

Xin Deng

Earth and Planets Laboratory, Carnegie Science
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Appointments

2024–2026 **Carnegie Postdoctoral Fellow**, Earth and Planets Laboratory, Carnegie Science

Education

2019–2024 **Ph.D.**, School of Earth and Space Sciences, University of Science and Technology of China

2015–2019 **B.Sc.**, School of the Gifted Young, University of Science and Technology of China

Research interests

First-principles calculations & machine learning potentials

Properties of materials under high-pressure and high-temperature conditions

Equilibrium element partition and isotope fractionation

Structure and dynamics in the subduction zone

Composition and structure of the deep planetary interior

Publications

Articles: Submitted

[21] Zhao, Yajie; Hsu, Han; Wang, Wenzhong; Zhang, Xin; **Deng, Xin**; Chen, Bowen; Wu, Zhongqing*. "Iron spin crossover in ferromagnesite (Mg,Fe)CO₃ and its link to lower-mantle seismic heterogeneity", submitted to *Earth and Planetary Science Letters*.

[20] Yuan, Ye*; Magali, John Keith; **Deng, Xin**; Rochira, Federica; Jiang, Xiuxuan; Thomas, Christine. "SS Reflections or P-to-S Conversions? New Insight into the 1000-km Discontinuity", submitted to *Earth and Planetary Science Letters*.

[19] Zhang, Qiwei*; Brenker, Frank E.; Timmerman, Suzette; Shirey, Steven B.; Stachel, Thomas; Luth, Robert W.; Locock, Andrew; Stern, Richard A.; Chinn, Ingrid L.; Nestola, Fabrizio; **Deng, Xin**; Pearson, D. Graham. "Sublithospheric diamond constraints on the state of deeply subducted slabs", submitted to *Science Advances*.

[18] Park, Doyoon; **Deng, Xin***; Deng, Jie*. "Melting phase relation of seifertite and pyrite-type SiO₂ determined by machine learning potentials", submitted to *Physical Review B*.

- [17] **Deng, Xin***; Deng, Jie*; Walter, Michael; Fei, Yingwei; Yang, Jing; Cohen, Ronald E. "Phase Relations and Melting of SiO₂ Under Mantle Conditions Determined from Machine Learning Potentials", submitted to *Geophysical Research Letters*.
- [16] Liu, Cong*; **Deng, Xin**; Cohen, Ronald E. "Order-Disorder in Fe-Si Alloys: Implications for Seismic Anisotropy and Thermal Evolution of Earth's Inner Core", submitted to *Science Advances*.
- [15] Liu, Hao*; **Deng, Xin**; Leng, Wei*; Wu, Zhongqing; Chu, Risheng; Wang, Xin. "Double volcanic tracks at Hawaii caused by bridgmanite-enriched primordial mantle blobs", submitted to *Nature Communications*.
- [14] **Deng, Xin**; Wu, Zhongqing*; Song, Jian. "Water-Induced Mantle Overturns Leading to the Oxidation of Archean Upper Mantle", submitted to *Geophysical Research Letters*.

