynamical Evidence for a Billion Solar Mass Black Hole in Galaxy NGC 4061 from ALMA $^{12}\text{CO}(2-1)$ Kinematics*. **Submitted to ApJ**.
5. Dieu D. Nguyen, Michele Cappellari, Tinh Q. T. Le, **Hai N. Ngo**, Tien H. T. Ho, Elena Gallo, Fan Zou, Niranjana Thatte, Tuan N. Le, Huy G. Tong, and Miguel Pereira-Santaella. [arXiv:2511.10427](#). *Extending the Frontier of Spatially-Resolved Supermassive Black Hole Mass Measurements to Galaxies at Cosmic Noon: Simulations with ELT/MICADO High-Resolution Mass Models and HARMONI Integral-Field Stellar Kinematics*. **Submitted to MNRAS**.

First-author & Main-contribution author papers

1. **Hai N. Ngo**, Dieu D. Nguyen, Tinh Q. T. Le, Khue N. H. Ho, Tien H. T. Ho, Elena Gallo, Kristina Nyland, Masatoshi Imanishi, Kouichiro Nakanishi, Que T. Le, Fabio Pacucci, and Eden Girma. [2025 ApJ, 992, 211](#). *Revisiting the supermassive black hole mass of NGC 7052 using high spatial resolution molecular gas observed with ALMA*.
2. **Hai N. Ngo**, Dieu D. Nguyen, Tinh Q. T. Le, Tien H. T. Ho, Truong N. Nguyen, and Trung H. Dang. [2025 Universe, 11\(11\), 360](#). *Detecting Intermediate-Mass Black Holes out to 20 Mpc with ELT/HARMONI: The Case of FCC 119*.
3. Dieu D. Nguyen, **Hai N. Ngo** ([main contributor](#)), Tinh Q. T. Le, Alister W. Graham, Roberto Soria, Igor V. Chilingarian, Niranjana Thatte, Niranjana Thatte, N. T. Phuong, Thiem Hoang, Miguel Pereira-Santaella, Mark Durre, Diep N. Pham, Le Ngoc Tram, Nguyen B. Ngoc, and Ngân Lê. [2025 A&A, 698, L9](#). *Supermassive black hole mass measurement in the spiral galaxy NGC 4736 using JWST/NIRSpec stellar kinematics*.
4. Dieu D. Nguyen, Michele Cappellari, **Hai N. Ngo** ([main contributor](#)), Tinh Q. T. Le, Tuan N. Le, Khue N. H. Ho, An K. Nguyen, Phong T. On, Huy G. Tong, Niranjana Thatte, and Miguel Pereira-Santaella. [2025 AJ, 170, 124](#). *Simulating intermediate black hole mass measurements for a sample of galaxies with nuclear star clusters using ELT/HARMONI high spatial resolution integral-field stellar kinematics*.
5. Tue Nguyen-Van, **Hai N. Ngo** ([main contributor](#)), Yuya Hirano, Yoichi Itoh, Thuy Le-Quang, An Nguyen-Khanh, Felix Wood, John Hoang, D. N. Hoang, Thierry Montmerle, Quang Nguyen-Luong. [Stars and Galaxies, 2023, 6,7](#). *First detection of exoplanet transit in Vietnam*.

In-preparation papers

1. **Hai N. Ngo**, Dieu D. Nguyen, Michele Cappellari, Tien H. T. Ho, Tinh Q. T. Le, Tuan N. Tuan, Elena Gallo, and Niranjan Thatte. *Re-deriving the M87 supermassive black hole mass using stellar dynamics from JWST/NIRSpec.*
2. Tuan N. Le, Dieu D. Nguyen, **Hai N. Ngo**, Long Q. T. Nguyen, Tinh Q. T. Le, Tien H. T. Ho, Elena Gallo, and Michele Cappellari. *Measurement of supermassive black hole mass in the active and optical jet galaxy 3C 264 (NGC 3862) using molecular gas kinematics observed with ALMA.*
3. Dieu D. Nguyen, Tinh Q. T. Le, Michele Cappellari, **Hai N. Ngo**, Tuan N. Le, Tien H. T. Ho, Elena Gallo, Michele Perna, and Niranjan Thatte. *Resolving the Heart of NGC 1052: JWST/NIRSpec Stellar Dynamical Black Hole Mass.*
4. Tien H. T. Ho, Dieu D. Nguyen, Michele Cappellari, **Hai N. Ngo**, Tinh Q. T. Le, Tuan N. Tuan, Elena Gallo, and Niranjan Thatte. *Weighing supermassive black hole mass in the Galaxy Sombrero (M94) using integral-field stellar dynamics with JWST/NIRSpec.*
5. Shelley-Anne Deborah Harrisberg, Sabine Thater, Dieu D. Nguyen, **Hai N. Ngo**, Tinh Q. T. Le, Tuan N. Le, and Tien H. T. Ho. *A high precision mass measurement of the central black hole in the massive elliptical NGC 2513 with ALMA molecular gas dynamics.*

