Dr. Advik D. Vira

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Education

2020 – 2026 **Ph.D., Physics, Georgia Institute of Technology**
Dissertation: *Radiation Effects, Dust Dynamics, and Petrology of Lunar Materials: Insights from Computational Modeling and Electron Microscopy*,
Advisors: Prof. Phillip N. First & Prof. Zhigang Jiang (co-advisor).

Doctoral Minor in Teaching and Learning for Higher Education.

M.S., Physics, Georgia Institute of Technology

2014 – 2018 **B.A., Physics, Smith College** with highest honors.
Honors Thesis: *High Precision Spectroscopy of Beryllium Lowest Singlet State*,
Advisor: Prof. William D. Raven.

B.A., Mathematics, Smith College

Research

2020-2026 **Ph.D. in Condensed Matter Physics**, *Georgia Institute of Technology.*

- Application of High-Resolution Electron Microscopy to Lunar Material (NASA program):
  - Performed nanoscale characterization of Apollo Rock 75035 using focused ion beam to directly analyze the subsurface without requiring polished sections. Utilized modern transmission electron microscopy techniques (EELS & 4D-STEM) to advance the field of lunar petrology.
  - Irradiated terrestrial ilmenite to recreate the solar wind and study mechanisms driving the formation of nanophase iron ($npFe^0$). Characterized structural evolution of $npFe^0$.
  - Manuscripts (in progress):
    (1) trivalent titanium in ilmenite from Apollo rock (published, Nature Communications);
    (2) pyroxene exsolution exhibiting antiphase domain boundaries in Apollo rock (in prep);
    (3) solar wind induced growth of $npFe^0$ (under review, Planetary Science Journal).

- Computational Modeling of Materials for Space Exploration Applications (NASA program):
  - Developed Monte Carlo code using the Geant4 framework to simulate the charge accumulation on lunar dust, `g4chargeit`: https://github.com/kgandhi63/g4chargeit.git (manuscript, submitted).
  - Simulated the optimal boron distribution within polyethylene shielding composites using Geant4 for incorporation into radiation protection equipment [*APL Materials* **11**, 101104 (2023)].

- Traditional condensed matter projects (Prof. Zhigang Jiang's Group):
  - Electron microscopy on disordered antiferromagnetic materials ($K_2Co(SeO_3)_2$).
  - Magnetotransport analysis for InAsSb/InSb band-engineered semiconductor structures.

2018-2020 **Research Appointment in Space Division**, *Los Alamos National Laboratory*.

- Simulated response of solid-state detectors using Monte Carlo code called SRIM/TRIM and compared to on-orbit satellite measurements from national security instruments (unpublished).
- Developed Bayesian model of NASA Van Allen Probes/HOPE ion spectra using SRIM/TRIM.

2014-2018 **Highest Honors in Atomic Physics**, *Smith College*.

- Measured the lowest singlet state of neutral beryllium to the highest precision to date.
- Preformed numerical analysis and modeling quantum states using Optical Bloch equations.

2017-2018 **Research Fellow**, *Smithsonian Astrophysical Observatory*.

Summer 2017 **NSF Research Experience**, *Harvard-Smithsonian Center for Astrophysics*.

Summer 2016 **DOE Science Internship**, *Los Alamos National Laboratory*.

Peer-Reviewed Publications

In Preparation

Vira, A. D., Burgess, K. D., Tian, M., Eames, K. M., Trivedi, R. S., Kim, D. M., Jones, B. M., Orlando, T. M., Jiang, Z. & First, P. N. Pyroxferroite Lamellae with Antiphase Domain Boundaries in Mare Basalt.

Submitted

1. Funsten, H. O., Dors, E. E., Fernandes, P. A., Harper, R. W., Ritzau, S. M., Skoug, R. M., Steinberg, J. T. & **Vira**, **A. D.** Exploiting the Physics of Ion Energy Loss in Solid State Detectors for Composition Measurement of Space Plasmas. *Journal of Geophysical Research: Space Physics* (2026).

Under Review

2. Gandhi, K. P., **Vira**, **A. D.**, Farrell, W. M., Simonov, N., Romero-Calvo, A., Orlando, T. M., First, P. N. & Jiang, Z. g4chargeit: Geant4-based kinetic Monte Carlo simulations of charging in dielectric materials. *Journal of Computational Physics.* doi:10.2139/ssrn.6352017 (2026).

