

# Hoang Anh (Benjamin) NGUYEN

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## PROFESSIONAL SUMMARY

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PhD student in Geophysics at Colorado School of Mines specializing in quantum computing, machine learning (ML), and computational physics. My research focuses on large-scale multi-component elastic wave simulation and inverse problems using GPU-accelerated solvers, quantum algorithms for PDE-based wave propagation and optimization, and hybrid quantum-classical physics-informed neural networks (PINNs) to improve training efficiency and inversion performance.

## EDUCATION

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| <b>Ph.D. of Geophysics</b>   Major: Geophysics - Minor: Computer Science<br>Colorado School of Mines (CSM)<br>Thesis: Solving inverse problems with quantum computing                    | Aug 2023 – 2027 (Expt.)<br>Golden, CO, USA |
| <b>Diploma of Earth Sciences</b>   Major: Earth System Physics<br>International Centre for Theoretical Physics (ICTP) - UNESCO<br>Thesis: Ambient noise tomography beneath the Banda Arc | Sept 2022 – Aug 2023<br>Trieste, Italy     |
| <b>Master of Physics</b>   Major: Computational Physics<br>Hanoi University of Science and Technology (HUST)<br>Thesis: Structural simulation of MgSiO <sub>3</sub> under compression    | May 2021 – Sept 2023<br>Hanoi, Vietnam     |
| <b>Bachelor of Physics</b>   Major: Computational Physics<br>Talent Honours Program – HUST<br>Thesis: Computational modeling of microstructure of magnesium silicate                     | Sept 2016 – April 2021<br>Hanoi, Vietnam   |

## RESEARCH EXPERIENCE

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| <b>Research Assistant</b><br>Department of Geophysics, CSM   | Aug 2023 – Present<br>Advisor: Prof. Tura, A.                          |
| <ul style="list-style-type: none"><li>Designed and implemented a hybrid quantum-classical PINN for seismic inverse problems, integrating finite-basis parameterization with ML-based optimization.</li><li>Developing a quantum encoder-decoder neural architecture for full waveform inversion (FWI), enabling low-dimensional latent representations of high-resolution velocity models.</li><li>PDEs solver &amp; optimization using quantum computing.</li><li>Built GPU-accelerated multicomponent elastic FWI framework with perfectly matched layer absorbing boundary conditions, achieving up to 100× speedup compared to baseline multiple CPU implementations.</li><li>Implemented distributed acoustic sensing (DAS) elastic FWI workflows using strain-velocity wave equations.</li></ul> |  |
| <b>Research Assistant</b><br>Earth System Physics, ICTP  | May 2023 – Aug 2023<br>Advisors: Prof. Aoudia, A. & Dr. Manu-Marfo, D. |
| <ul style="list-style-type: none"><li>Performed ambient noise tomography using four years of continuous seismic data to extract empirical Green's functions and invert surface-wave dispersion for crustal velocity models down to 200 km depth.</li><li>Implemented nonlinear inversion workflows for shear-wave velocity model reconstruction, including resolution analysis.</li></ul>  |  |
| <b>Research Assistant</b><br>Department of Computational Physics, HUST   | Aug 2018 – July 2023<br>Advisor: Prof. Nguyen, V.H.                    |
| <ul style="list-style-type: none"><li>Developed parallel molecular dynamics simulations in C on high-performance computing (HPC) architectures to investigate structural properties of condensed-matter systems at scale.</li><li>Performed first-principles density functional theory calculations in Quantum ESPRESSO, evaluating electronic structure and formation enthalpies using plane-wave pseudopotential methods.</li></ul>  |  |

## WORK EXPERIENCE

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| <b>Incoming Geophysics R&amp;D Research Intern</b>  | May 2026 – Aug 2026  |
| Shell: global integrated energy company   | Houston, TX          |
| <ul style="list-style-type: none"><li>Anisotropic elastic FWI and ML research within the Geophysics R&amp;D group.</li></ul>  |                      |
| <b>Geophysics R&amp;D Research Intern</b>   | May 2025 – Aug 2025  |
| TGS: energy data and analytics company  | Houston, TX          |
| <ul style="list-style-type: none"><li>Developed GPU-accelerated seismic wave solvers for high-performance computing environments</li><li>Q-attenuation and compensation modeling in isotropic and anisotropic (VTI/TTI) media using Devito Pro</li><li>Formulated anisotropic attenuation model on fully staggered grids for implementation</li><li>Implemented Q-elastic gradient computation for reverse time migration (RTM) and FWI</li></ul> |                      |
| <b>Geophysics R&amp;D Research Intern</b>   | Sept 2021 – Feb 2022 |
| VPI: national energy research institute   | Hanoi, Vietnam       |
| <ul style="list-style-type: none"><li>Implemented 3D seismic ray-tracing algorithms for travel-time modeling in heterogeneous velocity models.</li><li>Applied non-linear travel-time tomography techniques for subsurface velocity reconstruction.</li></ul>   |                      |

