Samuel Halverson

Education

2016 **Doctor of Philosophy**, *The Pennsylvania State University*, University Park, PA.
Astronomy & Astrophysics, Advisor: Suvrath Mahadevan

2013 **Master of Science**, *The Pennsylvania State University*, University Park, PA.
Astronomy & Astrophysics

2009 **Bachelor of Arts**, *The University of California, Berkeley*, Berkeley, CA.
Physics and Astrophysics (double major), Advisor: Jerry Edelstein

2006 **Associate of Arts**, *City College of San Francisco*, San Francisco, CA.
Chinese (Mandarin)

Appointments

2018 – **Sagan Postdoctoral Fellow**, *MIT*, Kavli Institute for Astrophysics.
Instrumentation development for high resolution Doppler radial velocity spectrometers.

2016 – 2018 **Sagan Postdoctoral Fellow**, *University of Pennsylvania*, Physics & Astronomy Department.
Developing ultra-stable, high resolution spectrometers in the optical and near-infrared.

2010 – 2016 **Graduate Research Assistant**, *The Pennsylvania State University*, Astronomy Department.
Developed photonic subsystems to improve the measurement precision of near-infrared and optical spectrometers for exoplanet surveys.

2010 **Department Researcher**, *University of California Berkeley*, Astronomy Department.
Combined stellar radial velocity and astrometric data to constrain masses of low-mass companions orbiting nearby Sun-like stars.

2007 – 2009 **Undergraduate Researcher**, *University of California Berkeley*, Space Sciences Laboratory.
Developed optomechanical hardware, control software, and data reduction software for an infrared externally dispersed Doppler interferometer for exoplanet discovery.

2005 – 2007 **Volunteer Tutor**, *City College of San Francisco*, Mathematics Library.
Undergraduate mathematics tutor

Skills & training

- Experience in design, construction, alignment, and testing of high resolution optical and near-infrared spectrometers and imaging systems

- Experience in deriving realistic instrument performance and error budgets for large-scale projects, systems engineering of multifaceted optical systems – including STOP analysis

- Development, assembly and performance verification of microscopic and macroscopic photonic systems, including miniature optical fiber devices for high resolution spectroscopy

- Development of spectroscopic frequency standards and calibration sources for high resolution spectrometers, such as stabilized Fabry-Perot cavities, broadband optical frequency combs

- Experience in the use and characterization of large-format scientific CMOS and CCD detectors in both the optical and near-infrared

- Extensive experience in the testing and characterization of specialized single-mode and multi-mode optical fibers

- Observing on large astronomical telescopes, including the 200" at Palomar Observatory & 120" at Lick Observatory

- Software: IDL (simulation, data processing and image analysis), Zemax (optical design), TFCalc (optical coating simulations), GSolver (diffraction grating simulations)

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Awards

2016 NASA Sagan Postdoctoral Fellowship, NASA Exoplanet Science Institute
2016 Lab Bench to Commercialization Grant (Co-Investigator), Penn State
2015 Downsbrough Graduate Fellowship, Penn State University
2013, 2015 Research Grant-in-Aid Award, Sigma-Xi
2013 Brumbach Fellowship, Penn State University
2010 – 2013 Bunton-Waller Fellowship, Penn State University
2012 – 2013 Zaccheus Daniel Award, Penn State University
2012 NSF Graduate Fellowship Honorable Mention, National Science Foundation
2010 – 2012 Braddock-Roberts Fellowship, Penn State University
2009 Group Achievement Award, NASA SIM Planet Finding Capability Study Team
2009 Physics Undergraduate Research Scholarship, UC Berkeley Physics Department
2006 Honors Certificate, City College of San Francisco
2005 Kerkhof Memorial Mathematics Scholarship, City College of San Francisco