3. Huang, Z., **Vira**, **A. D.**, Trivedi, R. S., Jiang, Z., First, P. N., Hirabayashi, M., Jones, B. M. & Orlando, T. M. Solar Wind-induced Oxygen Vacancies Nucleate Nanophase Iron in Lunar Regolith. *AGU Advances* (2026).

4. Trivedi, R. S., **Vira**, **A. D.**, Jones, B. M., Burgess, K. D., Huang, Z., Liu, H., Rane, P., Tian, M., Hirabayashi, M., Orlando, T. M., Jiang, Z. & First, P. N. Creation of Lunar-Like Rims in Ilmenite using Synthetic Solar Wind. *Planetary Science Journal.* doi:10.48550/arXiv.2509.03334 (2026).

Published

5. **Vira**, **A. D.**, Burgess, K. D., First, E. C., Tian, M., Eames, K. M., Trivedi, R. S., Dotson, G. K., Kim, D. M., Farr, T. P., Lisabeth, H., Tamura, N., Livernois, E. R., Jones, B. M., Orlando, T. M., Jiang, Z. & First, P. N. Trivalent Titanium in High-Titanium Lunar Ilmenite. *Nature Communications.* doi:10.1038/s41467-026-69770-w (2026).

6. Kim, C., Rathi, S., Zhang, N., Seth, A., Simonov, N. V., Rutherford, A., Chen, L., Zhou, H., Peng, C., Xu, M., Xie, W., **Vira**, **A. D.**, Tian, M., Ozerov, M., Kimchi, I., Mourigal, M., Smirnov, D. & Jiang, Z. Sharp spectroscopic fingerprints of disorder in an incompressible magnetic state. *Nature Communications.* ISSN: 2041-1723. doi:10.1038/s41467-025-67394-0 (2025).

7. Schaible, M. J., Dotson, G. K., Trivedi, R., **Vira**, **A. D.** & Hand, K. P. Solar wind sputtering of secondary ions from water-ice-covered regolith analogs. *The Planetary Science Journal* **6.** Publisher: The American Astronomical Society, 219. doi:10.3847/PSJ/adfc4f (2025).

8. **Vira**, **A. D.**, Mone, E. M., Ryan, E. A., Connolly, P. T., Smith, K., Roecker, C. D., Mesick, K. E., Orlando, T. M., Jiang, Z. & First, P. N. Designing a boron nitride polyethylene composite for shielding neutrons. *APL Materials* **11,** 101104. doi:10.1063/5.0163377 (2023).

9. Samra, J. E., Marquez, V., Cheimets, P., DeLuca, E. E., Golub, L., Hannigan, J. W., Madsen, C. A., **Vira**, **A. D.** & Adams, A. The Airborne Infrared Spectrometer: Development, Characterization, and the 2017 August 21 Eclipse Observation. *The Astronomical Journal* **164,** 39. doi:10.3847/1538-3881/ac7218 (2022).

10. **Vira**, **A. D.**, Larsen, B. A., Skoug, R. M. & Fernandes, P. A. Bayesian Model for HOPE Mass Spectrometers on Van Allen Probes. *Journal of Geophysical Research: Space Physics* **126,** e2020JA028862. doi:10.1029/2020JA028862 (2021).

11. Cook, E. C., **Vira**, **A. D.** & Williams, W. D. Resonant two-photon spectroscopy of the 2s3d $^1D_2$ level of neutral ^{9}Be. *Physical Review A* **101,** 042503. doi:10.1103/PhysRevA.101.042503 (2020).

12 **Vira**, **A. D.**, Fernandes, P. A., Skoug, R. M., Funsten, H. O. & Reisenfeld, D. B. Understanding Mass Resolution of Foil-Based Time-of-Flight Mass Spectrometry. *Journal of Geophysical Research: Space Physics* **125,** e2020JA027971. doi:10.1029/2020JA027971 (2020).

13 **Vira**, **A. D.**, Fernandes, P. A., Funsten, H. O., Morley, S. K., Yamaguchi, H., Liu, F. & Moody, N. A. Angular scattering of protons through ultrathin graphene foils: Application for time-of-flight instrumentation. *Review of Scientific Instruments* **91,** 033302. doi:10.1063/1.5134768 (2020).

14 Judge, P., Berkey, B., Boll, A., Bryans, P., Burkepile, J., Cheimets, P., DeLuca, E., De Toma, G., Gibson, K., Golub, L., Hannigan, J., Madsen, C., Marquez, V., Richards, A., Samra, J., Sewell, S., Tomczyk, S. & **Vira**, **A. D.** Solar Eclipse Observations from the Ground and Air from 0.31 to 5.5 Microns. *Solar Physics* **294,** 166. doi:10.1007/s11207-019-1550-3 (2019).