CONFERENCE TALKS

- **Conference on Earth Sciences and Sustainable Development 2024** Vietnam/2024
“Extending the Simulations of Intermediate-mass Black Hole Mass Measurements to Virgo Cluster Using ELT/HARMONI High Resolution Integral-field Stellar Kinematics.”
- **Austrian Early Career Conference 2024** Austria/2024
“A High Precision Mass Measurement of the Central Black Hole in the Massive Elliptical NGC 2513 with ALMA Molecular Gas Dynamics.”
- **SAGI Astrophysics Workshop on Dust Polarimetry** Vietnam/2023
“ELT High Spatial Resolution IFS Survey for Ultra-Massive Galaxies: Observational Strategy and First Simulated Results on Stellar Kinematic and SMBH Mass Measurements.”
- **Fourth ICEBA 2023 conference** Vietnam/2023
“Simulating ELT High Spatial Resolution IFS and FCC 119 Intermediate-Mass Black Hole Mass Measurements.”
- **Windows on the Universe** Vietnam/2023
“ELT High Spatial Resolution IFS Survey for Ultramassive Galaxies: Observational Strategy and First Simulated Results on Stellar-Kinematic and SMBH Mass Measurements.”
- **SAGI New Frontiers of Astrophysics in the Golden Era of Dust Polarimetry** Vietnam/2022
“Hunting Intermediate-Mass Black Holes with Extremely Large Telescope.”

ADVANCED SCHOOLS

- **SAGI Observational Astronomy School** July 17 – 28, 2023
 - Practicing machine learning applications for classifying exoplanets and gamma-ray images.
 - Learning about asteroid and exoplanet light curves and their data analysis.
 - Project: Detecting the exoplanet WASP-3b using the Quy Nhon Observatory.
- **Michigan Cosmology Summer School 2023** June 5 – 9, 2023
 - Modelling the weak gravitational lenses.
 - Deriving cosmological parameters (e.g., Hubble constant, baryonic density, etc) from the CMB.

HONORS & AWARDS

- 2025 **Vietnam National University Scholar**
Awarded to students with outstanding academic and research achievements.
- 2020 **Best presentation**, Student scientific conference.
- 2020 **1st prize**, Science in Harmoni 2020.
- 2019 **1st prize**, Space engineering design competition.
- 2018 **2nd prize**, Golden Erlen academic contest.

LEADERSHIP & PROFESSIONAL SERVICES

Founder of University of Science Astronomy Club *University of Science, Vietnam National University*

- The largest and most active astronomy club in Vietnam for college students.
- Outreach on the latest Astronomy & Astrophysics discoveries for students and the general public.
- Promoting observational training, learning, and camping activities.
- Strengthening professional Astronomical research with active research groups, both domestic and international.

Advisor of University of Science Astronomy Club *University of Science, Vietnam National University*

- Providing academic support to the Club.
- Offering guidance and contribute ideas for activities.

PUBLIC TALKS

- **Tran Dai Nghia High School for Gifted**
"Black Hole & the Ways to Find Them." July 2025
- **NASA Challenge Space Apps**
"Applications of Spatial Data in Astronomical Research." June 2025
- **University of Science, Vietnam National University**
"The James Webb Space Telescope's Recent Findings on Supermassive Black Holes." November 2025
"Galaxy Formation and Evolution: From Big Bang to Present Universe." January 2025
"Black Holes & the Ways to Find Them." May 2023
"Telescope: When the Naked Eyes Were Not Enough." June 2022

REFERENCES

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