Collaborations contributed to

2014 – The Extreme Precision Doppler Spectrometer (NEID), a NASA high resolution, ultra-stable optical spectrometer for the 3.5 meter WIYN telescope (Co-Investigator)
2011 – The Habitable-zone Planet Finder, a high resolution, near-infrared spectrometer for the 10 meter Hobby-Eberly Telescope (Co-Investigator)
2016 – The Keck Planet Finder, an ultra-stable, high resolution optical spectrometer for Keck Observatory (instrument & science team).
2016 – The MINiature Exoplanet Radial Velocity Array - Red (MINERVA-red), a diffraction-limited spectrometer on a 0.7 meter telescope (instrument & science team member)
2016 – EarthFinder, a space-borne precision radial velocity mission concept study (instrument team).
2011 – 2015 The Apache Point Observatory Galactic Evolution Explorer, a near-infrared, multi-object spectrometer part of the Sloan Digital Sky Survey
2007 – 2010 TripleSpec Exoplanet Discovery Instrument, a near-infrared, externally dispersed interferometer used as a Doppler velocimeter
2008 The Space Interferometer Mission, a former NASA astrometric observatory
2008 The Attempt To Observe Outer-planets In Non-single-stellar Environments, a ground-based radial-velocity survey designed to detect low-mass companions in multi-star systems

Service

Panelist: NASA XRP grants program
Referee: Proceedings of Astronomical Society of the Pacific (PASP), the Astrophysical Journal (ApJ), Journal of Astronomical Telescopes, Instruments, and Systems (JATIS), Geosciences, Applied Optics
Reviewer: NASA Earth and Space Science Fellowship Program

Patents

Optical fiber scramblers, S. Mahadevan, **S. Halverson**, A. Roy. U.S. Patent Application 62/204,206, filed August 2015.
Pending *A Robust Microscope for External Cell Phone Attachment*, A. Roy, S. Mahadevan, **S. Halverson**, Patent Pending

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Professional memberships

SPIE, The Optical Society (OSA), American Astronomical Society (AAS)

Publications

Peer-reviewed journal publications

Temporal Variations of Telluric Water Vapor Absorption at Apache Point Observatory, Li, D.; Blake, C.; Nidever, D.; **Halverson, S.**, PASP 130, 983, 2018

A Low-cost Environmental Control System for Precise Radial Velocity Spectrometers, Sliski, D.; Blake, C.; **Halverson, S.**, PASP 129, 982, 2017

Frequency stability characterization of a broadband fiber Fabry-Perot interferometer, Jennings, J.; **Halverson, S**.; Terrien, R.; Mahadevan, S.; Ycas, G.; & Diddams, S. Optics Express, 24, 14, 2017

Towards Space-like Photometric Precision from the Ground with Beam Shaping Diffusers, Stefansson, G.; Mahadevan, S.; Hebb, L.; Wisniewski, J.; Huehneroff, J.; Morris, B.; **Halverson, S.**; Zhao, M.; Wright, J.; O'rourke, J.; Knutson, H.; Hawley, S.; Kanodia, S.; Li, Y.; Hagen, L.; Lio, L.; Bender, C.; Robertson, P.; Dembicky, J.; Gray, C.; Ketzeback, W.; McMillan, R.; & Rudyk, T, ApJ, 848, 1, 2017

The Impact of Charge Transfer Inefficiency on Extreme Precision Doppler Measurements, Blake, C.; **Halverson, S.**; Roy, A, Journal of Instrumentation, 12, C04003, 2017

A Versatile Technique to Enable Sub-milli-Kelvin Instrument Stability for Precise Radial Velocity Measurements: Tests with the Habitable-zone Planet Finder, Stefansson, G.; Hearty, F.; Robertson, P.; Mahadevan, S.; Anderson, T.; Levi, E.; Bender, C.; Nelson, M.; Monson, A.; Blank, B.; **Halverson, S.**, Henderson, C.; Ramsey, L.; Roy, A.; Schwab, C.; & Terrien, R., ApJ, 833, 175, 2016

'Modal-noise' in single-mode fibers: A cautionary note for high precision radial velocity instruments, **Halverson, S.**; Roy, A.; Mahadevan, S.; & Schwab, C, ApJ, 814, L22, 2015

