

Nicole Xike Nie

Postdoctoral researcher

California Institute of Technology

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EDUCATION	Ph.D. in Isotope Geo/Cosmochemistry, University of Chicago, Chicago, IL (Advisor: Prof. Nicolas Dauphas)	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	Starting 07/2023
	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

SKILLS Element purification by column chromatography; MC-ICPMS; TIMS; Electron Microprobe; NRIXS (Nuclear Resonant Inelastic X-Ray Scattering Spectroscopy); Mössbauer Spectroscopy

AWARDS AND SCHOLARSHIPS	3CPE Grant, Caltech	2022–2023
	P ² (Postdoc x Postdoc) Grant, Carnegie Science	2020–2021
	Carnegie Postdoctoral Research Fellowship	2019–2021
	NASA Earth and Space Science Fellowship	2015–2018
	Goldschmidt Student Travel Grant	2016
	Department Fellowship, University of Chicago	2015
	Chinese Academy of Sciences Fellowship, CAS, China	2010–2013
	Outstanding Undergraduate Award, CUG, China	2010
	Laboratory Open Funding Outstanding Project Award, CUG, China	2009
	Tsang Hin-Chi Scholarship, China	2007–2010
	Excellence in Geology Award, CUG, China	2007–2010
	China National Scholarship (three times)	2007, 2008, 2009

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

- [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*. [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 N. 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 ABSTRACTS

- Nie N. X.**, Wang D., Torrano Z. T., Carlson R. W., Alexander C. M.O'D., Shahar A. (2022) Supernova-Derived Potassium-40 Anomalies in Primitive Meteorites. *AGU Fall Meeting*. [Invited talk]
- Nie N. X.**, Chen X.-Y., Hopp T., Hu J. Y., Zhang Z. J., Teng F.-Z., Shahar A., Dauphas N. (2022) Incomplete condensation of volatile elements as the cause for volatile depletion in carbonaceous chondrites. *Goldschmidt 2022*. [Invited keynote]
- Ni P., Shahar A., Liu Y., **Nie N.**, Young E., Shirey S. B. (2022) Revisiting iron isotope systematics of the Earth-Moon system. *Goldschmidt 2022*.
- Zhang Z. J., Mendybaev R. A., **Nie N. X.**, Ni P., Bullock E. S., Dauphas N. (2022) Evaporation kinetics of alkali elements from silicate melts: an experimental comparison between vacuum and 1-atm evaporations. *Goldschmidt 2022*.
- Nie N. X.**, Dauphas N. (2021) Rubidium isotopic compositions of non-carbonaceous chondrites. *AGU Fall Meeting*.
- Dauphas N., **Nie N. X.**, Blanchard M., Zhang Z., Zeng H., Hu J., Méheut M., Visscher C., Canup R. M., Hopp T. (2021) Did the depletion in moderately volatile elements of the Moon happen in the protolunar disk or lunar magma ocean? *AGU Fall Meeting*.
- Nie N. X.**, Chen X.-Y., Hopp T., Hu J. Y., Zhang Z. J., Teng F.-Z., Shahar A., Dauphas N. (2021) A condensation origin of potassium and rubidium isotopic variations in carbonaceous chondrites. *LPI Contributions* 2609, 6217. Annual Meetings of the Meteoritical Society. [Oral presentation]
- 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. *LPI Contributions* 2609, 6257.
- Dauphas N., **Nie N. X.**, Blanchard M., Zhang Z. J., Zeng H., Hu J. Y., Meheut M., Visscher C., Canup R., Hopp T. (2021) Are K and Rb uniformly depleted in lunar rocks? *LPI Contributions* 2609, 6226.
- Heard A. W., Dauphas N., Guilbaud R., Rouxel O. J., Butler I. B., **Nie N.**, Bekker A. (2021) Testing links between the pre-GOE iron cycle and oxygenation using triple iron isotopes. *Goldschmidt 2021*.
- Shahar A., Ni P., **Nie N.** (2021) Using stable isotopes to probe the evolution of planetary interiors. *Goldschmidt 2021*.
- Nie N. X.**, Hopp T., Dauphas N. (2020) Rubidium isotopic compositions of Earth, Moon, and chondrites. *51th Lunar and Planetary Science Conference*, #2180.
- Hopp T., **Nie N. X.**, Dauphas N. (2020) Reappraisal of K and Rb isotope fractionation in lunar soils and the origin of the lunar exosphere. *51th Lunar and Planetary Science Conference*, #1190.
- Zhang Z., **Nie N. X.**, Mendybaev R. A., Liu M. C., McKeegan K. D., Dauphas N. (2020) Evaporation kinetics of potassium and rubidium and their isotope fractionation under vacuum conditions. *51th Lunar and Planetary Science Conference*, #2341.
- Zhang Z., **Nie N. X.**, Mendybaev R. A., Dauphas N. (2019) Experimental study of potassium and rubidium evaporation under vacuum conditions. *AGU Fall Meeting Abstracts* V43D-0101.

