

## **Scot C. R. Rafkin, Ph.D.**

**Department of Space Studies, Southwest Research Institute, Boulder, Colorado, USA 80302**

Dr. Rafkin researches planetary atmospheres with a specialization in numerical weather prediction, mesoscale modeling, atmospheric dynamics, and cloud microphysics. He has extensive experience developing weather and research modeling codes and has applied these to the study of mesoscale circulations, clouds, and aerosols for Earth and to other terrestrial planetary atmospheres including Mars, Titan, Venus, and Pluto. NASA has selected Dr. Rafkin and his team to provide environmental predictions for every Mars rover and lander since 2003. Dr. Rafkin develops and leads proposals for space instrumentation and missions for remote and in situ atmospheric measurements. He currently serves as the MSL-RAD Instrument Project Scientist and is a science Co-Investigator on the MSL Rover Curiosity Meteorology team.

### **Education**

B.S., Dept. of Atmospheric Science, UCLA, 1989. Senior Thesis, "Tornadoes in the Los Angeles Basin", Advisor: R. Wakimoto.

M.S., Dept. of Atmospheric Science, Colorado State University, 1992, "Cloud Electrification of Monsoon Convection", Advisor: S. A. Rutledge.

Ph.D., Dept. of Atmospheric Science, Colorado State University, 1996, "Development of a Cumulus Parameterization Suitable for Use in Mesoscale through GCM-scale Models", Advisor: W. Cotton.

Post-Doctoral Fellow, University Corporation for Atmospheric Research, 1996-1997, "Implementation of a Mesoscale Model to Improve Convective Forecasting in the NWSFO".

### **Professional Employment**

2014-Present	Program Director, Southwest Research Institute, Boulder, CO
2011-2014	Assistant Director, Southwest Research Institute, Boulder, CO
2007-2011	Section Manager, Southwest Research Institute, Boulder, CO
2005-2007	Principal Scientist, Southwest Research Institute, Boulder, CO
2003-2005	Senior Scientist, Southwest Research Institute, Boulder, CO
1997-2003	Assistant Professor, Department of Meteorology, San Jose State University, San Jose, CA
1996-1997	Postdoctoral Fellow, University Corporation for Atmospheric Research, Boulder, CO
1989-1996	Graduate Research and Teaching Assistant, Colorado State University, Fort Collins, CO
1988-1988	Summer Undergraduate Fellow, Atmospheric Trace Molecule Spectroscopy Experiment (ATMOS), Jet Propulsion Laboratory, Pasadena, CA
1985-1989	Undergraduate Assistant, Cloud Microphysics Wind Tunnel & Stratospheric-Tropospheric Radar Project, Dept. Atmospheric Science, UCLA, Los Angeles, CA

### **Auxiliary Academic and Professional Titles**

2011-Present	Adjunct Faculty, University of Colorado, Boulder, Colorado
2013-Present	Visiting Research Scholar, University of Arizona
2014-Present	Adjunct Faculty, Universidad Complutense de Madrid, Spain
1998-2003	NASA Ames Research Center Associate
1998-1999	NASA-ASEE Faculty Fellow, NASA Ames Research Center

### **Experience, Service, and Awards**

- Mars Science Laboratory Rover, Radiation Assessment Detector (MSL-RAD) Project Scientist
- Mars Science Laboratory Rover, Science Co-Investigator
- PI of E/PO Camera on TGE Mars Scout Proposal (Phase A)
- Deputy PI of Mars Balloon Discovery Proposal
- Group Achievement Award, Mars Phoenix Scout
- Group Achievement Award, MSL-RAD Instrument
- Group Achievement Award, MSL Rover Environmental Monitoring Station Instrument
- Group Achievement Award, Mars Phoenix Entry, Descent and Landing Group

- NASA Planetary Science Subcommittee Managers Operations Working Group
- Subpanel Chair for NASA programs: PATM, MFRP, MDAP, OPR
- Review Panel Member for NASA programs: MRO PS, MSL PS, OPR, PATM, MFRP, ASTID, MDAP, PIDDP
- Science Definition Team, Mars Telecommunication Orbiter and Titan Flagship Mission
- NASA MEPAG Mars Science Objectives, Climate Goal Co-Chair (Emeritus)
- NASA MEPAG Humans on Mars Science Objectives Science Analysis Group Member
- Kavli Prize Symposia Lecturer, Oslo, Norway, 2014
- National Collegiate Weather Forecasting Contest, “Best Overall Graduate Student Forecaster”, 2003
- Honorable Mention, AMS Macelwane Award, “Tornadoes in the Los Angeles Basin”, 1989

### **Professional Societies**

American Geophysical Union, American Meteorological Society, American Astronomical Society, European Geophysical Union, Japan Geoscience Union.

