

# SHANE WESLEY STONE *Planetary Chemist*

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## PROFESSIONAL APPOINTMENTS

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NASA Goddard Space Flight Center

**Research Space Scientist, Research AST, Planetary Studies**

*November 2022 – Present*

Planetary Environments Laboratory (Code 699)

**Fellow, NASA Postdoctoral Program**

*July 2021 – November 2022*

*Atmospheric Escape on Mars and Implications for Detectability on Exoplanets*

Advisor: Dr. Geronimo L. Villanueva

Planetary Systems Laboratory (Code 693)

## EDUCATION

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University of Arizona

**Doctor of Philosophy in Planetary Sciences**

*2017 – 2021*

*Martian Upper Atmospheric Thermal Structure, Composition, and Water and their Significance for Atmospheric Escape and Evolution*

Advisor: Prof. Roger V. Yelle

**Master of Science in Planetary Sciences**

*2014 – 2017*

University of California, Los Angeles

**Master of Science in Organic Chemistry**

*2011 – 2014*

*Controlled Polymerization of  $\alpha$ -Amino Acid N-Thiocarboxyanhydrides*

Advisor: Prof. Timothy J. Deming

University of Texas at Dallas

**Bachelor of Science in Chemistry, summa cum laude with honors and distinction**

*2007 – 2011*

*Poly(3-hexylthiophene)-based Block Copolymers for Hybrid Solar Cells*

Advisor: Prof. John P. Ferraris

## TEACHING

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University of California, Los Angeles

**Teaching Associate, CHEM 136: Organic Spectroscopic Methods**

*Spring 2014*

Laboratory; chemical problem solving with emphasis on structure determination using 1D and 2D NMR, IR, mass spectrometry, and x-ray crystallography.

**Teaching Assistant, CHEM 14D: Organic Reactions**

*Fall 2013*

Organic reaction mechanisms; nucleophilic and electrophilic substitutions and additions, electrophilic aromatic substitutions, carbonyl reactions, and catalysis.

**Teaching Assistant, CHEM 14C: Organic Molecular Structure**

*5 quarters, 2011 – 2013*

Molecular structure with emphasis on biological applications; stereochemistry; resonance, conjugation, and aromaticity; mass spectrometry, IR, NMR; effects of structure on physical and chemical properties; survey of biomolecular structure.

## AWARDS & FELLOWSHIPS

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- LPL Scholarship Award, 2020
- UA Galileo Circle Scholarship, 2019
- Best Graduate Student Talk, Lunar and Planetary Laboratory Conference, 2017
- NASA Group Achievement Award: MAVEN Science Team, 2016
- NASA R. H. Goddard Exceptional Achievement for Science: MAVEN Science Team, 2016
- UCLA Graduate Division Unrestricted Fellowship, *Spring 2013*
- UCLA Hanson-Dow Teaching Assistant Award, *Fall 2012*
- UCLA Christopher S. Foote Graduate Fellowship, 2011 – 2013
- UTD Undergraduate Research Scholar Award, 2009 – 2010 and 2010 – 2011

## SERVICE & MISSION SUPPORT

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- Science Team, Geospace Dynamics Constellation, 2022 – Present
- Science Team, ExoMars Trace Gas Orbiter, 2021 – Present
- LPL Graduate Representative to the Faculty, 2018 – 2019
- Executive Secretary, NASA Review Panel, 2018
- LPL Graduate Outreach Coordinator, 2017 – 2019
- LPL Graduate Student Colloquium Coordinator, 2016 – 2018
- Regular Member, American Geophysical Union, 2015 – Present
- Science Team, NASA Mars Atmosphere and Volatile Evolution, 2014 – Present
- Full Member, American Astronomical Society, 2014 – Present
- President, UCLA Chemistry and Biochemistry Graduate Student Association, 2013 – 2014
- Founding Member, UCLA Chemistry and Biochemistry Graduate Student Association, 2012 – 2013
- Regular Member, American Chemical Society, 2009 – Present

