

Nicole Xike Nie

Assistant professor
Massachusetts Institute of Technology
77 Massachusetts Ave, E25-641
Cambridge, MA 02139
(312) 647-3877 | nxnie@mit.edu | cosmoslab.mit.edu

EDUCATION Ph.D. in Isotope Geo/Cosmochemistry, University of Chicago, Chicago, IL 2019
M.S. in Geochemistry, Chinese Academy of Sciences (CAS), Beijing, China 2013
B.S. in Geology, China University of Geosciences (CUG), Beijing, China 2010

APPOINTMENTS Assistant professor, MIT, Cambridge, MA 07/2023–present
Visiting scientist, MIT, Cambridge, MA 07/2022–06/2023
Postdoctoral researcher, Caltech, Pasadena, CA 01/2022–06/2023
Carnegie Postdoctoral Fellow, Carnegie Institution for Science, Washington, DC 09/2019–01/2022

RESEARCH INTERESTS Isotope geo/cosmochemistry; early solar system processes; Moon formation; volatile element depletion in planetary bodies; Earth and planetary surface weathering; ion exchange column chromatography; NRIXS spectroscopy; MC-ICPMS and TIMS technique

AWARDS 3CPE Grant, Caltech 2022–2023
P² (Postdoc x Postdoc) Grant, Carnegie Science 2020–2021
Carnegie Postdoctoral Research Fellowship 2019–2021
NASA Earth and Space Science Fellowship 2015–2018
Department Fellowship, University of Chicago 2015
Chinese Academy of Sciences Fellowship, CAS, China 2010–2013
Tsang Hin-Chi Scholarship, China 2007–2010
China National Scholarship (three times) 2007, 2008, 2009

PEER-REVIEWED PUBLICATIONS ([GOOGLE SCHOLAR](#))

- [25] Prissel K. B., Krawczynski M. J., Nie N. X., Dauphas N., Aarons S. M., Heard A. W., Hu M. Y., Alp E. E., Zhao J. (2024) Fractionation of iron and titanium isotopes by ilmenite and the isotopic compositions of lunar magma ocean cumulates. *Geochimica et Cosmochimica Acta*. In press. [Link](#)
- [24] Grewal D. S., Nie N. X., Zhang B., Izidoro A., Asimow P. D. (2024) Accretion of the earliest inner solar system planetesimals beyond the water-snowline. *Nature Astronomy*, 1–8. [Link](#)
- [23] Hu J. Y., Dauphas N., Nie N. X., Roskosz M., Chen X., Heard A. W., Zhang Z. J., Alp E. E., Hu M. Y., Zhao J. (2023) Equilibrium fractionation of REE isotopes in nature: insights from NRIXS and DFT studies of Eu and Dy phonon density of states. *Geochimica et Cosmochimica Acta* 348, 323–339. [Link](#)
- [22] Heard A. W., Dauphas N., Hinz I. L., Johnson J. E., Blanchard M., Alp E. E., Hu M. Y., Zhao J., Lavina B., Fornace M. E., Hu J. Y., Roskosz M., Sio C. K. I., Nie N. X., Baptiste B. (2023) Isotopic constraints on the nature of primary precipitates in Archean–early Paleoproterozoic iron formations from determinations of the iron phonon density of states of greenalite and 2L- and 6L-ferrihydrite. *ACS Earth Space Chemistry* 7(4), 712–727. [Link](#)
- [21] Nie N. X., Wang D., Torrano Z. T., Carlson R. W., Alexander C. M. O'D., Shahar A. (2023) Meteorites have inherited nucleosynthetic anomalies of potassium-40 produced in supernovae. *Science* 379, 372–376. [Link](#)