Articles: Published or In-Press

- [13] Wang, Dong; Duan, Longyu; **Deng, Xin**; Wang, Wenzhong; Wu, Zhongqing*. "Seismic Signature of the Upper Continental Crust: Implications from the thermoelastic properties of Liebermannite and K-hollandite II", *American Mineralogist*, in press. <https://doi.org/10.2138/am-2024-9562>
- [12] Zhao, Yajie; **Deng, Xin**; Wang, Wenzhong; Wu, Zhongqing*; Yuan, Ye. (2025) "Seismic Visibility of carbonated subducted oceanic crust in the lower mantle", *Communications Earth & Environment*, 6, 146. <https://doi.org/10.1038/s43247-025-02128-0>
- [11] Yuan, Ye*; Magali, John Keith; **Deng, Xin**; Sun, Daoyuan; Thomas, Christine. (2025) "Mantle discontinuities and reflectors beneath the Arctic Ocean and Aleutian-Alaska subduction zone: Evidence for MORB crust at the top of the lower mantle", *Earth and Planetary Science Letters*, 652, 119199. <https://doi.org/10.1016/j.epsl.2024.119199>
- [10] **Deng, Xin**; Chen, Yi-Xiang; Wang, Wenzhong; Li, Yonghui; Xiao, Zicong; Wu, Zhongqing*. (2024) "Heavy magnesium isotopic signatures in arc lavas may be attributed to dehydration of subducting hydrated mantle", *Communications Earth & Environment*, 5, 299. <https://doi.org/10.1038/s43247-024-01466-9>
- [9] Zhao, Yajie; **Deng, Xin**; Chen, Ling; Wu, Zhongqing*. (2024) "Is there a carbonated mid-lithosphere discontinuity in cratons?", *Journal of Geophysical Research: Solid Earth*, 129 (6). <https://doi.org/10.1029/2024JB028925>
- [8] Wang, Dong; Wu, Zhongqing*; **Deng, Xin**. (2023) "Thermal conductivity of Fe-bearing bridgmanite and post-perovskite: Implications for the heat flux from the core", *Earth and Planetary Science Letters*, 621, 118368. <https://doi.org/10.1016/j.epsl.2023.118368>
- [7] **Deng, Xin**; Xu, Yinhan; Hao, Shangqin; Ruan, Youyi; Zhao, Yajie; Wang, Wenzhong; Ni, Sidao; Wu, Zhongqing*. (2023) "Compositional and thermal state of the lower mantle from joint 3D inversion with seismic tomography and mineral elasticity", *Proceedings of the National Academy of Sciences*, 120 (26). <https://doi.org/10.1073/pnas.2220178120>
- [6] **Deng, Xin**; Song, Jian; Qian, Wangsheng; Wu, Zhongqing*. (2023) "Seismic signals induced by the Metasomatism of mantle wedge by siliceous melts: Insights from the elasticity of orthopyroxene at high pressure and temperature", *Tectonophysics*, 846, 229681. <https://doi.org/10.1016/j.tecto.2022.229681>

- [5] Wang, Dong; Wu, Zhongqing*; **Deng, Xin**. (2022) "Thermal Conductivity of Hydrous Wadsleyite Determined by Non-Equilibrium Molecular Dynamics Based on Machine Learning", *Geophysical Research Letters*, 49 (22). <https://doi.org/10.1029/2022GL100337>
- [4] **Deng, Xin**; Luo, Chenxing; Wentzcovitch, Renata M.; Abers, Geoffrey A.; Wu, Zhongqing*. (2022) "Elastic Anisotropy of Lizardite at Subduction Zone Conditions", *Geophysical Research Letters*, 49 (18). <https://doi.org/10.1029/2022GL099712>
- [3] Zhao, Yajie; Wu, Zhongqing*; Hao, Shangqin; Wang, Wenzhong; **Deng, Xin**; Song, Jian. (2022) "Elastic properties of Fe-bearing Akimotoite at mantle conditions: Implications for composition and temperature in lower mantle transition zone", *Fundamental Research*, 2, 570 577. <https://doi.org/10.1016/j.fmre.2021.12.013>
- [2] Liu, Cong; Wang, Junjie; **Deng, Xin**; Wang, Xiaomeng; Pickard, Chris J.; Helled, Ravit; Wu, Zhongqing; Wang, Huitian; Xing, Dingyu; Sun, Jian*. (2022) "Partially Diffusive Helium-Silica Compound under High Pressure", *Chinese Physics Letters*, 39, 076101. <https://doi.org/10.1088/0256-307X/39/7/076101>
- [1] Luo, Chenxing; **Deng, Xin**; Wang, Wenzhong; Shukla, Gaurav; Wu, Zhongqing; Wentzcovitch, Renata M.* (2021) "cij: A Python code for quasiharmonic thermoelasticity", *Computer Physics Communications*, 267, 108067. <https://doi.org/10.1016/j.cpc.2021.108067>

Invited talks

- 2025.9 **Magma Ocean Evolution Shapes the Redox State of Planets**
National Museum of Natural History, Smithsonian Institution (Invited by Elizabeth Cottrell)
- 2025.1 **Subduction Zone Structure and Lower Mantle Composition based on First-Principles Calculations**
Guangzhou Institute of Geochemistry (Invited by Yangfan Deng)
- 2023.12 **Large Low Shear Velocity Provinces**
USTC (Recent Advances in Geophysics)
- 2023.11 **Physics and Chemistry of the Earth's Interior: Insights from ab-initio Calculations**
USTC (Academic Salon for Postgraduates of Solid Geophysics)
- 2022.4 **Formation of Low V_P/V_S Regions in the Mantle Wedges of Subduction Zones**
USTC (Academic Forum for Postgraduates of Solid Geophysics)
- 2021.12 **3D Compositional and Thermal State of the Lower Mantle**
USTC (Academic Forum for Postgraduates of Solid Geophysics)

Conference presentations

- [32] **Deng, Xin**; Walter, Michael; Wu, Zhongqing; Cohen, Ronald E. (2025) "Secular cooling of the Magma Ocean Controls Early Planetary Oxidation State", *AGU Annual Meeting 2025*, New Orleans, USA.