15 Cook, E. C., **Vira**, **A. D.**, Patterson, C., Livernois, E. & Williams, W. D. Testing Quantum Electrodynamics in the Lowest Singlet State of Neutral Beryllium-9. *Physical Review Letters* **121,** 053001. doi:10.1103/PhysRevLett.121.053001 (2018).

16 Patterson, C., **Vira**, **A. D.**, Herd, M. T., Hawkins, W. B. & Williams, W. D. Calibrating an ultra-low expansion cavity for high precision spectroscopy from 630 THz to 685 THz using molecular tellurium lines. *Review of Scientific Instruments* **89,** 033107. doi:10.1063/1.5008290 (2018).

Grants

2023 - 2028 **CLEVER: Center for Lunar Environment and Volatile Exploration Research**
NASA Solar System Exploration Research Virtual Institute (SSERVI)
Contributed to proposal writing and funded as a Ph.D. Student, Total: [redacted]
PI: Prof. Thomas M. Orlando, Deputy PI: Prof. Frances Rivera-Hernández

Spring 2025 **Co-location Fellowship, "Advancing our understanding of lunar petrology"**
Center for Space Technology and Research (CSTAR), Georgia Institute of Technology
Wrote proposal and funded as a Ph.D. Student, Total: [redacted]
PI: Prof. Phillip N. First, Collaborator: Dr. Katherine D. Burgess

Fall 2024 **Seed Funding, "Support for investigations of a lunar mineral"**
Center for Space Technology and Research (CSTAR), Georgia Institute of Technology
Funded as a Ph.D. Student, Total: [redacted], PI: Prof. Phillip N. First

2021-2024 **Seed Funding, "Materials development for additive manufacture of radiation sensors"**
NASA CAN, Funded as a Graduate Student, Total: [redacted], PI: Prof. Phillip N. First

2017-2022 **REVEALS: Radiation Effects on Volatiles & Exploration of Asteroids and Lunar Surfaces**
NASA Solar System Exploration Research Virtual Institute (SSERVI)
Funded as a Graduate Student, Total: [redacted], PI: Prof. T. M. Orlando

Presentations

Invited Seminars

04/2025 ● **Planetary Sample Science Seminar** [virtual]
"Nanoscale characterization of Apollo lunar samples", Orlando, T. M. & **Vira**, **A. D.**

03/2024 ● **University of Georgia, Center for Simulational Physics** [Athens, GA]
"Computational Perspective on Material Interactions with Lunar Radiation", **Vira**, **A. D.**

09/2023 ● **Los Alamos National Laboratory, Space Science and Applications** [Los Alamos, NM]
"Designing Boron Nitride Polyethylene Composites for Shielding Neutrons", **Vira**, **A. D.**

12/2022 ● **Smith College, Physics Department** [Northampton, MA]
"Material Solutions for Radiation Protection in Space Exploration", **Vira**, **A. D.**

Conferences (Oral)

07/2024 ● **NASA Exploration Science Forum** [St. Louis, MO]
"Role of Near-Surface Vesicles in Lunar Water Formation", **Vira**, **A. D.**, Trivedi, R. S., Rane, P., Schaible, M. J., Orlando, T. M., Jiang, Z. & First, P. N.

12/2023 ● **Geant4 Space Users Workshop** [Pasadena, CA]
"Designing Boron Nitride Polyethylene Composites for Shielding Neutrons", **Vira**, **A. D.**, Ryan, E. A., Mone, E. M., Connolly, P. T., Smith, K., Roecker, C. D., Mesick, K. E., Orlando, T. M., Jiang, Z. & First, P. N.

07/2023 ● **NASA Exploration Science Forum** [College Park, MD]
"Designing Boron Nitride Polyethylene Composites for Shielding Neutrons", **Vira**, **A. D.**, Ryan, E. A., Mone, E. M., Connolly, P. T., Smith, K., Roecker, C. D., Mesick, K. E., Orlando, T. M., Jiang, Z. & First, P. N.

03/2022 ● **American Physical Society March Meeting** [Chicago, IL]
"Effective g-factor and phase-coherent transport in InAsSb/InSb double quantum wells", **Vira**, **A. D.**, Zhao, T., Zhang, L. Z., First, P. N., Pan, W., Ermolaev, M., Kipshidze, G., Suchalkin, S. & Jiang, Z.

