

# Hoang Anh (Benjamin) NGUYEN

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## PROFESSIONAL SUMMARY

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

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

## RESEARCH EXPERIENCE

<b>Research Assistant</b>	Aug 2023 – Present
Department of Geophysics, CSM	Advisor: Prof. Tura, A.
• Designed and implemented a hybrid quantum–classical PINN for seismic inverse problems, integrating finite-basis parameterization with ML-based optimization.	
• Developing a quantum encoder–decoder neural architecture for full waveform inversion (FWI), enabling low-dimensional latent representations of high-resolution velocity models.	
• PDEs solver & optimization using quantum computing.	
• 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.	
• Implemented distributed acoustic sensing (DAS) elastic FWI workflows using strain-velocity wave equations.	
<b>Research Assistant</b>	May 2023 – Aug 2023
Earth System Physics, ICTP	Advisors: Prof. Aoudia, A. & Dr. Manu-Marfo, D.
• 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.	
• Implemented nonlinear inversion workflows for shear-wave velocity model reconstruction, including resolution analysis.	
<b>Research Assistant</b>	Aug 2018 – July 2023
Department of Computational Physics, HUST	Advisor: Prof. Nguyen, V.H.
• Developed parallel molecular dynamics simulations in C on high-performance computing (HPC) architectures to investigate structural properties of condensed-matter systems at scale.	
• Performed first-principles density functional theory calculations in Quantum ESPRESSO, evaluating electronic structure and formation enthalpies using plane-wave pseudopotential methods.	

## 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
• Anisotropic elastic full waveform inversion and machine learning research within the Geophysics R&D group.	
<b>Geophysics R&amp;D Research Intern</b>	May 2025 – Aug 2025
TGS: energy data and analytics company	Houston, TX
• Developed GPU-accelerated seismic wave solvers for high-performance computing environments	
• Q-attenuation and compensation modeling in isotropic and anisotropic (VTI/TTI) media using Devito Pro	
• Formulated anisotropic attenuation model on fully staggered grids for implementation	
• Implemented Q-elastic gradient computation for reverse time migration (RTM) and FWI	
<b>Geophysics R&amp;D Research Intern</b>	Sept 2021 – Feb 2022
VPI: national energy research institute	Hanoi, Vietnam
• Implemented 3D seismic ray-tracing algorithms for travel-time modeling in heterogeneous velocity models.	
• Applied non-linear travel-time tomography techniques for subsurface velocity reconstruction.	

## 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-IAGA25 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 traveltimes 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 traveltimes 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.