

# Xin Deng

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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

- [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 SiO<sub>2</sub> 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 SiO<sub>2</sub> 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 Overtures 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 10<sup>th</sup> 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 9<sup>th</sup> "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 2<sup>nd</sup> 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 21<sup>st</sup> 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 8<sup>th</sup> 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 5<sup>th</sup> 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 18<sup>th</sup> 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 18<sup>th</sup> 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 33<sup>rd</sup> 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 6<sup>th</sup> 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 8<sup>th</sup> "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	<b>Carnegie Postdoctoral Fellowship</b> (Earth and Planets Lab, Carnegie Science)
2024	<b>Excellent Graduation Thesis Award</b> (USTC)
2024	<b>Excellent Graduate of Anhui Province Ordinary Colleges and Universities</b> (Anhui Province)
2024	<b>Outstanding Graduate of University of Science and Technology of China</b> (USTC)
2024	<b>President's Award of the Chinese Academy of Sciences</b> (Chinese Academy of Sciences)
2024	<b>Dean's Award for Outstanding Students, School of Earth and Space Sciences</b> (USTC)
2023	<b>National Scholarship for Postgraduates</b> (USTC)
2023	<b>Outstanding Student Presentation Award</b> (Seminar on Deep Mantle and Core)
2023	<b>Best Student Presentation Award (Hongsen Award)</b> (The 9th "From Atom to Earth" Symposium on High-pressure Science)
2023	<b>Poster Presentation Award 2<sup>nd</sup> Prize</b> (2023 IPACES Annual Meeting)
2023	<b>Outstanding Student Presentation Award</b> (Japan Geoscience Union Meeting 2023)
2022	<b>Outstanding Student Presentation Award</b> (AGU Fall Meeting 2022)
2022	<b>Outstanding Student Presentation Award</b> (Annual Meeting of CGU 2022/2021)
2022	<b>Best Poster Award</b> (Frontiers of High Pressure Research – Science under Extreme Conditions)
2021-2023	<b>First-Class Academic Scholarship for Doctoral Students</b> (USTC)
2019-2020	<b>First-Class Academic Scholarship for Master Students</b> (USTC)

## **Teaching experience**

### **Teaching Fellowship 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)