### **Peer Reviewed Journal Publications (6740 Citations, h-index: 40, i10-index: 78)**

#### **2019**

**Rafkin, S.C.R.** and Soto, A., 2019: Air-Sea Interactions on Titan: Lake Evaporation, Atmospheric Circulation, and Cloud Formation, Icarus, Submitted.

Pla-Garcia, J., **Rafkin, S. C. R.**, Karatekin, O. and Gloesener, E., 2019: Comparing MSL Curiosity rover TLS-SAM methane measurements with Mars Regional Atmospheric Modeling System (MRAMS) atmospheric transport experiments. J. Geophys. Res., Accepted with Rev.

#### **2018**

Rodriguez, S., Le Mouélic, S., Barnes, J.W., Kok, J.F., **Rafkin, S.C.R.**, Lorenz, R.D., Charnay, B., Radebaugh, J., Nartean, C., Cornet, T. and Bourgeois, O., 2018. Observational evidence for active dust storms on Titan at equinox. *Nature Geoscience*, 11(10), p.727.

Read, W.G., Tamppari, L.K., Livesey, N.J., Clancy, R.T., Forget, F., Hartogh, P., **Rafkin, S.C.** and Chattopadhyay, G., 2018. Retrieval of wind, temperature, water vapor and other trace constituents in the Martian Atmosphere. *Planetary and Space Science*, 161, pp.26-40.

García, J.P. and **Rafkin, S.C.**, 2018. Resolviendo el misterio del metano marciano. *Astronomía*, (227), pp.24-31.

#### **2017**

**Rafkin, S. C. R.**, Spiga, A., and Michaels, T. I., 2017: Mesoscale Meteorology, In *The Atmosphere and Climate of Mars*, 18, Cambridge University Press.

Guo, J., Slaba, T. C., Zeitlin, C., Wimmer-Schweingruber, R. F., Badavi, F. F., Böhm, E., Böttcher, S., Brinza, D. E., Ehresmann, B., Hassler, D., Matthiä, D., and **Rafkin, S.**, 2017: Dependence of the Martian radiation environment on atmospheric depth: Modeling and measurement. *Journal of Geophysical Research: Planets*, 122(2), pp.329-341.

Ehresmann, B., Zeitlin, C. J., Hassler, D. M., Matthiä, D., Guo, J., Wimmer-Schweingruber, R. F., Appel, J. K., Brinza, D. E., **Rafkin, S. C.**, Böttcher, S. I. and Burmeister, S., 2017: The charged particle radiation environment on Mars measured by MSL/RAD from November 15, 2015 to January 15, 2016. *Life Sciences in Space Research*, 14, pp.3-11.

#### **2016**

**Rafkin, S. C. R.** et al., 2017: Mesoscale Meteorology, In *The Atmosphere and Climate of Mars*, Cambridge University Press.