07/2019 ● **Ion Composition in the Sun-Earth System** [Durango, CO]
"Observations of Oxygen Abundance Enhancements in the Inner Magnetosphere", **Vira**, **A. D.**, Fernandes, P. A., Skoug, R. M. S., Thomsen, M. F., Larsen, B. A. L., Reeves, G. & Funsten, H.

12/2019 ● **American Geophysical Union** [San Francisco, CA]
"Model of Solid-State Detectors for Space Plasma Spectroscopy", **Vira**, **A. D.**, Funsten, H. O., Fernandes, P. A., Skoug, R. M., Greco, R., Steinberg, J. T. & Larsen, B.

08/2018 ● **International Society for Optics and Photonics Conference** [San Diego, CA]
"Image Stabilization for Airborne Infrared Spectrometer", **Vira**, **A. D.**, Samra, J., Cheimets, P., DeLuca, E. & Marquez, V.

Conferences (Poster)

03/2025 ● **56th Lunar and Planetary Science Conference** [Woodlands, TX]
"Uncovering the Mysteries Hidden in Apollo 17 Rocks", **Vira**, **A. D.**, Burgess, K. D., Kim, D., Eames, K. M., Trivedi, R. S., Tian, M., Orlando, T. M., Jiang, Z. & First, P. N.

07/2022 ● **NASA Exploration Science Forum** [Boulder, CO]
"Radiation Shielding and Dosimetry: Simulations and Experiments", **Vira**, **A. D.**, Alandmatouq, F., Mone, E. M., Connolly, P. T., Ryan, E. A., Smith, K., Roecker, C. D., Mesick, K. E., Mukhopadhyayand, S., Orlando, T. M., Jiang, Z. & First, P. N.

11/2022 ● **Lunar Surface Innovation Consortium Fall Meeting** [virtual]
"Radiation Protection: Polymer-Based Shielding Composites", **Vira**, **A. D.**, Ryan, E. A., Mone, E. M., Connolly, P. T., Smith, K., Roecker, C. D., Mesick, K. E., Orlando, T. M., Jiang, Z. & First, P. N.

12/2018 ● **American Geophysical Union** [Washington, DC]
"Van Allen/HOPE: Oxygen Abundance Enhancements in the Inner Magnetosphere", **Vira**, **A. D.**, Fernandes, P. A., Skoug, R. M. S., Thomsen, M. F., Larsen, B. A. L., Reeves, G. & Funsten, H.

01/2017 ● **Optics and Photonics Winter School and Workshop** [Tucson, AZ]
"Calibrating an Ultra-Low Expansion Cavity for High Precision Spectroscopy", Patterson, C., **Vira**, **A. D.**, Hawkins, W. B. & Raven, W. D.

06/2017 ● **APS Division of Atomic, Molecular, and Optical Physics** [Sacramento, CA]
"Testing Quantum Electrodynamics in the Lowest Singlet State of Be-9", **Vira**, **A. D.**, Patterson, C., Hawkins, W. B. & Raven, W. D.

08/2017 ● **American Geophysical Union** [New Orleans, LA]
"Characterization of Airborne Infrared Spectrometer for 2017 Solar Eclipse", **Vira**, **A. D.**, Samra, J., Cheimets, P., DeLuca, E., Fedeler, S., Guth, G. & Marquez, V.

Teaching

Spring 2024 **Co-Instructor, Graduate Computational Physics**, *Georgia Institute of Technology.*

- Worked with Prof. J. H. Wise to modify syllabus, organize topics, and design homework assignments.
- Developed course material and delivered lectures on the following topics: Monte Carlo and Molecular Dynamics, HPC capabilities, and radiation transport.

2023–2024 **Graduate Teaching Fellow**, *Georgia Institute of Technology.*

- Led institute-wide TA training sessions through the Center for Teaching and Learning.
- Conducted classroom observations for CIRTL students.

Fall 2022 **Teaching Assistant, Introductory Physics I**, *Georgia Institute of Technology*.

- Ran five studio sections each week with 20-25 students in each class.
- Led weekly problems and answered questions during class.

2015–2017 **Teaching Assistant, Undergraduate Electronics**, *Smith College*.

- Held weekly TA sessions and assisted with the setup of laboratory lectures and exams.
- Contributed to course development over three years of serving as a TA.

