Stanford

# Sonia Tikoo-Schantz

Assistant Professor of Geophysics and, by courtesy, of Earth and Planetary Sciences

Curriculum Vitae available Online

## Bio

### BIO

I utilize paleomagnetism and fundamental rock magnetism as tools to investigate problems in the planetary sciences. By studying the remanent magnetism recorded within rocks from differentiated planetary bodies, I can learn about core processes that facilitate the generation of dynamo magnetic fields within the Earth, Moon, and planetesimals. Determining the longevities and paleointensities of dynamo fields that initially magnetized rocks also provides insight into the long-term thermal evolution (i.e., effects of secular cooling) of planetary bodies. I also use paleomagnetism to understand impact cratering events, which are the most ubiquitous modifiers of planetary surfaces across the solar system. Impact events produce heat, shock, and sometimes hydrothermal systems that are all capable of resetting magnetization within impactites and target rocks via thermal, shock, and chemical processes. Therefore, I am able to use a combination of paleomagnetic and rock magnetic characterization to investigate shock pressures, temperatures, structural changes, and post-impact chemical alteration experienced by cratered planetary surfaces.

### ACADEMIC APPOINTMENTS

- Assistant Professor, Geophysics
- Assistant Professor (By courtesy), Earth & Planetary Sciences

### LINKS

- Google Scholar Profile: https://scholar.google.com/citations?user=E4SNn_MAAAAJ&hl=en&oi=ao

## Teaching

### COURSES

**2025-26**

- Designing Science Fiction Planets: EPS 30N, GEOPHYS 30N (Win)
- Paleomagnetism: EPS 129, EPS 229, GEOPHYS 139, GEOPHYS 239 (Aut)
- Planetary Magnetism: GEOPHYS 385T (Aut, Win, Spr)
- Planetary Science and Exploration Seminar: AA 299, EPS 375, GEOPHYS 375 (Aut, Win, Spr)

**2024-25**

- Introduction to Planetary Science: AA 124, EPS 124, ESS 125, GEOPHYS 124 (Spr)
- Planetary Magnetism: GEOPHYS 385T (Aut, Win)
- Planetary Science and Exploration Seminar: AA 299, EPS 375, GEOPHYS 375 (Aut, Win, Spr)

**2023-24**

- Designing Science Fiction Planets: EPS 30N, GEOPHYS 30N (Aut)
- Evolution of Terrestrial Planets: EPS 238, GEOPHYS 237 (Spr)
- Frontiers of Geophysical Research at Stanford: GEOPHYS 101, GEOPHYS 201 (Aut)
- Planetary Magnetism: GEOPHYS 385T (Aut, Win, Spr)

**2022-23**

- Introduction to Planetary Science: ESS 125, GEOLSCI 124, GEOPHYS 124 (Spr)
- Planetary Magnetism: GEOPHYS 385T (Aut, Win, Spr, Sum)

### STANFORD ADVISEES

**Doctoral Dissertation Reader (AC)**

Andrea Zorzi

**Orals Chair**

Keidai Iiyama

**Postdoctoral Faculty Sponsor**

Ji In Jung

**Doctoral Dissertation Advisor (AC)**

Alexander Gleason, Alexis Hensley, Ethan Lopes, Vespera Luo

## Publications

### PUBLICATIONS

- **Thank You to Our 2025 Peer Reviewers** *GEOCHEMISTRY GEOPHYSICS GEOSYSTEMS*
  Dixon, J., Asimow, P., Behr, W., Bremer, A., Edmonds, M., Uribe, D., Kaus, B., Paul, A., Tikoo, S., Williams, B.
  2026; 27 (4)
- **Nonlinear Redox Transformations of Chromium in Soil during Wildfire Heating: The Critical Role of Iron Mineralogy.** *Environmental science & technology*
  Namayandeh, A., Lamb, C., Sarabia, J. L., Shakouri, M., Lopes, E., Lezama Pacheco, J., Honeyman, A., Coker, A., Stewart, B., Tikoo, S., Peak, D., Fendorf, S.
  2025
- **Magnetic Mineralogy in Lunar Mare Basalts and Implications for Paleointensity Retrieval** *JOURNAL OF GEOPHYSICAL RESEARCH-PLANETS*
  Jung, J., Tikoo, S. M., Vaci, Z., Krawczynski, M. J., Solheid, P., Burns, D. H., Vailionis, A.
  2025; 130 (9)
- **Notional Geological Traverses, Station Activities, and Sample Collection on Mons Malapert, Lunar South Polar Region** *JOURNAL OF GEOPHYSICAL RESEARCH-PLANETS*
  Kring, D. A., Fagan, A. L., Bickel, V. T., Deutsch, A. N., Gaddis, L. R., Gross, J., Hiesinger, H., Huning, T. M., Hurtado, J. M., Iqbal, W., Joy, K. H., Keszthelyi, L., Lemelin, et al
  2025; 130 (7)
- **Exploring the origins of magnetization within the Chicxulub crater upper peak ring** *METEORITICS & PLANETARY SCIENCE*
  Verhagen, C. M., Tikoo, S. M., Schmieder, M., Gattacceca, J., Demory, F., Gross, J., Kring, D. A., Burger, P. V., Gulick, S. P. S., Morgan, J. V., Rebolledo-Vieyra, M., Urrutia-Fucugauchi, J., Pickersgill, et al
  2025; 60 (4): 823-848
- **Thank You to Our 2024 Peer Reviewers** *GEOCHEMISTRY GEOPHYSICS GEOSYSTEMS*
  Dixon, J., Asimow, P., Behr, W., Bremer, A., Edmonds, M., Uribe, D., Kaus, B., Paul, A., Tikoo, S., Williams, B.
  2025; 26 (4)

