*Curriculum Vitae* *updated 03/2023*

# Mitchell M. Shen

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Postdoctoral Research Associate
Department of Astrophysical Sciences, Princeton University
171 Broadmead St, Princeton, NJ 08540

## EDUCATION

**University of Colorado Boulder** 08/2018 – 07/2021
Ph.D., Aerospace Engineering Sciences
Dissertation: Cosmic Dust Detection by Antenna Instruments
Advisor: Zoltán Sternovsky

**National Cheng Kung University, Taiwan** 08/2014 – 01/2017
M.S., Aeronautics and Astronautics
Thesis: Development of a Micro ECR Ion Thruster for Space Propulsion
Advisor: Yei-Chin Chao, Co-Advisor: Wing-Yee Tam

**National Cheng Kung University, Taiwan** 08/2010 – 06/2014
B.S., Aeronautics and Astronautics
Project: The Generalization of Complex Mechanics
Advisor: Ciann-Dong Yang

## RESEARCH EXPERIENCES

**Princeton University**
Space Physics group @ Department of Astrophysical Sciences
*Postdoctoral Research Associate* 09/2021 – present

**University of Colorado Boulder**
IMPACT Lab @ Laboratory for Atmospheric and Space Physics
*Graduate Research Assistant* 08/2018 – 08/2021

**National Cheng Kung University, Taiwan**
LASC Lab @ Department of Earth Sciences
*Research Assistant (Full time)* 03/2017 – 07/2018

**National Cheng Kung University, Taiwan**
Combustion Lab @ Department of Aeronautics and Astronautics
*Graduate Research Assistant* 07/2014 – 01/2017

## RESEARCH INTERESTS

- Cosmic dust & Dust detection by electric field instruments
- Interaction of heliosphere with local interstellar medium
- Transportation & Acceleration of energetic particles
- Space plasmas & Spacecraft charging
- Planetary magnetospheres, ionospheres, and atmospheres
- Electric propulsion (e.g., ion thruster, Hall thruster, hollow cathode, etc.)

## AWARDS & SCHOLARSHIPS

- Government Scholarship to Study Abroad (GSSA), Ministry of Education, Taiwan, 2020
- Graduate School UF Scholarship, University of Colorado Boulder, 2018

## MISSION EXPERIENCES (*science*$^{\dagger}$, *development*$^{\star}$, *calibration*$^{\ddagger}$)

*Cassini* — Radio and Plasma Wave Science instrument (RPWS)$^{\dagger}$
*Parker Solar Probe* — IS⊙IS$^{\dagger}$, FIELDS$^{\dagger}$, & SWEAP$^{\dagger}$
*IMAP* — Solar Wind and Pickup Ion (SWAPI)$^{\star\ddagger}$, IMAP-Lo$^{\star\ddagger}$
*Voyager* — Plasma Wave Subsystem (PWS)$^{\dagger}$
*Juno* — WAVES$^{\dagger}$

## FUNDED RESEARCH

**PI** — NASA New Frontiers Data Analysis Program (ROSES-2022) 2023 – 2026
*The Dust Environment Near Jupiter*

## PEER-REVIEWED PUBLICATIONS (*Citations: 141, h-index: 7, first author: 4*)

[14] Khoo, L. Y., McComas, D. J., Rankin, J. S., **Shen, M. M.**, Sharma, T., & Shi, C. (2023). Compensating for gyroradius effects in beamlines with small helmholtz coils. *Review of Scientific Instruments*, *94*(3), 035102. https://doi.org/10.1063/5.0135154

[13] Li, Y.-H., Huang, T.-Y., **Shen, M. M.**, & Chen, Y.-C. (2023). Development of Miniature Radio Frequency Ion Thruster with Inductively Coupled Plasma Source. *Journal of Aeronautics, Astronautics and Aviation*, *55*(1), 13–28. https://doi.org/10.6125/JoAAA.202303_55(1).02

[12] McComas, D. J., Sharma, T., Christian, E. R., Cohen, C. M. S., Desai, M. I., Hill, M. E., Khoo, L. Y., Matthaeus, W. H., Mitchell, D. G., Pecora, F., Rankin, J. S., Schwadron, N. A., Szalay, J. R., **Shen, M. M.**, Braga, C. R., Mostafavi, P. S., & Bale, S. D. (2023). Parker Solar Probe Encounters the Leg of a Coronal Mass Ejection at 14 Solar Radii. *The Astrophysical Journal*, *943*(2), 71. https://doi.org/10.3847/1538-4357/acab5e