- [31] **Deng, Xin**; Walter, Michael; Wu, Zhongqing; Cohen, Ronald E. (2025) "Secular cooling of the Magma Ocean Controls Early Planetary Oxidation State", *The 10th International Symposium on "From Atom to Earth" High pressure Science*, Beijing, China.
- [30] **Deng, Xin**; Zhao, Yajie; Walter, Michael; Wu, Zhongqing. (2025) "Elasticity of Aragonite under mantle conditions: implications for the carbonation of the big mantle wedge", *Goldschmidt 2025 Conference*, Prague, Czech.
- [29] **Deng, Xin**; Zhao, Yajie; Wu, Zhongqing. (2024) "Elasticity of Aragonite under mantle conditions by first-principles calculations", *AGU Annual Meeting 2024*, Washington, USA.
- [28] **Deng, Xin**; Chen, Yi-Xiang; Wang, Wenzhong; Li, Yonghui; Xiao, Zicong; Wu, Zhongqing. (2023) "Dehydration of Subducting Hydrated Mantle Revealed by Heavy Mg Isotopes in Arc Lavas", *AGU Fall Meeting 2023*, San Francisco, USA.
- [27] **Deng, Xin**; Chen, Yi-Xiang; Wang, Wenzhong; Li, Yonghui; Xiao, Zicong; Wu, Zhongqing. (2023) "Dehydration of Subducting Oceanic Mantle indicated by Heavy Magnesium Isotopes in Arc Lavas", *Annual Meeting of Chinese Geoscience Union 2023*, Zhuhai, China.
- [26] **Deng, Xin**; Xu, Yinhan; Hao, Shangqin; Ruan, Youyi; Zhao, Yajie; Wang, Wenzhong; Ni, Sidao; Wu, Zhongqing. (2023) "3D Composition and Temperature Structure of the Lower Mantle: Based on Seismic Tomography and Mineral Physics", *Seminar on Deep Mantle and Core*, Beijing, China.
- [25] **Deng, Xin**; Chen, Yi-Xiang; Wang, Wenzhong; Li, Yonghui; Xiao, Zicong; Wu, Zhongqing. (2023) "Dehydration of Subducting Hydrated Mantle indicated by High $\delta^{26}\text{Mg}$ Values in Arc Lavas", *Habitable Earth – Geoscience for Sustainability*, Qingdao, China.
- [24] **Deng, Xin**; Xu, Yinhan; Hao, Shangqin; Ruan, Youyi; Zhao, Yajie; Wang, Wenzhong; Ni, Sidao; Wu, Zhongqing. (2023) "Combining the high P-T elasticity of lower mantle minerals with seismic tomography to Constrain the 3D Composition and Temperature Structure of the Lower Mantle", *The 9th "From Atom to Earth" Symposium on High-pressure Science*, Chengdu, China. (**Best Student Presentation Award (Hongsen Award)**)
- [23] **Deng, Xin**; Xu, Yinhan; Hao, Shangqin; Ruan, Youyi; Zhao, Yajie; Wang, Wenzhong; Ni, Sidao; Wu, Zhongqing. (2023) "Construction of 3D Composition and Temperature Structure of the Lower Mantle", *The 2nd conference of "China Seismological Reference Model"*, Hefei, China. (poster)
- [22] **Deng, Xin**; Xu, Yinhan; Hao, Shangqin; Ruan, Youyi; Zhao, Yajie; Wang, Wenzhong; Ni, Sidao; Wu, Zhongqing. (2023) "Compositional and Thermal State of the Lower Mantle from Joint 3D Inversion with Seismic tomography and Mineral Elasticity", *Goldschmidt 2023 Conference*, Lyon, France.
- [21] **Deng, Xin**; Xu, Yinhan; Hao, Shangqin; Ruan, Youyi; Zhao, Yajie; Wang, Wenzhong; Ni, Sidao; Wu, Zhongqing. (2023) "Compositional and Thermal State of the Lower Mantle from Joint 3D Inversion with Seismic tomography and Mineral Elasticity", *2023 IPACES Annual Meeting*, Hefei, China. (poster / **Poster Presentation Award 2nd Prize**)
- [20] **Deng, Xin**; Xu, Yinhan; Hao, Shangqin; Ruan, Youyi; Zhao, Yajie; Wang, Wenzhong; Ni, Sidao; Wu, Zhongqing. (2023) "Compositional and Thermal State of the Lower Mantle from Joint 3D Inversion with Seismic Tomography and Mineral Elasticity", *Japan Geoscience Union Meeting 2023*, Chiba, Japan. (poster / **Outstanding Student Presentation Award**)
- [19] **Deng, Xin**; Xu, Yinhan; Hao, Shangqin; Ruan, Youyi; Zhao, Yajie; Wang, Wenzhong; Ni, Sidao;