Mentoring

Graduate Students [2]

2024–2026 ● **Roshan Trivedi**, *Georgia Tech* (advised on ilmenite irradiation project).

2023–2024 ● **Benyuan Liu**, *Georgia Tech* (co-advised on HPC SLURM management).

Undergraduate Students [10]

2023–2026 ● **Kush Gandhi**, *Georgia Tech* (advised, developed `g4chargeit`, Georgia Tech); *First-authored publication for submission in Journal of Computational Physics, Interned with collaborators at Los Alamos National Laboratory (Summer 2024).*

2024–2025 ● **Keyes Eames**, *Georgia Tech* (co-advised on microscopy data analysis using ML); *Now Ph.D. student at University of California, Santa Barbara*.

● **Dean Kim**, *Georgia Tech* (co-advised on 4D-STEM data analysis); *Now at IBM*.

Summer 2024 ● **Pranav Rane**, *Haverford College* (co-advised, REU intern at Georgia Tech); *Now Ph.D. student at California Institute of Technology*.

Summer 2023 ● **John Le**, *Colorado College* (co-advised, REU intern at Georgia Tech); *Now Ph.D. student at Rice University*.

Spring 2023 ● **Shahana Lahiri**, *Georgia Tech* (advised on Geant4 simulations).

Summer 2022 ● **Grant Mayberry**, *University of Tulsa* (co-advised, REU intern at Georgia Tech); *Now Ph.D. student at Vanderbilt University*.

2021–2022 ● **Elizabeth Mone**, *Georgia Tech* (advised on Geant4, co-authored publication); *Now Ph.D. student at Northwestern University*.

● **Nikolai Simonov**, *Georgia Tech* (co-advised on experimental STM projects).

Fall 2021 ● **Patrick Connolly**, *Georgia Tech* (co-advised on MCNP simulations).

High School Students [3]

Summer 2024 ● **Gianmarco Pelino**, *Atlanta International School* (advised on XRF, Georgia Tech).

Summer 2023 ● **Brent Shi**, *Atlanta International School* (advised on Geant4, Georgia Tech).

Summer 2022 ● **Marco Bertolini**, *Atlanta International School* (advised on Geant4, Georgia Tech).

Outreach

2022–2024 ● **Mentored High School Students**, Summer Internship, Atlanta International School.
2019–2020 ● **Founded Asian Pacific Islander ERG**, Los Alamos National Laboratory.
Spring 2018 ● **Science Enrichment Educator**, Jackson Street Elementary School.

Awards

Fellowships

2024–2025 ● **Graduate Teaching Fellow**, Center for Teaching and Learning, Georgia Tech, Total: [redacted].
Fall 2022 ● **Bonnie B. and Charles K. Rice Jr. Fellowship Award**, Georgia Tech, Total: [redacted].
Spring 2022 ● **College of Science Student Travel Grant**, Georgia Tech. Total: [redacted].
● **Amelio Endowment Graduate Student Travel Grant**, Georgia Tech, Total: [redacted].
2020–2024 ● **Georgia Tech Institute Fellowship**, Georgia Tech, Total: [redacted].
● **Georgia Tech President's Fellowship**, Georgia Tech, Total: [redacted].

Honors

12/2022 ● **Thank-a-Teacher Note and Certificate**, Georgia Tech.
09/2020 ● **Spot Award**, *Initiative or creativity in addressing a critical need or difficult problem*, LANL.
06/2019 ● **Spot Award**, *Recognized for Outstanding Contributions to ZPS Instrument Modelling*, LANL.
08/2018 ● **Instruments Research Excellence Award**, MKS Instruments Research Excellence Award.
05/2018 ● **Highest Honors in Physics**, Smith College.
● **Exceptional Achievement and Departmental Service Award**, Physics, Smith College.

Press

03/2026 ● **New study of trivalent Ti in lunar ilmenite published in Nat. Comm.**, The Conversation brief & Georgia Tech press release.
09/2023 ● **Announcement of Graduate Teaching Fellows**, https://ctl.gatech.edu/2023-2024-graduate-teaching-fellows-cohort/.
04/2021 ● **Bayesian Model Highlighted in New Mexico Consortium Website**, https://newmexicoconsortium.org/nmc-scientists-publish-journal-geophysical-research/.

Affiliations

2020–2026 ● **Sigma Xi**, Georgia Institute of Technology.
2018–2020 ● **American Geophysical Union**, Los Alamos National Laboratory.