[11] Mitchell, J. G., Cohen, C. M. S., Eddy, T. J., Joyce, C. J., Rankin, J. S., **Shen, M. M.**, de Nolfo, G. A., Christian, E. R., McComas, D. J., McNutt, R. L., Wiedenbeck, M. E., Schwadron, N. A., Hill, M. E., Labrador, A. W., Leske, R. A., Mewaldt, R. A., Mitchell, D. G., & Szalay, J. R. (2023). A Living Catalog of Parker Solar Probe IS⊙IS Energetic Particle Enhancements. *The Astrophysical Journal Supplement Series*, *264*(2), 31. https://doi.org/10.3847/1538-4365/aca4c8

[10] **Shen, M. M.**, Sternovsky, Z., & Malaspina, D. M. (2022). Variability of Antenna Signals from Dust Impacts. *Earth and Space Science Open Archive*, 24. https://doi.org/10.1002/essoar.10512342.1

[9] Malaspina, D. M., Stenborg, G., Mehoke, D., Al-Ghazwi, A., **Shen, M. M.**, Hsu, H.-W., Iyer, K., Bale, S. D., & de Wit, T. D. (2022). Clouds of Spacecraft Debris Liberated by Hypervelocity Dust Impacts on Parker Solar Probe. *The Astrophysical Journal*, *925*(1), 27. https://doi.org/10.3847/1538-4357/ac3bbb

[8] **Shen, M. M.**, Sternovsky, Z., Garzelli, A., & Malaspina, D. M. (2021). Electrostatic Model for Antenna Signal Generation From Dust Impacts. *Journal of Geophysical Research: Space Physics*, *126*(9), e2021JA029645. https://doi.org/10.1029/2021JA029645

[7] **Shen, M. M.**, Sternovsky, Z., Horányi, M., Hsu, H.-W., & Malaspina, D. M. (2021). Laboratory Study of Antenna Signals Generated by Dust Impacts on Spacecraft. *Journal of Geophysical Research: Space Physics*, *126*(4), e2020JA028965. https://doi.org/10.1029/2020JA028965

[6] Sun, Y.-Y., **Shen, M. M.**, Tsai, Y.-L., Lin, C.-Y., Chou, M.-Y., Yu, T., Lin, K., Huang, Q., Wang, J., Qiu, L., Chen, C.-H., & Liu, J.-Y. (2021). Wave Steepening in Ionospheric Total Electron Density due to the 21 August 2017 Total Solar Eclipse. *Journal of Geophysical Research: Space Physics*, *126*(3), e2020JA028931. https://doi.org/10.1029/2020JA028931

[5] Nouzák, L., Sternovsky, Z., Horányi, M., Hsu, S., Pavlů, J., **Shen, M.-H.**, & Ye, S.-Y. (2020). Magnetic Field Effect on Antenna Signals Induced by Dust Particle Impacts. *Journal of Geophysical Research: Space Physics*, *125*(1), e2019JA027245. https://doi.org/10.1029/2019JA027245

[4] Chou, M.-Y., Lin, C. C. H., **Shen, M.-H.**, Yue, J., Huba, J. D., & Chen, C.-H. (2018). Ionospheric Disturbances Triggered by SpaceX Falcon Heavy. *Geophysical Research Letters*, *45*(13), 6334–6342. https://doi.org/10.1029/2018GL078088

[3] Chou, M.-Y., **Shen, M.-H.**, Lin, C. C. H., Yue, J., Chen, C.-H., Liu, J.-Y., & Lin, J.-T. (2018). Gigantic Circular Shock Acoustic Waves in the Ionosphere Triggered by the Launch of FORMOSAT-5 Satellite. *Space Weather*, *16*(2), 172–184. https://doi.org/10.1002/2017SW001738

[2] Sun, Y.-Y., Liu, J.-Y., Lin, C. C.-H., Lin, C.-Y., **Shen, M.-H.**, Chen, C.-H., Chen, C.-H., & Chou, M.-Y. (2018). Ionospheric Bow Wave Induced by the Moon Shadow Ship Over the Continent of United States on 21 August 2017. *Geophysical Research Letters*, *45*(2), 538–544. https://doi.org/10.1002/2017GL075926

[1] Lin, C. C. H., **Shen, M.-H.**, Chou, M.-Y., Chen, C.-H., Yue, J., Chen, P.-C., & Matsumura, M. (2017). Concentric traveling ionospheric disturbances triggered by the launch of a SpaceX Falcon 9 rocket. *Geophysical Research Letters*, *44*(15), 7578–7586. https://doi.org/10.1002/2017GL074192

## SELECTED CONFERENCE PROCEEDINGS

[11] Huang, B.-H., Li, Y.-H., **Shen, M. M.**, Huang, T.-Y., Lien, W.-C., & Hsieh, J. H. (2022). Triple Langmuir Probe Diagnostics for Vacuum Arc Thruster with Multilayer Electrodes. *International electric propulsion conference 2022*. https://www.electricrocket.org/IEPC_2022_Papers.html