## ACADEMIC ACTIVITIES

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| <b>Peer-review service</b>  |                     |
| Geophysical Journals International (Oxford), <a href="#">IMAGE25</a> (SEG)  |                     |
| <b>PhD application mentoring</b>  |                     |
| Mentored 3 students attending PhD programs in the US  |                     |
| <b>IMAGE25 post-convention workshop presentation</b>  | Aug 2025            |
| Nguyen, H.A. Optimization with quantum annealing method   | Houston, TX         |
| <b>IASPE-IGA25 presentation</b>   | Sep 2025            |
| Manu-Marfo, D., Nguyen, H. A., Aoudia, A. Ambient noise tomography beneath the Banda basin reveals new insights into the arc-continent collision zone | Lisbon, Portugal    |
| <b>IMAGE25 presentation</b>   | Aug 2025            |
| Nguyen, H.A., Tura, A. Crosswell travelttime inversion using a quantum computing method   | Houston, TX         |
| <b>RCP25 presentation</b>   | Apr 2025            |
| Nguyen, H.A., Tura, A. Seismic wave propagation with gate-based quantum computing   | Golden, CO          |
| <b>RCP24 presentation</b>   | Apr 2024            |
| Nguyen, H.A., Tura, A. Seismic inversion with quantum computing   | Golden, CO          |
| <b>Erasmus master exchange 2022</b>   | Feb 2022 – Jul 2022 |
| Physics of complex systems - Polytechnic University of Turin (POLITO)   | Torino, Italy       |
| <b>HUST scientific research conference presentation</b>   | May 2020            |
| Nguyen, H.A. <i>et al.</i> Study on structure of magnesium silicate material under densification  | Hanoi, Vietnam      |
| <b>Vietnam Robot National Contest 2019</b>  | May 2019            |
| Team member of HUST   | Hanoi, Vietnam      |

## HONORS AND AWARDS

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- [1] Fully funded scholarship for postgraduate program at ICTP 2023
- [2] VEF 2.0 Program recommended candidate 2023: The [VEF 2.0](#) Program is conducted by the Fellows and Scholars of the Vietnam Education Foundation (VEF) – an independent U.S. Federal Government agency created by the U.S. Congress
- [3] Erasmus scholarship for master exchange students at POLITO 2022
- [4] Fully funded scholarship for the master program at HUST 2021, 2022
- [5] Certificate of Merit from School of Engineering Physics for undergraduates: Excellent Student in Fall Semester 2017, Spring Semester 2018, Fall Semester 2018, Spring Semester 2019
- [6] The 20th Vietnam National Student Physics Olympiad 2018: Second Prize
- [7] Lawrence S.Ting Scholarship 2017 for undergraduates

## OTHER CERTIFICATIONS

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- [1] Deep Learning Specialization from DeepLearning.AI
  - Neural Networks and Deep Learning ([Certificate](#))
  - Improving Deep Neural Networks: Hyperparameter Tuning, Regularization and Optimization ([Certificate](#))
  - Structuring Machine Learning Projects ([Certificate](#))