Wu, Zhongqing. (2023) "Inversion of 3D Thermo-Chemical Structure of the Lower Mantle using Seismic Tomography and Elasticity of Lower-mantle Minerals at High Pressure and Temperature Conditions", *The 21st China High-Pressure Science Conference*, Dalian, China.

[18] **Deng, Xin**; Xu, Yinhan; Hao, Shangqin; Ruan, Youyi; Zhao, Yajie; Wang, Wenzhong; Ni, Sidao; Wu, Zhongqing. (2023) "3D Compositional and Thermal Structure of the Lower Mantle Inverted from Seismic Tomography and Mineral Elasticity", *The 8th Young Scientist Forum of Earth Science*, Wuhan, China.

[17] **Deng, Xin**; Xu, Yinhan; Hao, Shangqin; Ruan, Youyi; Zhao, Yajie; Wang, Wenzhong; Ni, Sidao; Wu, Zhongqing. (2023) "3D Thermo-Chemical Structure of the Lower Mantle based on Seismic Tomography and Mineral Elasticity", *The 5th Congress of China Geodesy and Geophysics*, Wuhan, China.

[16] **Deng, Xin**; Luo, Chenxing; Wentzcovitch, Renata; Abers, Geoffrey; Wu, Zhongqing. (2023) "Elasticity of Serpentine Minerals at Subduction Zone Conditions", *The 18th Annual Meeting of Chinese Society for Mineralogy Petrology and Geochemistry*, Hefei, China.

[15] **Deng, Xin**; Song, Jian; Qian, Wangsheng; Wu, Zhongqing. (2023) "Elasticity of Orthopyroxene at High P-T Conditions: Implications for the Metasomatism of Mantle Wedge by Siliceous Melts", *The 18th Annual Meeting of Chinese Society for Mineralogy Petrology and Geochemistry*, Hefei, China.

[14] **Deng, Xin**; Xu, Yinhan; Hao, Shangqin; Ruan, Youyi; Zhao, Yajie; Wang, Wenzhong; Ni, Sidao; Wu, Zhongqing. (2022) "Compositional and Thermal State of the Lower Mantle from Joint 3D Inversion with Seismic Tomography and Mineral Elasticity", *AGU Fall Meeting 2022*, Chicago, USA. (**Outstanding Student Presentation Award**)

[13] **Deng, Xin**; Xu, Yinhan; Hao, Shangqin; Ruan, Youyi; Zhao, Yajie; Wang, Wenzhong; Ni, Sidao; Wu, Zhongqing. (2022) "Compositional and Thermal State of the Lower Mantle from Joint 3D Inversion with Seismic Tomography and Mineral Elasticity", *Annual Meeting of Chinese Geoscience Union 2022/2021*, Fuzhou, China.

[12] **Deng, Xin**; Song, Jian; Qian, Wangsheng; Wu, Zhongqing. (2022) "Seismic signals induced by the Metasomatism of mantle wedge by siliceous melts: insights from the Elasticity of Orthopyroxene at High Pressure and Temperature", *Annual Meeting of Chinese Geoscience Union 2022/2021*, Fuzhou, China. (**Outstanding Student Presentation Award**)

[11] **Deng, Xin**; Xu, Yinhan; Hao, Shangqin; Ruan, Youyi; Zhao, Yajie; Wang, Wenzhong; Ni, Sidao; Wu, Zhongqing. (2022) "Compositional and Thermal State of the Lower Mantle from Joint 3D Inversion with Seismic tomography and Mineral Elasticity", *Frontiers of High Pressure Research – Science under Extreme Conditions*, Shanghai, China. (poster / **Best Poster Award**)

[10] **Deng, Xin**; Luo, Chenxing; Wentzcovitch, Renata; Abers, Geoffrey; Wu, Zhongqing. (2022) "Elastic anisotropy of lizardite at subduction zone conditions", *The 33rd IUPAP Conference on Computational Physics*, Austin, USA.