- [20] Nie N. X., Chen X.-Y., Zhang Z. J., Hu J. Y., Liu W., Tissot F. L. H., Teng F.-Z., Shahar A, Dauphas N. (2023) Rubidium and potassium isotopic variations in chondrites and mars: accretion signatures and planetary overprints. *Geochimica et Cosmochimica Acta* 344, 207–229. [Link](#)
- [19] Huang C., Wang H, Xie L.-W., Nie N., Yang Y.-H., Zhao X., Li J., Tian H.-C., Wu S.-T., Xu L., Yang J.-H. (2022) In situ Ti isotopic analysis by femtosecond laser ablation MC-ICP-MS. *Journal of Analytical Atomic Spectrometry* 37, 2165–2175. [Link](#)
- [18] Roskosz M., Dauphas N., Hu J., Hu M. Y., Neuville D. R., Brown D., Bi W., Nie N. X., Zhao J., Alp E. E. (2022) Structural, redox and isotopic behaviors of iron in geological silicate glasses: a NRIXS study of Lamb-Mössbauer factors and force constants. *Geochimica et Cosmochimica Acta* 321, 184–205. [Link](#)
- [17] Dauphas N., Nie N. X., Blanchard M., Zhang Z. J., Zeng H., Hu J. Y., Meheut M., Visscher C., Canup R., Hopp T. (2022) The extent, nature, and origin of K and Rb depletions and isotopic fractionations in Earth, Moon, and other planetary bodies. *The Planetary Science Journal* 3(29). [Link](#)
- [16] Nie N. X., Chen X.-Y., Hopp T., Hu J. Y., Zhang Z. J., Teng F.-Z., Shahar A., Dauphas N. (2021) Imprint of chondrule formation on the K and Rb isotopic compositions of carbonaceous meteorites. *Science Advances* 7(49), eabl3929. [Link](#)
- [15] Nie N. X., Dauphas N., Hopp T., Hu J. Y., Zhang Z. J., Yokochi R., Ireland T., Tissot F. L. H. (2021) Chromatography purification of Rb for accurate isotopic analysis by MC-ICPMS: A comparison between AMP-PAN, cation-exchange, and Sr resins. *Journal of Analytical Atomic Spectrometry* 36, 2588–2602. DOI: 10.1039/D1JA00268F. [Link](#)
- [14] Aarons S. M., Dauphas N., Blanchard M., Zeng H., Nie N. X., Johnson A. C., Greber N. D. and Hopp T. (2021) Clues from ab initio calculations on titanium isotopic fractionation in tholeiitic and calc-alkaline magma Series. *ACS Earth and Space Chemistry* 5(9), 2466–2480. [Link](#)
- [13] Nie N. X., Dauphas N., Alp E. E., Zeng H., Sio C. K., Hu J. Y., Chen X., Aarons S. M., Zhang Z., Tian H.-C., Wang D., Prissel K. B., Greer J., Bi W., Hu M. Y., Zhao J., Shahar A., Roskosz M., Teng F.-Z., Krawczynski M. J., Heck P. R. and Spear F. S. (2021) Iron, magnesium, and titanium isotopic fractionations between garnet, ilmenite, fayalite, biotite, and tourmaline: results from NRIXS, ab initio, and study of mineral separates from the Moosilauke metapelite. *Geochimica et Cosmochimica Acta* 302, 18–45. [Link](#)
- [12] Zhang Z. J., Nie N. X., Mendybaev R. A., Liu M. C., Hu J. J., Hopp T., Alp E. E., Lavina B., Bullock E. S., McKeegan K. D. and Dauphas N. (2021) Loss and isotopic fractionation of alkali elements during diffusion-limited evaporation from molten silicate: theory and experiments. *ACS Earth and Space Chemistry* 5(4), 755–784. [Link](#)
- [11] Chen X., Tissot F. L. H., Jansen M. F., Bekker A., Liu C. X., Nie N. X., Halverson G. P., Veizer J., Dauphas N. (2021) The uranium isotopic record of shales and carbonates through geologic time. *Geochimica et Cosmochimica Acta* 300, 164–191. [Link](#)
- [10] Heard A. W., Dauphas N., Guilbaud R., Rouxel O. J., Butler I. B., Nie N. X., Bekker A. (2020) Triple iron isotope constraints on the role of ocean iron sinks in early atmospheric oxygenation. *Science* 370(6515), 446–449. [Link](#)
- [9] Chen X., Wang W., Zhang Z., Nie N. X., Dauphas N. (2020) Evidence from ab initio and transport modeling for diffusion-driven zirconium isotopic fractionation in igneous rocks. *ACS Earth and Space Chemistry* 4(9), 1572–1595. [Link](#)
- [8] Nie N. X., Dauphas N., Villalon K. L., Liu N., Heard A. W., Morris R. V., Mertzman S. A. (2020) Iron isotopic and chemical tracing of basalt alteration and hematite spherule formation in Hawaii: A prospective study for Mars. *Earth and Planetary Science Letters* 544, 116385. [Link](#)
- [7] Zeng H., Rozsa V., Nie N. X., Zhang Z., Pham T. A., Galli G., Dauphas N. (2019) Ab initio calculation of equilibrium isotopic fractionations of potassium and rubidium in minerals and water. *ACS Earth and Space Chemistry* 3(11), 2601–2612. [Link](#)