## CURRENT WORK & PUBLICATIONS

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- [1] Nguyen, H.A., Vashisth, D., Tura, A. Hybrid quantum–classical finite-basis physics-informed neural network for wave propagation and full waveform inversion. Manuscript in preparation for submission to *Communications AI & Computing* (2026).
- [2] Nguyen, H. A., Manu-Marfo, D., & Aoudia, A. Ambient noise tomography beneath the Banda basin reveals new insights into the Arc-Continent collision zone. Under review at *Geophys. Res. Lett.* (2026). [10.22541/es-soar.176790173.31128656/v1](https://doi.org/10.22541/es-soar.176790173.31128656/v1)
- [3] Plan, E.L.C.V.M., Phan, H., Nguyen, H.A. *et al.* Numerical simulation on structural and topological transitions of GeO<sub>2</sub> liquid under compression. *Eur. Phys. J. B* **99**, 20 (2026). [10.1140/epjb/s10051-026-01143-0](https://doi.org/10.1140/epjb/s10051-026-01143-0)
- [4] Nguyen, H.A., Tura, A. Seismic traveltime inversion with quantum annealing. *Scientific Reports* **15**, 17984 (2025). [10.1038/s41598-025-01188-8](https://doi.org/10.1038/s41598-025-01188-8)
- [5] Lai, D.V., Nguyen, S.H., Nguyen, H.A. *et al.* Tailoring hydrogen storage performance of Mg–Mg<sub>2</sub>Ni alloys: synergistic effects of composition and phase formation with first-principles insights. *RSC Advances* **15**, 31240–31254 (2025). [10.1039/D5RA04356E](https://doi.org/10.1039/D5RA04356E)
- [6] Nguyen, V.H., Pham, T.D., Nguyen, H., Mai, T.L. Molecular dynamics-based analysis of cavity distribution in GeO<sub>2</sub> glass: a novel computational method. (Manuscript). [Link](#)
- [7] Nguyen, V.H., Nguyen, H.A. Crystallisation of liquid silica under compression: a molecular dynamics simulation. *Pramana - J Phys* **98**, 142 (2024). [10.1007/s12043-024-02839-7](https://doi.org/10.1007/s12043-024-02839-7)
- [8] Nguyen, H.A., Nguyen, V.H. Study of the structure of MgSiO<sub>3</sub> system under compression by using ring statistics and voronoi analysis. *Phys. Scr.* **98**, 045919 (2023). [10.1088/1402-4896/acc5b7](https://doi.org/10.1088/1402-4896/acc5b7)
- [9] Nguyen, V.H., Nguyen, H.A., Iitaka, T., Mai, T.L. Computer simulation of phosphate-silicate and calcium phosphate-silicate systems. *Phys. Scr.* **98**, 065704 (2023). [10.1088/1402-4896/acd4fb](https://doi.org/10.1088/1402-4896/acd4fb)
- [10] Nguyen, H.A., Nguyen, S., Nguyen, V.H. Pressure-induced glassy networks of enstatite (MgSiO<sub>3</sub>) and forsterite (Mg<sub>2</sub>SiO<sub>4</sub>). *VNU J. Sci. Math. - Phys.* **39**, 1 (2023). [10.25073/2588-1124/vnumap.4767](https://doi.org/10.25073/2588-1124/vnumap.4767)
- [11] Pham, T.H.H., Doan, H.H., Ta, Q.M., Mai, T.L., Nguyen, H.A. Some results of seismic travel-time reflection tomography study. *Petrovietnam Journal* **10**, 4–16 (2021). [10.47800/PVJ.2021.10-01](https://doi.org/10.47800/PVJ.2021.10-01)
- [12] Nguyen, H.S., Nguyen, H.A., Pham, H.K., Iitaka, T., Nguyen, V.H. Topology of SiO<sub>x</sub> units and glassy network of magnesium silicate glass under densification: correlation between radial distribution function and bond angle distribution. *Modelling Simul. Mater. Sci. Eng.* **28**, 065007 (2020). [10.1088/1361-651X/ab9bb4](https://doi.org/10.1088/1361-651X/ab9bb4)
- [13] Nguyen, H.S., Nguyen, H.A. Structural simulation of Mg<sub>2</sub>SiO<sub>4</sub> under compression. *VNU J. Sci. Math. - Phys.* **36**, 4 (2020). [10.25073/2588-1124/vnumap.4484](https://doi.org/10.25073/2588-1124/vnumap.4484)

## TECHNICAL SKILLS

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Programming: Python, C, C++, Fortran, Matlab

Machine Learning Frameworks: JAX, PyTorch, TensorFlow, scikit-learn

Geophysical Modeling: Anisotropic elastic FWI, RTM, DASFWI, ambient noise tomography, quantum PDE solvers

Optimization: Adjoint-state methods, quantum annealing

HPC: Slurm, MPI, OpenMP/OpenACC, GPU computing.