[10] Hsieh, J. H., Li, Y.-H., **Shen, M. M.**, & Huang, Y.-L. (2022). Cylindrical Magnetic Quadrupole Plasma Thruster with a Filament Emitter Hollow Cathode. *International electric propulsion conference 2022*. https://www.electricrocket.org/IEPC_2022_Papers.html

[9] Hsieh, J. H., Li, Y.-H., **Shen, M. M.**, Lien, W.-C., & Lin, P.-H. (2022). Hectowatt-Class Double-Peaked Hall Thruster for Future Space Missions. *International electric propulsion conference 2022*. https://www.electricrocket.org/IEPC_2022_Papers.html

[8] Huang, Y.-L., Li, Y.-H., **Shen, M. M.**, Huang, T.-Y., & Hsieh, J. H. (2022). Development of a low power cylindrical Hall thruster with tungsten filament cathode. *International electric propulsion conference 2022*. https://www.electricrocket.org/IEPC_2022_Papers.html

[7] Chen, Y.-C., Li, Y.-H., **Shen, M. M.**, Liu, S.-W., & Huang, T.-Y. (2022). Stability Control of Inductively Coupled Plasma for RF Ion Thrusters. *International electric propulsion conference 2022*. https://www.electricrocket.org/IEPC_2022_Papers.html

[6] Hsieh, J. H., Li, Y.-H., **Shen, M. M.**, & Huang, B.-H. (2022). LaB6 Hollow Cathode Design and Development for Magnetic Octupole Plasma Thruster. *International electric propulsion conference 2022*. https://www.electricrocket.org/IEPC_2022_Papers.html

[5] Hsieh, J. H., Li, Y.-H., Lee, H.-Y., & **Shen, M.-H.** (2021). Development of Wien Filter for a low-power Hall Thruster Plume Characterization. *Aiaa propulsion and energy 2021 forum*. https://doi.org/10.2514/6.2021-3380

[4] Huang, T.-Y., Li, Y.-H., **Shen, M.-H.**, & Chen, Y.-C. (2021). Development of a Miniature Radio-Frequency Ion Engine with Inductively Coupled Plasma (ICP) Source for Cube Satellite Propulsion. *Aiaa propulsion and energy 2021 forum*. https://doi.org/10.2514/6.2021-3417

[3] **Shen, M.-H.**, Fang, H.-K., Chao, Y.-C., Tam, S. W., & Li, Y.-H. (2017). Development of a Micro ECR Ion Thruster for Space Propulsion. *International electric propulsion conference 2017*. http://electricrocket.org/IEPC/IEPC_2017_466.pdf

[2] Chang, T.-W., Li, H.-Y., Cheng, T.-S., Chao, Y.-C., & **Shen, M.-H.** (2017). The Reattachment Process of Turbulent Lifted Diffusion Jet Flames Induced by Repetitive DC Electric Pulse Discharges. *26th international colloquium on the dynamics of explosions and reactive systems*. http://www.icders.org/ICDERS2017/abstracts/ICDERS2017-1125.pdf

[1] Li, H.-Y., **Shen, M.-H.**, & Chao, Y.-C. (2016). A Comprehensive Study of the Effects of Microwave induced Plasma on Premixed Methane-Air Flames. *The 26th national conference on combustion and energy*. https://reurl.cc/xg6Z65

## POPULAR SCIENCE PRESS

[3] Lin, C. C. H., Chou, M.-Y., & **Shen, M.-H.**. (2018). Ionospheric plasma hole and gigantic shock waves induced by the launch of FORMOSAT-5 using the Space-X rocket. 成大研發快訊, 31(8). http://ir.lib.ncku.edu.tw/handle/987654321/183711

[2] **Shen, M.-H.**, Chou, M.-Y., & Lin, C. C. H. (2018). SpaceX獵鷹重型火箭的太空夢：人類登陸火星、重返月球就靠它. The News Lens關鍵評論. https://www.thenewslens.com/article/89183

[1] Lin, C. C. H., **Shen, M.-H.**, & Chen, P.-C. (2018). 為何這次Falcon 9發射升空，會產生像UFO的特殊形狀？. PanSci 泛科學. https://pansci.asia/archives/133675

## INVITED TALKS & GUEST LECTURES

[3] Introduction to Space Instrumentation, guest lecture of Introduction to space science and engineering, National Cheng Kung University, Tainan, Taiwan. (Jun 2022)