- [6] Nie N. X., Dauphas N. (2019) Vapor drainage in the protolunar disk as the cause for the depletion in volatile elements of the Moon. *The Astrophysical Journal Letters* 884(2), L48. [Link](#)
- [5] Johnson A. C., Aarons S. M., Dauphas N., Nie N. X., Zeng H., Helz R. T., Romaniello S. J., Anbar A. D. (2019) Titanium isotopic fractionation in Kilauea Iki lava lake driven by oxide crystallization. *Geochimica et Cosmochimica Acta* 264, 180–190. [Link](#)
- [4] Prissel K. B., Krawczynski M. J., Nie N. X., Dauphas N., Couvy H., Hu M. Y., Alp E. E., Roskosz M. (2018) Experimentally determined effects of olivine crystallization and melt titanium content on iron isotopic fractionation in planetary basalts. *Geochimica et Cosmochimica Acta* 238, 580–598. [Link](#)
- [3] Dauphas N., Hu M. Y., Baker E. M., Hu J., Tissot F. L. H., Alp E. E., Roskosz M., Zhao J., Bi W., Liu J., Lin J. F., Nie N. X., Heard A. (2018) SciPhon: a data analysis software for Nuclear Resonant Inelastic X-ray Scattering with applications to Fe, Kr, Sn, Eu and Dy. *Journal of Synchrotron Radiation* 25(5). [Link](#)
- [2] Nie N. X., Dauphas N., Greenwood R. C. (2017) Iron and oxygen isotope fractionation during iron UV photo-oxidation: Implications for early Earth and Mars. *Earth and Planetary Science Letters* 458, 179–191. [Link](#)
- [1] Zheng Y., Jia J., Nie X., Kong P. (2014) Cosmogenic nuclide burial age of the Sanying Formation and its implications. *Science China Earth Sciences*, 57(6): 1141–1149. [Link](#)

CONFERENCE PRESENTATIONS Isotopic Variations of Rb and K in Non-Carbonaceous Chondrites: Insights into Parent Body Processes. *AGU Fall Meeting*, San Francisco, 2023.

Rb and K isotopic variations in non-carbonaceous chondrites and Mars. *54th Lunar and Planetary Science Conference*, Houston, 2023.

[Invited] Supernova-Derived Potassium-40 Anomalies in Primitive Meteorites. *AGU Fall Meeting*, Chicago, 2022.

[Invited keynote] Incomplete condensation of volatile elements as the cause for volatile depletion in carbonaceous chondrites. *Goldschmidt conference*, Hawai'i, 2022.

Rubidium isotopic compositions of non-carbonaceous chondrites. *AGU Fall Meeting*, New Orleans, 2021.

A condensation origin of potassium and rubidium isotopic variations in carbonaceous chondrites. *Annual Meetings of the Meteoritical Society*, Chicago, 2021.

Rubidium isotopic compositions of Earth, Moon, and chondrites. *51st Lunar and Planetary Science Conference*, Houston, 2020.

Rubidium isotopic compositions of the Earth and the Moon. *50th Lunar and Planetary Science Conference*, Houston, 2019.