## PUBLICATIONS

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21. G. L. Villanueva, G. Liuzzi, S. Aoki, **S. W. Stone**, A. Brines, I. R. Thomas, M. A. Lopez-Valverde, L. Trompet, J. T. Erwin, F. Daerden, B. Ristic, M. D. Smith, M. J. Mumma, S. Faggi, V. Kofman, S. Robert, L. Neary, M. Patel, G. Bellucci, J.-J. Lopez-Moreno, A. C. Vandaele. The deuterium isotopic ratio of water released from the Martian caps as measured with TGO/NOMAD. *Geophys. Res. Lett.*, **2022**, 49(12), e2022GL098161, doi:10.1029/2022GL098161.
20. G. L. Villanueva, S. Faggi, S. Protopapa, V. Kofman, T. J. Fauchez, **S. W. Stone**, A. M. Mandell. Fundamentals of the Planetary Spectrum Generator. **2022**. ISBN 978-0-578-36143-7.  
<https://psg.gsfc.nasa.gov/images/help/handbook.pdf>
19. **S. W. Stone**, R. V. Yelle, M. Benna, M. K. Elrod, P. R. Mahaffy. Composition and Horizontal Variations of the Neutral Upper Atmosphere of Mars as Measured by MAVEN NGIMS. *J. Geophys. Res. Planets*, **2022**, 127, e2021JE007085, doi:10.1029/2021JE007085.
18. K. G. Hanley, J. P. McFadden, D. L. Mitchell, C. M. Fowler, **S. W. Stone**, R. V. Yelle, M. Mayyasi, R. E. Ergun, L. Andersson, M. Benna, M. K. Elrod, B. M. Jakosky. In Situ Measurements of Thermal Ion Temperature in the Martian Ionosphere. *J. Geophys. Res. Space Phys.*, **2021**, 126(12), e2021JA029531, doi:10.1029/2021JA029531.
17. **S. W. Stone**. Martian Upper Atmospheric Thermal Structure, Composition, and Water and their Significance for Atmospheric Escape and Evolution. Doctoral dissertation, University of Arizona, **2021**.  
<https://hdl.handle.net/10150/660769>
16. **S. W. Stone**, R. V. Yelle, M. Benna, D. Y. Lo, M. K. Elrod, P. R. Mahaffy. Hydrogen Escape from Mars is Driven by Seasonal and Dust Storm Transport of Water. *Science*, **2020**, 370(6518), 824–831, doi:10.1126/science.aba5229.
15. W. K. Peterson, L. Andersson, R. Ergun, E. Thiemann, M. Pilinski, S. Thaller, C. Fowler, D. Mitchell, M. Benna, R. V. Yelle, **S. W. Stone**. Subsolar Electron Temperatures in the Lower Martian Ionosphere. *J. Geophys. Res. Space Phys.*, **2020**, 125, e2019JA027597, doi:10.1029/2019ja027597.
14. D. Bhattacharyya, J.-Y. Chaufray, M. Mayyasi, J. T. Clarke, **S. W. Stone**, R. V. Yelle, W. Pryor, J. L. Bertaux, J. Deighan, S. K. Jain, N. M. Schneider. Two-dimensional model for the Martian exosphere: Applications to hydrogen and deuterium Lyman  $\alpha$  observations. *Icarus*, **2020**, 339, 113573, doi:10.1016/j.icarus.2019.113573.
13. A. G. Siddle, I. C. F. Mueller-Wodarg, **S. W. Stone**, R. V. Yelle. Global characteristics of gravity waves in the upper atmosphere of Mars as measured by MAVEN/NGIMS. *Icarus*, **2019**, 333, 12–21, doi:10.1016/j.icarus.2019.05.021.
12. J. Cui, Y.-T. Cao, X.-S. Wu, S.-S. Xu, R. V. Yelle, S. Stone, E. Vigren, N. J. T. Edberg, C.-L. Shen, F. He, Y. Wei. Evaluating Local Ionization Balance in the Nightside Martian Upper Atmosphere during MAVEN Deep Dip Campaigns. *Ap. J. Lett.*, **2019**, 876, L12, doi:10.3847/2041-8213/ab1b34.
11. M. Mayyasi, J. T. Clarke, D. Bhattacharyya, J.-Y. Chaufray, M. Benna, P. R. Mahaffy, **S. W. Stone**, R. V. Yelle, E. Thiemann, M. Chaffin, J. Deighan, S. K. Jain, N. M. Schneider, B. M. Jakosky. Seasonal variability of Deuterium in the Upper Atmosphere of Mars. *J. Geophys. Res. Space Phys.*, **2019**, 124(3), 2152–2164, doi:10.1029/2018JA026244.
10. M. Slipski, B. M. Jakosky, M. Benna, M. K. Elrod, P. R. Mahaffy, D. Kass, **S. W. Stone**, R. V. Yelle. Variability of Martian Turbopause Altitudes. *J. Geophys. Res. Planets*, **2018**, 123(11), 2939–2957, doi:10.1029/2018JE005704.
9. **S. W. Stone**, R. V. Yelle, M. Benna, M. K. Elrod, P. R. Mahaffy. Thermal Structure of the Martian Upper Atmosphere from MAVEN NGIMS. *J. Geophys. Res. Planets*, **2018**, 123(11), 2842–2867, doi:10.1029/2018JE005559.
8. B. M. Jakosky and 131 others including **S. W. Stone**. Loss of the Martian atmosphere to space: Present-day loss rates determined from MAVEN observations and integrated loss through time. *Icarus*, **2018**, 315, 146–157, doi:10.1016/j.icarus.2018.05.030.