- Aarons S. M., Dauphas N., Zeng H., **Nie N. X.**, Greber N. D., Johnson A. (2019) Controls on titanium isotope fractionation in tholeiitic and calc-alkaline magmas. *AGU Fall Meeting Abstracts V54A-07*.
- Heard A. W., Dauphas N., Rouxel O. J., Bekker A., Guilbaud R., Butler I. B., **Nie N. X.** (2019) Triple iron isotope analyses as a tracer of sulfidic and oxic iron sinks before Earth's Great Oxygenation. *AGU Fall Meeting Abstracts V54A-07*.
- Dauphas N., **Nie N. X.** (2019) Why is the Moon depleted in moderately volatile elements? *82nd Annual Meeting of The Meteoritical Society*, vol. 2157.
- Liu N., Oglione R. C., Nittler L. R., **Nie N. X.**, Dauphas N. (2019) Isotopic and elemental analyses of meteorites and Mars analogues by Hyperion-NanoSIMS. *82nd Annual Meeting of The Meteoritical Society*, vol. 2157.
- Nie N. X.**, Dauphas N. (2019) Rubidium isotopic compositions of the Earth and the Moon. *50th Lunar and Planetary Science Conference*, #2098. [Oral presentation]
- Zhang Z., **Nie X.**, Mendybaev R. A., Dauphas N. (2019) Experimental study of potassium and rubidium evaporation under vacuum conditions. *50th Lunar and Planetary Science Conference*, #2834.
- Finlayson V., Rubin K. H., Konter J. G., **Nie N. X.**, Dauphas N. (2018) Variable fluid contributions to boninite magma generation, Mata Volcanic Field, NE Lau Basin as determined by trace elements and Fe-Sr-Pb-Nd-Hf-U-Th-Ra isotopes. *AGU Fall Meeting, December 10-14, Washington, DC*.
- Nie N. X.**, Dauphas N., Zeng H., Sio C. K., Hu J. Y., Alp E. E., Bi W., Hu M. Y., Spear F. S. (2018) High-temperature equilibrium Fe isotope fractionation: A comparison among NRIXS, ab-initio calculations and natural samples. *AGU Fall Meeting, December 10-14, Washington, DC*.
- Nie N. X.**, Dauphas N., Sio C. K., Spear F. S. (2018) Inter-mineral equilibrium iron isotopic fractionation factors from a special metamorphic rock. *Goldschmidt Conference, August 12-17, Boston, MA*.
- Heard A. Dauphas N. Rouxel O., **Nie N.** (2018) Triple iron isotope variations in Archean ocean sediments. *Goldschmidt Conference, August 12-17, Boston, MA*.
- Prissel K. B., Krawczynski M. J., Dauphas N., **Nie N. X.** (2018) Evaporative iron loss during one-atmosphere gas-mixing experiments. *Sixteenth International Symposium on Experimental Mineralogy, Petrology, and Geochemistry, June 17-21, Clermont-Ferrand, France*.
- Heard A. W., Dauphas N., Rouxel O. J., **Nie N. X.** (2018) Insights into redox cycling on early earth from the mass fractionation law of iron isotopes in Archean sediments. *49th Lunar and Planetary Science Conference*, #2470.
- Dauphas N., Meheut M., Blanchard M., Zeng H., Galli G., Canup R. N., Visscher C., **Nie N.** (2018) Can lunar formation theories be tested with K isotopes? *49th Lunar and Planetary Science Conference*, #2481.
- Finlayson V., Konter J., Rubin K. H., **Nie N. X.**, Dauphas N. (2017) A subduction zone spreading ridge transition signature preserved in recent volcanic activity in the NE Lau Basin. *The Geological Society of America 113th Annual Meeting, May 23-25, Honolulu, Hawaii*.
- Nie N. X.**, Dauphas N., Morris R. V. (2017) 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*, #2802. [Oral presentation]
- Nie N. X.**, Dauphas N., Greenwood R. C. (2016) Iron and oxygen isotope fractionation during photo-oxidation. *Goldschmidt Conference, June 26-July 1, Yokohama, Japan*. [Oral presentation]
- Nie N. X.**, Dauphas N., Greenwood R. C. (2016) Iron and oxygen isotope fractionation during photo-oxidation. *47th Lunar and Planetary Science Conference*, #1489.
- Williams K. B., Krawczynski M. J., **Nie N. X.**, Dauphas N., Couvy H., Hu M. Y., Alp E. E. (2016) The role of differentiation processes in mare basalt iron isotope signatures. *47th Lunar and Planetary Science Conference*, #2779.

Nie N. X., Dauphas N. (2015) Iron isotope constraints on the photo-oxidation pathway to BIF formation. 46th Lunar and Planetary Science Conference, #2635. [Oral presentation]

**INVITED
SEMINARS**

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
ASSISTANT-
SHIPS**

GEOS 21100: Introduction to Petrology, University of Chicago	Spring 2014, 2015, 2016
PHSC 13600: Natural Hazards, University of Chicago	Winter 2014, 2018
PHSC 13400: Global Warming, University of Chicago	Fall 2013, 2014

(Total hours \approx 200; total number of students \approx 120)

**ACADEMIC
SERVICE**

Reviewer for *Nature Geoscience*, *Nature Communications*, *Geochemical Perspective Letters (GPL)*, *Geochimica et Cosmochimica Acta (GCA)*, *Chemical Geology*, *Geostandards and Geoanalytical Research (GGR)*, *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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