High-temperature equilibrium Fe isotope fractionation: A comparison among NRIXS, ab-initio calculations and natural samples. *AGU Fall Meeting*, Washington DC, 2018.

Inter-mineral equilibrium iron isotopic fractionation factors from a special metamorphic rock. *Goldschmidt Conference*, Boston, 2018.

Clues on acid-sulfate alteration and hematite formation on Earth and Mars from iron isotope analyses of terrestrial analogues from Hawaii. *48th Lunar and Planetary Science Conference*, Houston, 2017.

Iron and oxygen isotope fractionation during photo-oxidation. *Goldschmidt Conference, Japan*, 2016.

Iron and oxygen isotope fractionation during photo-oxidation. *47th Lunar and Planetary Science Conference*, Houston, 2016.

Iron isotope constraints on the photo-oxidation pathway to BIF formation. *46th Lunar and Planetary Science Conference*, Houston, 2015.

**INVITED
SEMINARS**

Nucleosynthetic anomalies of volatile elements. (2023) Zhejiang University, China.
Volatile depletion in the early solar system. (2022) UCLA.
Chondrule and chondrite formation recorded by volatile element isotopes. (2022) MIT.
Lunar volatile loss in the aftermath of the Giant Impact. (2022) MIT.
Tracing early solar system processes using non-traditional isotopes. (2022) University of Iowa.
Lunar volatile loss, Giant Impact, and Moon formation. (2022) University of Iowa.
Lunar volatile loss in the aftermath of the Giant Impact. (2022) Rice University.
Astrophysical context of Moon formation. (2022) Peking University, Beijing, China.
Volatile loss in the early solar system: The Moon and chondrites. (2021) The University of Maryland.
Lunar volatile depletion and the Moon-forming giant impact. (2020) Chengdu University of Technology, Sichuan, China.
Volatile element depletion in the Moon. (2020) China University of Geosciences, Wuhan, China.
How did the Moon lose its volatiles after the Giant Impact? An isotopic perspective. (2020) University of California, Berkeley.
An isotopic perspective on lunar volatile loss through the Giant Impact. (2020) Carnegie Institution for Science.
Photo-oxidation on early Earth and Mars: insights from Fe isotopes. (2017) Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing, China.

TEACHING

12.412/12.612 Meteorites, Cosmochemistry, and Solar System Formation.

Fall 2023

**ACADEMIC
SERVICE**

Reviewer for *Chemical Geology (CG)*, *Geochimica et Cosmochimica Acta (GCA)*, *Geochemical Perspective Letters (GPL)*, *Geostandards and Geoanalytical Research (GGR)*, *Monthly Notices of the Royal Astronomical Society (MNRAS)*, *Nature Communications (NC)*, *Nature Geoscience (NG)*, *Proceedings of the National Academy of Sciences (PNAS)*, *Terra Nova*.

Judge for Meteoritical Society student awards. (2021)

NASA proposal evaluation panel. (2020)

OUTREACH

Nucleosynthetic anomalies in meteorites. (2022) [Link1](#) [Link2](#) [Link3](#) [Link4](#)

Interview with *American Scientist* magazine. (2022) [Link](#)

The grand prize of the UChicago Science as Art contest. (2022) *University of Chicago*. [Link1](#) [Link2](#)

Tracking down the forces that shaped our solar system's evolution. (2021) *Carnegie Science*. [Link](#)

Beads of glass in meteorites help scientists piece together how solar system formed. (2021) *Uchicago News*. [Link](#)

NASA moon rocks help form new picture of early moon and Earth. (2019) *Uchicago News*. [Link](#)

50 years later, UChicago scientists continue to decode moon's mysteries. (2019) *Uchicago News*. [Link](#)

French-American Science Festival. (2017) *Chicago*. [Link](#)

The idea of hematite formation on Mars through photo-oxidation. (2016) *CosmoSparks*. [Link](#)

PROFESSIONAL AFFILIATIONS American Geophysical Union (AGU), Geochemical Society (GS), Meteoritical Society

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