7. J. Cui, R. V. Yelle, L.-L. Zhao, **S. W. Stone**, F.-Y. Zhang, Y.-T. Cao, M.-J. Yao, T. T. Koskinen, Y. Wei. The Impact of Crustal Magnetic Fields on the Thermal Structure of the Martian Upper Atmosphere. *Astrophys. J. Lett.*, **2018**, 853(2), L33, doi:10.3847/2041-8213/aaa89a.
6. B. M. Jakosky, M. Slipski, M. Benna, P. R. Mahaffy, M. K. Elrod, R. V. Yelle, **S. W. Stone**, N. Alsaed. Mars' atmospheric history derived from upper-atmosphere measurements of  $^{38}\text{Ar}/^{36}\text{Ar}$ . *Science*, **2017**, 355(6332), 1408–1410, doi:10.1126/science.aai7721.
5. M. K. Elrod, S. W. Bougher, J. Bell, P. R. Mahaffy, M. Benna, **S. W. Stone**, R. V. Yelle, B. M. Jakosky. He bulge revealed: He and  $\text{CO}_2$  diurnal and seasonal variations in the upper atmosphere of Mars as detected by MAVEN NGIMS. *J. Geophys. Res. Space Phys.*, **2017**, 122(2), 2564–2573, doi:10.1002/2016JA023482.
4. P. R. Mahaffy, M. Benna, M. K. Elrod, R. V. Yelle, S. W. Bougher, **S. W. Stone**, B. M. Jakosky. Structure and composition of the neutral upper atmosphere of Mars from the MAVEN NGIMS investigation. *Geophys. Res. Lett.*, **2015**, 42(21), 8951–8957, doi:10.1002/2015GL065329.
3. S. W. Bougher and 93 others including **S. W. Stone**. Early MAVEN Deep Dip campaign reveals thermosphere and ionosphere variability. *Science*, **2015**, 350(6261), aad0459, doi:10.1126/science.aad0459.
2. B. M. Jakosky and 93 others including **S. W. Stone**. MAVEN observations of the response of Mars to an interplanetary coronal mass ejection. *Science*, **2015**, 350(6261), aad0210, doi:10.1126/science.aad0210.
1. D. Lee, **S. W. Stone**, J. P. Ferraris. A novel dialkylthio benzo[1,2-b:4,5-b']dithiophene derivative for high open-circuit voltage in polymer solar cells. *Chem. Commun.*, **2011**, 47(39), 10987–10989, doi:10.1039/C1CC14780C.

## TALKS & POSTERS

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36. MAVEN Project Science Group Meeting, 18 October 2022  
*Isotope Ratios in the Martian Upper Atmosphere Measured by MAVEN NGIMS*
35. Division for Planetary Sciences 54, 3 October 2022  
*Isotope Ratios in the Martian Upper Atmosphere Measured by MAVEN NGIMS*
34. Europlanet Science Congress 2022, 18 September 2022  
*Isotope Ratios in the Martian Upper Atmosphere MEasured by MAVEN NGIMS*
33. Mars Atmosphere Modeling and Observations, 16 June 2022  
*Transport and Escape of Water: Toward a More Complete Interpretation with TGO NOMAD and MAVEN NGIMS*
32. MAVEN Project Science Group Meeting, 11 May 2022  
*Isotope Ratios in the Upper Atmosphere Observed by NGIMS*
31. Planet Mars V, Les Houches School of Physics 11 May 2022  
*Isotope Ratios in the Upper Atmosphere of Mars from MAVEN NGIMS (Poster)*
30. MAVEN Project Science Group Meeting, 21 October 2020  
*Horizontal Variations of the Neutral Species as Observed by NGIMS*
29. Trace Gas Orbiter/MAVEN Meeting, 21 February 2020  
*NGIMS/ACC Comparison*
28. Trace Gas Orbiter/MAVEN Meeting, 20 February 2020  
*Seasonal and Dust-Storm-Induced Changes in Upper Atmospheric  $\text{H}_2\text{O}$  and H Escape*
27. MAVEN Project Science Group Meeting, 9 October 2019  
*Seasonal and Dust Storm Induced Variation in Upper Atmospheric Water on Mars*
26. European Planetary Science Congress 2019 / Division for Planetary Sciences 51, 19 September 2019  
*Upper Atmospheric Water and its role in H Escape from Mars*
25. Lunar and Planetary Laboratory Conference, 23 August 2019  
*The Upper Atmospheric Water Abundance and its role in H Escape from Mars*
24. MAVEN Accelerometer (ACC) Team Meeting, 6 August 2019  
*NGIMS/ACC Comparison*
23. Ninth International Conference on Mars, 22 July 2019  
*Transport of Water to the Martian Upper Atmosphere amid Regional and Global Dust Storms (Poster)*
22. MAVEN Project Science Group Meeting, 17 April 2019  
*Transport of Water to the Martian Upper Atmosphere amid Regional and Global Dust Storms (Poster)*
21. American Geophysical Union 2018 Fall Meeting, 12 December 2018  
*The Variation of Hydrogen in the Upper Atmosphere of Mars as Observed by MAVEN NGIMS*
20. MAVEN Project Science Group Meeting, 25 September 2018  
*NGIMS  $\text{H}_2$*