[9] **Deng, Xin**; Song, Jian; Qian, Wangsheng; Wu, Zhongqing. (2022) "Elasticity of Orthopyroxene at High Pressure and Temperature: Insights into the Metasomatism of Mantle Wedge by Siliceous Melts", *Goldschmidt 2022 Conference*, Honolulu, USA. (poster)

[8] **Deng, Xin**; Song, Jian; Qian, Wangsheng; Wu, Zhongqing. (2022) "Elasticity of Orthopyroxene at

High Pressure and Temperature: Insights into the Metasomatism of Mantle Wedge by Siliceous Melts", *Japan Geoscience Union Meeting 2022*, Chiba, Japan.

[7] **Deng, Xin**; Song, Jian; Qian, Wangsheng; Wu, Zhongqing. (2021) "Elasticity of Orthopyroxene at High Pressure and Temperature: Insights into the Metasomatism of Mantle Wedge by Siliceous Melts", *AGU Fall Meeting 2021*, New Orleans, USA. (poster)

[6] **Deng, Xin**; Luo, Chenxing; Wentzcovitch, Renata; Abers, Geoffrey; Wu, Zhongqing. (2021) "Elasticity of Lizardite at High Pressure and Temperature: Implications for the Water Content in Subduction Zones", *AGU Fall Meeting 2021*, New Orleans, USA. (poster)

[5] **Deng, Xin**; Song, Jian; Qian, Wangsheng; Wu, Zhongqing. (2021) "Elasticity of Orthopyroxene at High Pressure and Temperature: Insights into the Metasomatism of Mantle Wedge by Siliceous Melts", *2021 International Symposium on Deep Earth Exploration and Practices*, Nanjing, China.

[4] **Deng, Xin**; Luo, Chenxing; Wentzcovitch, Renata; Wu, Zhongqing. (2021) "Elasticity of Lizardite at High Pressure and Temperature: Implications for the Water Content in Subduction Zones and Arc Magmas", *The 6th Conference on Earth System Science*, Shanghai, China.

[3] **Deng, Xin**; Song, Jian; Qian, Wangsheng; Wu, Zhongqing. (2021) "Elasticity of Orthopyroxene at High Pressure and Temperature: Insights into the Metasomatism of Mantle Wedge by Siliceous Melts", *The 8th "From Atom to Earth" Symposium on High-pressure Science and Earth Science*, Guiyang, China.

[2] **Deng, Xin**; Wu, Zhongqing. (2021) "Compositional and thermal state of the Moon from first-principles calculations", *2021 National Planetary Science Conference*, Suzhou, China.

[1] **Deng, Xin**; Wu, Zhongqing. (2020) "Elasticity of Lizardite at High Pressure and Temperature: Implications for the Water Content in Subduction Zones", *Annual Meeting of Chinese Geoscience Union 2020*, Chongqing, China.

Honors

2024	Carnegie Postdoctoral Fellowship (Earth and Planets Lab, Carnegie Science)
2024	Excellent Graduation Thesis Award (USTC)
2024	Excellent Graduate of Anhui Province Ordinary Colleges and Universities (Anhui Province)
2024	Outstanding Graduate of University of Science and Technology of China (USTC)
2024	President's Award of the Chinese Academy of Sciences (Chinese Academy of Sciences)
2024	Dean's Award for Outstanding Students, School of Earth and Space Sciences (USTC)
2023	National Scholarship for Postgraduates (USTC)
2023	Outstanding Student Presentation Award (Seminar on Deep Mantle and Core)
2023	Best Student Presentation Award (Hongsen Award) (The 9th "From Atom to Earth" Symposium on High-pressure Science)
2023	Poster Presentation Award 2nd Prize (2023 IPACES Annual Meeting)
2023	Outstanding Student Presentation Award (Japan Geoscience Union Meeting 2023)
2022	Outstanding Student Presentation Award (AGU Fall Meeting 2022)
2022	Outstanding Student Presentation Award (Annual Meeting of CGU 2022/2021)
2022	Best Poster Award (Frontiers of High Pressure Research – Science under Extreme Conditions)
2021-2023	First-Class Academic Scholarship for Doctoral Students (USTC)
2019-2020	First-Class Academic Scholarship for Master Students (USTC)

Teaching experience

Teaching Assistant at University of Science and Technology of China

2021–2023	GEPH6411P	Solid Mechanics
2018–2023	PHYS1001A	Mechanics A
2019–2020	PHYS1004A	Electromagnetism A

Service

Peer review for Communications Earth & Environment (1)

Proposal reviewer (non-panelist) for NSF (1)