- **Assessing lunar paleointensity variability during the 3.9-3.5 Ga high field epoch** *EARTH AND PLANETARY SCIENCE LETTERS*
  Jung, J., Tikoo, S. M., Burns, D., Vaci, Z., Krawczynski, M. J.
  2024; 638

- **Sea changes for scientific ocean drilling** *PHYSICS TODAY*
  Robinson, R. S., Tikoo, S., Fulton, P.
  2024; 77 (2): 28-34

- **Significance of Secondary Fe-Oxide and Fe-Sulfide Minerals in Upper Peak Ring Suevite from the Chicxulub Impact Structure** *MINERALS*
  Verhagen, C. M., Jung, J., Tikoo, S. M., Wittmann, A., Kring, D. A., Brachfeld, S., Wu, L., Burns, D. H., Gulick, S. P. S.
  2023; 13 (3)

- **Lunar Magnetism** *NEW VIEWS OF THE MOON 2*
  Wieczorek, M. A., Weiss, B. P., Breuer, D., Cebron, D., Fuller, M., Garrick-Bethell, I., Gattacceca, J., Halekas, J. S., Hemingway, D. J., Hood, L. L., Laneuville, M., Nimmo, F., Oran, et al
  edited by Neal, C. R., Gaddis, L. R., Jolliff, B. L., Lawrence, S. J., Mackwell, S. J., Shearer, C. K., Valencia, S. N.
  2023; 89: 207-241

- **Elevation Changes and Slope that May Affect EVA Workload Near Potential Artemis Landing Sites**
  Kring, D. A., Bickel, V. T., van der Bogert, C. H., Fagan, A. L., Gaddis, L. R., Hiesinger, H., Hurtado, J. M., Joy, K. H., Lemelin, M., Looper, C. A., Osinski, G. R., Poesges, G., Siegler, et al
  IEEE.2023

- **LUNAR VERTEX: A LOW-COST LANDER-ROVER INVESTIGATION OF REINER GAMMA**
  Blewett, D. T., Halekas, J., Ho, G. C., Greenhagen, B. T., Anderson, B. J., Vines, S. K., Regoli, L., Jahn, J., Kollmann, P., Denevi, B. W., Meyer, H. M., Klima, R. L., Cahill, et al
  WILEY.2022

- **A South Pole-Aitken impact origin of the lunar compositional asymmetry.** *Science advances*
  Jones, M. J., Evans, A. J., Johnson, B. C., Weller, M. B., Andrews-Hanna, J. C., Tikoo, S. M., Keane, J. T.
  2022; 8 (14): eabm8475

- **An episodic high-intensity lunar core dynamo** *NATURE ASTRONOMY*
  Evans, A. J., Tikoo, S. M.
  2022

- **Dynamos in the Inner Solar System** *ANNUAL REVIEW OF EARTH AND PLANETARY SCIENCES*
  Tikoo, S. M., Evans, A. J.
  2022; 50: 99-122

- **Mars as a time machine to Precambrian Earth** *Journal of the Geological Society*
  Lapotre, M., Bishop, J., Ielpi, A., Lowe, D., Siebach, K., Sleep, N., Tikoo, S.
  2022

- **Probing the hydrothermal system of the Chicxulub impact crater.** *Science advances*
  Kring, D. A., Tikoo, S. M., Schmieder, M., Riller, U., Rebolledo-Vieyra, M., Simpson, S. L., Osinski, G. R., Gattacceca, J., Wittmann, A., Verhagen, C. M., Cockell, C. S., Coolen, M. J., Longstaffe, et al
  2020; 6 (22): eaaz3053

- **Explosive interaction of impact melt and seawater following the Chicxulub impact event** *GEOLOGY*
  Osinski, G. R., Grieve, R. A. F., Hill, P. J. A., Simpson, S. L., Cockell, C., Christeson, G. L., Ebert, M., Gulick, S., Melosh, H., Riller, U., Tikoo, S. M., Wittmann, A.
  2020; 48 (2): 108–12

- **Probing space to understand Earth** *Nature Reviews Earth & Environment*
  Lapotre, M. G., O'Rourke, J. G., Schaefer, L. K., Siebach, K. L., Spalding, C., Tikoo, S. M., Wordsworth, R. D.
  2020; 1: 170-181