An Efficient, Compact, and Versatile Fiber Double Scrambler for High Precision Radial Velocity Instruments, **Halverson, S.**; Roy, A.; Mahadevan, S.; Ramsey, L.; Levi, E.; Schwab, C.; Hearty, F.; & MacDonald, N.,ApJ, 806, 61, 2015

Development of Fiber Fabry-Perot Interferometers as Stable Near-infrared Calibration Sources for High Resolution Spectrographs, **Halverson, S.**; Mahadevan, S.; Ramsey, L.; Hearty, F.; Wilson, J.; Holtzman, J.; Redman, S.; Nave, G.; Nidever, D.; Nelson, M.; Venditti, N.; Bizyaev, D.; & Fleming, S.,PASP, 126, 939, 2014

Suppression of Fiber Modal Noise Induced Radial Velocity Errors for Bright Emission-line Calibration Sources, Mahadevan, S.; **Halverson, S.**, Ramsey, & Venditti, N. ApJ, 786, 18, 2014

The Tenth Data Release of the Sloan Digital Sky Survey: First Spectroscopic Data from the SDSS-III Apache Point Observatory Galactic Evolution Experiment, Ahn, Christopher P.; Alexandroff, Rachael, Allende Prieto, Carlos, Anders, Friedrich, Anderson, Scott F.; Anderton, Timothy.; **Halverson, S. (85th author)** ApJS, 211, 17, 2014

Spectro-interferometric Observations of Classical Nova V458 VUL 2007, Rajabi, S.; Muterspaugh, M. W.; Lane, B.; Sirk, M.; Browne, S.; Ghasempour, A.; **Halverson, S.**; Kelly, J.; & Williamson, M., ApJ, 786, 18, 2012

Precise Stellar Radial Velocities of an M Dwarf with a Michelson Interferometer and a Medium-Resolution Near-Infrared Spectrograph, Muirhead, P.; Edelstein, J.; Erskine, D. J.; Wright, J. T.; Muterspaugh, M. W.; Covey, K.; Wishnow, E.; Hamren, K.; Andelson, P.; Kimber, D.; Mercer, T.; **Halverson, S.**, Vanderburg, A.; Mondo, D.; Czeszumska, A.; & Lloyd, J. P., PASP, 123, 709, 2011

A Prograde, Low-inclination Orbit for the Very Hot Jupiter WASP-3b, Tripathi, A.; Winn, J.; Johnson, J. A.; Howard, A.; **Halverson, S.**; Marcy, G. W.; Holman, M.; de Kleer, K.; Carter, J.; Esquerdo, G.; Everett, M.; & Cabrera, N., ApJ,715, 421, 2010

Conference proceedings

Keck Planet Finder: preliminary design, Gibson, S.; Howard, A.; Roy, A.; Smith, C.; **Halverson, S.**; Edelstein, J.; Kassis, M.; Wishnow, E.; Raffanti, M; Allen, S.; Chin, J.; Coutts, D.; Cowley, D.; Curtis, J.; Deich, W.; Feger, T.; Finstad, D.; Gurevich, Y.; Ishikawa, Y.; James, E.; Jhoti, E.; Lanclos, K.; Lilley, S.; Miller, T.; Milner, S.; Payne, T.; Rider, K.; Rockosi, C.; Sandford, D.; Schwab, C.; Seifahrt, A.; Sirk, M.; Smith, R.; Stuermer, J.; Weisfeiler, M.; Wilcox, M.; Vandenberg, A.; Wizinowich, P., Proceedings of the SPIE, Volume 1070267, 2018

Overview of the spectrometer optical fiber feed for the habitable-zone planet finder Kanodia, S.; Mahadevan, S.; Ramsey, L.; Stefansson, G.; Monson, A.; Hearty, F.; Blakeslee, S.; Lubar, E.; Bender, C.; Ninan, J.; Sterner, D.; Roy, A.; **Halverson, S.**; Robertson, P.,Proceedings of the SPIE, Volume 1070267, 2018

Extreme precision photometry from the ground with beam-shaping diffusers for K2, TESS, and beyond, Stefansson, G.; Mahadevan, S.; Wisniewski, J.; Li, Y.; Hebb, L.; Morris, B.; **Halverson, S.**; Monson, A.; Robertson, P.,Proceedings of the SPIE, Volume 1070267, 2018

