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

[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_2 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_2 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 δ^{26}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)