- **The first day of the Cenozoic** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
  Gulick, S. P. S., Bralowe, T. J., Ormo, J., Hall, B., Grice, K., Schaefer, B., Lyons, S., Freeman, K. H., Morgan, J., Artemieva, N., Kaskes, P., de Graaff, S. J., Whalen, et al

2019; 116 (39): 19342–51

- **Drilling-induced and logging-related features illustrated from IODP-ICDP Expedition 364 downhole logs and borehole imaging tools** *SCIENTIFIC DRILLING*
  Lofi, J., Smith, D., Delahunty, C., Le Ber, E., Brun, L., Henry, G., Paris, J., Tikoo, S., Zylberman, W., Pezard, P. A., Celerier, B., Schmitt, D. R., Nixon, et al
  2018; 24: 1–13

- **Lunar Swirl Morphology Constrains the Geometry, Magnetization, and Origins of Lunar Magnetic Anomalies** *JOURNAL OF GEOPHYSICAL RESEARCH-PLANETS*
  Hemingway, D. J., Tikoo, S. M.
  2018; 123 (8): 2223–41

- **Rapid recovery of life at ground zero of the end-Cretaceous mass extinction** *NATURE*
  Lowery, C. M., Bralower, T. J., Owens, J. D., Rodriguez-Tovar, F. J., Jones, H., Smit, J., Whalen, M. T., Claeys, P., Farley, K., Gulick, S. P. S., Morgan, J. V., Green, S., Chenot, et al
  2018; 558 (7709): 288-+

- **The Case Against an Early Lunar Dynamo Powered by Core Convection** *GEOPHYSICAL RESEARCH LETTERS*
  Evans, A. J., Tikoo, S. M., Andrews-Hanna, J. C.
  2018; 45 (1): 98–107

- **A two-billion-year history for the lunar dynamo** *SCIENCE ADVANCES*
  Tikoo, S. M., Weiss, B. P., Shuster, D. L., Suavet, C., Wang, H., Grove, T. L.
  2017; 3 (8): e1700207

- **The fate of water within Earth and super-Earths and implications for plate tectonics** *PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY A-MATHEMATICAL PHYSICAL AND ENGINEERING SCIENCES*
  Tikoo, S. M., Elkins-Tanton, L. T.
  2017; 375 (2094)

- **Further evidence for early lunar magnetism from troctolite 76535** *JOURNAL OF GEOPHYSICAL RESEARCH-PLANETS*
  Garrick-Bethell, I., Weiss, B. P., Shuster, D. L., Tikoo, S. M., Tremblay, M. M.
  2017; 122 (1): 76–93

- **The formation of peak rings in large impact craters** *SCIENCE*
  Morgan, J. V., Gulick, S. P. S., Bralower, T., Chenot, E., Christeson, G., Claeys, P., Cockell, C. S., Collins, G. S., Coolen, M. J. L., Ferriere, L., Gebhardt, C., Goto, K., Jones, et al
  2016; 354 (6314): 878–82

- **Reply to Comment on "Pervasive remagnetization of detrital zircon host rocks in the Jack Hills, Western Australia and implications for records of the early dynamo"** *EARTH AND PLANETARY SCIENCE LETTERS*
  Weiss, B. P., Maloof, A. C., Harrison, T., Swanson-Hysell, N. L., Fu, R. R., Kirschvink, J. L., Watson, E., Coe, R. S., Tikoo, S. M., Ramezani, J.
  2016; 450: 409–12

- **A matter of minutes: Breccia dike paleomagnetism provides evidence for rapid crater modification** *GEOLOGY*
  Fairchild, L. M., Swanson-Hysell, N. L., Tikoo, S. M.
  2016; 44 (9): 723–26

- **Magnetism of a very young lunar glass** *JOURNAL OF GEOPHYSICAL RESEARCH-PLANETS*
  Buz, J., Weiss, B. P., Tikoo, S. M., Shuster, D. L., Gattacceca, J., Grove, T. L.
  2015; 120 (10): 1720–35

- **Preservation and detectability of shock-induced magnetization** *JOURNAL OF GEOPHYSICAL RESEARCH-PLANETS*
  Tikoo, S. M., Gattacceca, J., Swanson-Hysell, N. L., Weiss, B. P., Suavet, C., Cournede, C.
  2015; 120 (9): 1461–75

- **The lunar dynamo** *SCIENCE*
  Weiss, B. P., Tikoo, S. M.
  2014; 346 (6214): 1198-+

- **Decline of the lunar core dynamo** *EARTH AND PLANETARY SCIENCE LETTERS*
  Tikoo, S. M., Weiss, B. R., Cassata, W. S., Shuster, D. L., Gattacceca, J., Lima, E. A., Suavet, C., Nimmo, F., Fuller, M. D.
  2014; 404: 89–97
- **A Long-Lived Lunar Core Dynamo** *SCIENCE*
  Shea, E. K., Weiss, B. P., Cassata, W. S., Shuster, D. L., Tikoo, S. M., Gattacceca, J., Grove, T. L., Fuller, M. D.
  2012; 335 (6067): 453–56