Rubidium traced etalon wavelength calibrators: towards deployment at observatories, Schwab, C.; Feger, T.; Stürmer, J.; Seifahrt, A.; Gurevich, Y.; Rogozin, D.; Führer, T.; **Halverson, S.**; Terrien, R.; Legero, T.; Coutts, D.; Raskin, G.; Walther, T.; Bean, J.; Quirrenbach, A.,Proceedings of the SPIE, Volume 1070267, 2018

The NEID precision radial velocity spectrometer: optical design of the port adapter and ADC, Schwab, C.; Liang, M.; Gong, Q.; Bender, C.; Blake, C.; **Halverson, S.**; Harbeck, D.; Hearty, F.; Hunting, E.; Jaehnig, K.; Logsdon, S.; Mahadevan, S.; McElwain, M.; Monson, A.; Percival, J.; Rajagopal, J.; Ramsey, L.; Robertson, P.; Roy, A.; Santoro, F.; Smith, M.; Terrien, R.; Timmermann, E.; Willems, P.; Wolf, J.; Wright, J.,Proceedings of the SPIE, Volume 1070267, 2018

A optical fiber double scrambler and mechanical agitator system for the Keck planet finder spectrograph, Sirk, M.; Wishnow, E.; Weisfeiler, M.; Jhoti, E.; Curtis, J.; Ishikawa, Y.; Finstad, D.; O'Hanlon, T.; Gibson, S.; Edelstein, J.; **Halverson, S.**; Roy, A,; Howard, A.,Proceedings of the SPIE, Volume 1070267, 2018

The NEID precision radial velocity spectrometer: port adapter overview, requirements, and test plan, Logsdon, S.; McElwain, M.; Gong, Q.; Liang, M.; Santoro, F.; Schwab, C.; Bender, C.; Blake, C.; **Halverson, S.**; Hearty, F.; Hunting, E.; Jaehnig, K.; Mahadevan, S.; Monson, A.; Percival, J.; Rajagopal, J.; Ramsey, L.; Roy, A.; Smith, M.; Terrien, R.; Timmermann, E.; Willems, P.; Wolf, M.; Wright, J.,Proceedings of the SPIE, Volume 1070267, 2018

A comprehensive radial velocity error budget for next generation Doppler spectrometers, **Halverson, S.**; Terrien, R.; Mahadevan, S.; Roy, A.; Bender, C.; Stefansson, G.; Monson, A.; Levi, E.; Hearty, F.; Blake, C.; McElwain, M.; Schwab, C.; Ramsey, L.; Wright, J.; Wang, S.; Gong, Q.; Roberston, P., Proceedings of the SPIE, Volume 9908, 99086P, 2016

Measuring extended red sensitivity in a 1.7μm-cutoff HgCdTe detector array, Terrien, R.; Monson, A.; Mahadevan, S.; Bender, C.; **Halverson, S.**; Ramsey, L., Proceedings of the SPIE, Volume 9915, 99151Q, 2016

The instrument control software package for the Habitable-Zone Planet Finder spectrometer, Bender, C.; Robertson, P.; Stefansson, G.; Monson, A.; Anderson, T.; **Halverson, S.**; Hearty, F.; Levi, E.; Mahadevan, S.; Nelson, M.; Ramsey, L.; Roy, A.; Schwab, C.; Shetrone, M.; & Terrien, R., Proceedings of the SPIE, Volume 9913, 991338, 2016

Design of NEID, an extreme precision Doppler spectrograph for WIYN, Schwab, C.; Rakich, A.; Gong, Q.; Mahadevan, S.; **Halverson, S.**; Roy, A.; Terrien, R.; Robertson, P.; Hearty, F.; Levi, E.; Monson, A.; Wright, J.; McElwain, M.; Bender, C.; Blake, C.; Sturmer, J.; Gurevich, Y. V.; Chakraborty, A.; & Ramsey, L., Proceedings of the SPIE, Volume 9908, 99087H, 2016