[2] Understanding cosmic dust detection using antenna instruments, AGU Fall Meeting 2021, New Orleans, US. (Dec 2021)

[1] Principles and Applications of Space Instrumentation, guest lecture of Introduction to space science and engineering, National Cheng Kung University, Tainan, Taiwan. (Jun 2021)

## SEMINARS & COLLOQUIA

[6] Dust Detection by Antenna Instruments: Modeling and Measurements, Space Physics seminar, University of California, Berkeley, CA, USA. (Mar 2021)

[5] Introduction to Electric Propulsion and Ongoing Projects at NCKU, Taiwanese Young Research Association, CA, USA. https://youtu.be/4c8qFWg3JCw (Mar 2021)

[4] Dust Detection by Antenna Instruments, Taiwanese Young Research Association, CA, USA. https://youtu.be/VpRneRhmItk (Dec 2020)

[3] How do we IMPACT on Space and Planetary Science? In Dust we Trust., CU STEMinar, University of Colorado Boulder, Boulder, CO, USA. https://youtu.be/3zw1Tz1x7n0 (Nov 2020)

[2] How do we IMPACT on Space and Planetary Science? In Dust we Trust., National Central University, Taoyuan, Taiwan. (May 2019)

[1] Introduction to Chemical and Electric Propulsion for Space Exploration and Ongoing Research in NCKU, National Central University, Taoyuan, Taiwan. (Feb 2017)

## TEACHING EXPERIENCES

*09/2021 — present* **Princeton University**
Department of Astrophysical Sciences
Instructional Staff
- AST250 Space Physics Laboratory I (Fall 21' 22')
- AST251 Space Physics Laboratory II (Spring 22' 23')

*09/2014 — 01/2017* **National Cheng Kung University, Taiwan**
Department of Aeronautics and Astronautics
Graduate Teaching Assistant
- Clean Fossil Fuel Technology (Fall 15' 16')
- Combustion Theory (Fall 14')
- Energy Saving in Building (Spring 16', Fall 16')
- Energy Strategy (Spring 16')
- Thermodynamics II (Spring 15')

## MENTORING EXPERIENCES

*12/2020 — 12/2021* **Yi-Long Huang**
M.S., National Cheng Kung University, Taiwan
Focus: Low Power Cylindrical Hall Thruster

*12/2020 — 12/2021* **Jordan H. Hsieh**
B.S., National Cheng Kung University, Taiwan
Focus: Hall Effect Thruster, hollow cathode

*09/2020 — 12/2021* **Ping-Han Huang**
M.S., National Cheng Kung University, Taiwan
Focus: Development of a Vacuum Arc Thruster with Multilayer Electrodes

*09/2020 — 12/2021* **Yi-Chien Chen**
M.S., National Cheng Kung University, Taiwan
Focus: Optimization of Ion Propulsion

*09/2020 — 10/2021* **Ta-Yen Huang**
M.S., National Cheng Kung University, Taiwan
Thesis: Development of a Miniature Radio-Frequency ICP Ion Thruster

*09/2020 — 02/2021* **Alessandro Garzelli**
M.S., Politécnico di Milano, Italy
Thesis: Electrostatic model for antenna signal generation from dust impacts

## PROFESSIONAL EXPERIENCES

*02/2022 — present* **Global Ambassador**
Global Engagement Office, CU Boulder

*08/2019 — 12/2019* **Student Project Manager of Cubesat CANVAS**
Department of Aerospace Engineering Sciences, CU Boulder

*09/2018 — 12/2018* **CU Science Ambassador**
CU Science Discovery, CU Boulder

*01/2014 — 02/2014* **Intern (Basic Flight)**
Flight Operations Division, EVA Air

*07/2013 — 08/2013* **Intern (Aircraft Maintenance)**
Evergreen Aviation Technologies Corporation

*07/2012 — 08/2012* **Intern (Plaster Additive Manufacturing)**
Research and Services Headquarter, Nat'l Cheng Kung Univ.

*09/2011 — 06/2012* **Vice Leader of Curriculum Section**
Leadership Center, Nat'l Cheng Kung Univ.

## PROFESSIONAL CERTIFICATIONS

*02/2014 — present* **Professional Training course of Aircraft Maintenance**
480hrs from 2013/07 – 2014/02, #L20140211-TRD-015
EVERGREEN Aviation Technologies Corp.

## SERVICE

- **Journal Reviewer**: *JGR: Space Physics*, *Space Weather*, *Earth and Planetary Science Letters*
- **NASA Review Panels**: Executive Secretary (2021)
- **Science Organizing Committee**: Parker Two Conference (2022)
- **Thesis Committee**: student mentees at National Cheng Kung University in Taiwan

## Additional URL

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