- Rafkin, S. C. R.**, et al., 2016: The Meteorology of Gale Crater as Determined from Rover Environmental Monitoring Station Observations and Numerical Modeling. Part II: Interpretation, *Icarus*, 280, 114-138.
- Rafkin, S.**, Jemmett-Smith, B., Fenton, L., Lorenz, R., Takemi, T., Ito, J. and Tyler, D., 2016: Dust devil formation. *Space Science Reviews*, 203(1-4), pp.183-207.
- Rafkin, S. C. R.**, 2016: Prólogo. Física de la Tierra, Norteamérica. Disponible en: <<https://revistas.ucm.es/index.php/FITE/article/view/53885/49328>>. Fecha de acceso: 24 ene. 2017.
- Barth, E.L., Farrell, W.M. and **Rafkin, S. C.**, 2016: Electric field generation in Martian dust devils. *Icarus*, 268, pp.253-265.
- Ehresmann, B., Hassler, D. M., Zeitlin, C., Guo, J., Köhler, J., Wimmer-Schweingruber, R. F., Appel, J. K., Brinza, D. E., **Rafkin, S. C.**, Böttcher, S.I. and Burmeister, S., 2016: Charged particle spectra measured during the transit to Mars with the Mars Science Laboratory Radiation Assessment Detector (MSL/RAD). *Life Sciences in Space Research*, 10, pp.29-37.
- Kite, E. S., Sneed, J., Mayer, D. P., Lewis, K. W., Michaels, T. I., Hore, A. and **Rafkin, S. C.**, 2016: Evolution of major sedimentary mounds on Mars: Buildup via anticompensational stacking modulated by climate change. *Journal of Geophysical Research: Planets*, 121(11), pp.2282-2324.
- Matthiä, D., Ehresmann, B., Lohf, H., Köhler, J., Zeitlin, C., Appel, J., Sato, T., Slaba, T., Martin, C., Berger, T. Boehm, E., Boettcher, S., Brinza, D. E., Burmeister, S., Guo, J., Hassler, D. M., Posner, A., **Rafkin, S. C. R.**, Reitz, G., Wilson, J. W., and Wimmer-Schweingruber, R. F., 2016. The Martian surface radiation environment—a comparison of models and MSL/RAD measurements. *Journal of Space Weather and Space Climate*, 6, p.A13.
- Moore, C. A., Moores, J. E., Lemmon, M. T., **Rafkin, S. C.**, Francis, R., Pla-García, J., Haberle, R. M., Zorzano, M.-P., Martín-Torres, F. J., Burton, J. R. and MSL Team, 2016: A full martian year of line-of-sight extinction within Gale Crater, Mars as acquired by the MSL Navcam through sol 900. *Icarus*, 264, pp.102-108.
- Moores, J.E., Schieber, J., Kling, A.M., Haberle, R.M., Moore, C.A., Anderson, M.S., Katz, I., Yavrouian, A., Malin, M.C., Olson, T. and **Rafkin, S.C.**, 2016: Transient atmospheric effects of the landing of the Mars Science Laboratory rover: The emission and dissipation of dust and carbazic acid. *Advances in Space Research*, 58(6), pp.1066-1092.
- Pla-Garcia, J., and **Rafkin, S. C. R.**, 2016: Meteorología mesoescalar en Marte. Física de la Tierra, Norteamérica, 28.
- Spiga, A., Barth, E., Gu, Z., Hoffmann, F., Ito, J., Jemmett-Smith, B., Klose, M., Nishizawa, S., Raasch, S., **Rafkin, S.** and Takemi, T., 2016: Large-eddy simulations of dust devils and convective vortices. *Space Science Reviews*, 203(1-4), pp.245-275.
- Zeitlin, C., Hassler, D.M., Wimmer-Schweingruber, R.F., Ehresmann, B., Appel, J., Berger, T., Böhm, E., Böttcher, S., Brinza, D.E., Burmeister, S., Guo, J., Lohf, H., Martin C., Matthiäs, D., Posner, A., **Rafkin S.**, Reitz, G., Tyler, Y. D., Vincent, M., Weigle G., Iwata Y., Kitamura, H., and Murakami, T., 2016. Calibration and Characterization of the Radiation Assessment Detector (RAD) on Curiosity. *Space Science Reviews*, 201(1-4), pp.201-233.

## **2015**

- Rafkin, S. C. R.** and E. L. Barth, 2015: Environmental Control of Deep Convective Clouds on Titan: The Combined Effect of CAPE and Wind Shear on Storm Dynamics, Morphology and Lifetime, *J. Geophys. Res.*, In press, DOI: 10.1002/2014JE004749.
- Rafkin, S.**, 2015: The atmospheric characterization for exploration and science (ACES) instrument suite for Mars. In *Aerospace Conference, 2015 IEEE* (pp. 1-6). IEEE.
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- Charnay, B., Barth, E., **Rafkin, S.**, Narteau, C., Lebonnois, S., Rodriguez, S., Du Pont, S. C. and Lucas, A., 2015. Methane storms as a driver of Titan/s dune orientation. *Nature Geoscience*, 8(5), pp.362-366.
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- Guo, J., Zeitlin, C., Wimmer-Schweingruber, R. F., **Rafkin, S.**, Hassler, D. M., Posner, A., Heber, B., Köhler, J., Ehresmann, B., Appel, J. K. and Böhm, E., 2015: Modeling the variations of dose rate measured by RAD during the first MSL Martian year: 2012–2014. *The Astrophysical Journal*, 810(1), p.24.
- Guo, J., Zeitlin, C., Wimmer-Schweingruber, R.F., Hassler, D.M., Posner, A., Heber, B., Köhler, J., **Rafkin, S.**, Ehresmann, B., Appel, J.K. and Böhm, E., 2015. Variations of dose rate observed by MSL/RAD in transit to Mars. *Astronomy & Astrophysics*, 577, p.A58.
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- Hamilton, V.E., **Rafkin, S.**, Withers, P., Ruff, S., Yingst, R.A., Whitley, R., Center, J.S., Beaty, D.W., Diniega, S., Hays, L. and Zurek, R., 2015: Mars Science Goals, Objectives, Investigations, and Priorities: 2015 Version, NASA Mars Exploration Program Analysis Group.
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- Moore, J. E., Lemmon, M. T., Kahanpää, H., **Rafkin, S. C.**, Francis, R., Pla-Garcia, J., Bean, K., Haberle, R., Newman, C., Mischna, M. and Vasavada, A. R., 2015: Observational evidence of a suppressed planetary boundary layer in northern Gale Crater, Mars as seen by the Navcam instrument onboard the Mars Science Laboratory rover. *Icarus*, 249, pp.129-142.
- Moore, J. E., Lemmon, M. T., **Rafkin, S. C.**, Francis, R., Pla-Garcia, J., De La Torre Juárez, M., et al., 2015: Atmospheric movies acquired at the Mars Science Laboratory landing site: Cloud morphology, frequency and significance to the Gale Crater water cycle and Phoenix mission results. *Advances in Space Research*, 55(9), 2217-2238.
- Wimmer-Schweingruber, R.F., Köhler, J., Hassler, D.M., Guo, J., Appel, J.K., Zeitlin, C., Böhm, E., Ehresmann, B., Lohf, H., Böttcher, S.I. and Burmeister, S., Cesar Martin, Alexander Kharytonov, David E. Brinza, Arik Posner, Günther Reitz, Daniel Matthiä, **Scot Rafkin**, Gerald Weigle, Francis Cucinotta 2015. On determining the zenith angle dependence of the Martian radiation environment at Gale Crater altitudes. *Geophysical Research Letters*, 42(24).