19. MAVEN Project Science Group Meeting, 25 September 2018  
*NGIMS Thermospheric Composition and Temperature*
18. MAVEN Project Science Group Meeting, 24 September 2018  
*Variation of Hydrogen in the Upper Atmosphere of Mars as Observed by MAVEN NGIMS (Poster)*
17. Lunar and Planetary Laboratory Conference, 17 August 2018  
*Global Dust Storm 2018a and Upper Atmospheric Hydrogen at Mars*
16. 52<sup>nd</sup> ESLAB Symposium: Comparative Aeronomy of Terrestrial Planets, 14 May 2018  
*Protonated Ions and the Seasonal Variation of Hydrogen Observed by MAVEN NGIMS*
15. MAVEN Project Science Group Meeting, 15 March 2018  
*Protonated Ions and the Seasonal Variation of Hydrogen Observed by NGIMS (Poster)*
14. Lunar and Planetary Laboratory Conference, 18 August 2017  
*Temperature Structure of the Martian Upper Atmosphere from MAVEN NGIMS*
13. International Conference on Mars Aeronomy, 15 May 2017  
*Temperature Variations of the Martian Upper Atmosphere from MAVEN NGIMS*
12. MAVEN Project Science Group Meeting, 14 November 2016  
*Validation of NGIMS O Densities*
11. Division for Planetary Sciences 48 / European Planetary Science Congress 11, 19 October 2016  
*Temperature Variations in the Martian Upper Atmosphere from the MAVEN Neutral Gas and Ion Mass Spectrometer*
10. Lunar and Planetary Laboratory Conference, 19 August 2016  
*Temperatures of the Martian Upper Atmosphere from MAVEN NGIMS*
9. American Geophysical Union 2015 Fall Meeting, 15 December 2015  
*He Bulge Detection by MAVEN NGIMS in the Upper Atmosphere of Mars (Poster)*
8. American Geophysical Union 2015 Fall Meeting, 15 December 2015  
*Retrieval and Distribution of Neutral and Ionic Species in the Martian Upper Atmosphere as Measured by MAVEN NGIMS (Poster)*
7. MAVEN Project Science Group Meeting, 28 October 2015  
*Thermospheric Temperatures Profiles from NGIMS Deep Dip Data*
6. Lunar and Planetary Laboratory Graduate Student Colloquium, 29 September 2015  
*Recent Results from MAVEN NGIMS*
5. Lunar and Planetary Laboratory Conference, 20 August 2015  
*Recent Results from MAVEN NGIMS*
4. Lunar and Planetary Laboratory Graduate Student Colloquium, 5 May 2015  
*Membrane Alternatives in Worlds without Oxygen: Creation of an Azosome*
3. Lunar and Planetary Laboratory Conference, 22 August 2014  
*The van der Waals Dimer of Hydrogen Cyanide in Titan's Atmosphere*
2. UCLA Organic Chemistry Graduate Student Seminar, 4 March 2013  
*The Chemistry of Borole*
1. American Chemical Society 43<sup>rd</sup> Annual Dallas-Fort Worth Meeting-in-Miniature, 17 April 2010  
*Progress toward block copolymers for photovoltaic applications*