## **2014**

- Rafkin, S. C. R.** et al., 2014: Diurnal Variations of Energetic Particle Radiation at the Surface of Mars as Observed by the Mars Science Laboratory Radiation Assessment Detector, *J. Geophys. Res.*, 119, DOI: 10.1002/2013JE004525.
- Chen, A., Cianciolo, A., Vasavada, A. R., Karlgaard, C., Barnes, J., Cantor, B., Kass, D., **Rafkin, S.** and Tyler, D., 2014: Reconstruction of Atmospheric Properties from Mars Science Laboratory Entry, Descent, and Landing. *Journal of Spacecraft and Rockets*, 51(4), pp.1062-1075.
- Ehresmann, B., Zeitlin, C., Hassler, D. M., Wimmer-Schweingruber, R. F., Böhm, E., Böttcher, S., Brinza, D. E., Burmeister, S., Guo, J., Köhler, J., Martin, C., Posner, A., **Rafkin, S.**, Reitz, G., 2014: Charged particle spectra obtained with the Mars Science Laboratory Radiation Assessment Detector (MSL/RAD) on the surface of Mars. *Journal of Geophysical Research: Planets*, 119(3), pp.468-479.
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- Frías, J., Mischna, M., Mora, L., Navarro, S., Newman, C., de Pablo, M. A., Peinado, V., Polkko, J., **Rafkin, S. C. R.**, et al., 2014: Curiosity's rover environmental monitoring station: Overview of the first 100 sols. *Journal of Geophysical Research: Planets*, 119(7), pp.1680-1688.
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- Harri, A. M., Genzer, M., Kempainen, O., Kahanpää, H., Gomez-Elvira, J., Rodriguez-Manfredi, J. A., Haberle, R., Polkko, J., Schmidt, W., Savijärvi, H., Kauhanen, J., Atlaskin, E., Richardson, M., Siili, T., Paton, M., de la Torre M., Newman, C., **Rafkin, S.**, et al., 2014: Pressure observations by the Curiosity rover: Initial results. *Journal of Geophysical Research: Planets*, 119(1), pp.82-92.
- Harri, A.M., Genzer, M., Kempainen, O., Gomez-Elvira, J., Haberle, R., Polkko, J., Savijärvi, H., Rennó, N., Rodriguez-Manfredi, J.A., Schmidt, W. and Richardson, M., Siili, T., Paton, M., de La Torre-Juarez, M., Mäkinen, T., Newman, C., **Rafkin, S.**, et al., 2014: Mars Science Laboratory relative humidity observations: Initial results. *Journal of Geophysical Research: Planets*, 119(9), pp.2132-2147.
- Haberle, R. M., Gómez-Elvira, J., Torre Juárez, M. D. L., Harri, A. M., Hollingsworth, J. L., Kahanpää, H., Kahre, M. A., Lemmon, M., Martín-Torres, F. J., Mischna, M. and Moores, J. E., Newman, C., **Rafkin, S. C. R.**, et al., 2014: Preliminary interpretation of the REMS pressure data from the first 100 sols of the MSL mission. *Journal of Geophysical Research: Planets*, 119(3), pp.440-453.
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### 2013

- Rafkin, S. C. R.**, 2013: Mesoscale Modeling of Extraterrestrial Atmospheres, In *Mesoscale Meteorological Modeling, 3<sup>rd</sup> Ed.*, Academic Press Intl. Geophys, Series 98, R. Pielke (Ed), 491-500.

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## 2012

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## 2011

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