A system to provide sub-milliKelvin temperature control at T 300K for extreme precision optical radial velocimetry, Robertson, P.; Hearty, F.; Anderson, T.; Stefansson, G.; Levi, E.; Bender, C.; Mahadevan, S.; **Halverson, S.**; Monson, A.; Ramsey, L.; Roy, A.; Schwab, C.; Terrien, R.; Nelson, M.; & Blank, B., Proceedings of the SPIE, Volume 9908, 990862, 2016

Measuring the thermal sensitivity of a fiber Fabry-Perot interferometer, Jennings, J.; **Halverson, S.**; Diddams, S.; Terrien, R.; Ycas, G.; & Mahadevan, S., Proceedings of the SPIE, Volume 9907, 99072G, 2016

Adaptive optics fed single-mode spectrograph for high-precision Doppler measurements in the near-infrared, Schwab, C.; Jovanovic, N.; Feger, T.; Bakovic, M.; Gurevich, Y. V.; Sturmer, J.; Apodaca, R.; Vanzi, L.; Rukdee, S.; Lawrence, J. S.; Coutts, D. W.; Cvetojevic, N.; Mahadevan, S.; Stefansson, G. K.; **Halverson, S.**; & Guyon, O., Proceedings of the SPIE, Volume 9912, 991274, 2016

Ultra-stable temperature and pressure control for the Habitable-zone Planet Finder spectrograph, Stefansson, G.; Hearty, F.; Robertson, P.; Levi, E.; Mahadevan, S.; Anderson, T.; Monson, A.; Bender, C.; **Halverson, S.**, Li, Y.; Ramsey, L.; Roy, A.; Schwab, C.; Terrien, R.; Nelson, M.; & Blank, B., Proceedings of the SPIE, Volume 9908, 990871, 2016

The Habitable-zone Planet Finder Calibration System, **Halverson, S**; Mahadevan, S.; Ramsey, L. W.; Terrien, R.; Roy, A.; Schwab, C.; Bender, C.; Hearty, F.; Levi, E.; Osterman, S.; Ycas, G.; Diddams, S., Proceedings of the SPIE, Volume 9147, 91477Z, 2014

Developments in simulations and software for a near-infrared precision radial velocity spectrograph, Terrien, R.; Bender, C.; Mahadevan, S; **Halverson, S.**; Ramsey, L. W.; Hearty, F., Proceedings of the SPIE, Volume 9152, 915226, 2014

Scrambling and modal noise mitigation in the Habitable Zone Planet Finder fiber feed, Roy, A.; **Halverson, S.**; Mahadevan, S.; Ramsey, L. W., Proceedings of the SPIE, Volume 9147, 91476B, 2014

Environmental control system for Habitable-zone Planet Finder (HPF), Hearty, F.; Levi, E. Nelson, M.; Mahadevan, S.; Burton, A.; Ramsey, L.; Bender, C.; Terrien, R.; **Halverson, S.**; Robertson, P.; Roy, A.; Blank, B.; Blanchard, K.; Stefansson, G., Proceedings of the SPIE, Volume 9147, 914752, 2014

The Habitable-zone Planet Finder: A status update on the development of a stabilized fiber-fed near-infrared spectrograph for the for the Hobby-Eberly telescope, Mahadevan, S.; Ramsey, L. W.; Terrien, R.; **Halverson, S**; Roy, A.; Hearty, F.; Levi, E.; Stefansson, G.; Robertson, P.; Bender, C.; Schwab, C.; Nelson, M., Proceedings of the SPIE, Volume 9147, 91471G, 2014

A Fiber Fabry-Perot Interferometer as Stable Wavelength Reference for High-resolution Astronomical Spectrographs, **Halverson, S.**; Mahadevan, S.; Ramsey, L., OSA Workshop on Specialty Optical Fibers and their Applications, W3.3, 2013

Optical fiber modal noise in the 0.8 to 1.5 micron region and implications for near infrared precision radial velocity measurements, McCoy, K. S.; Ramsey, L.; Mahadevan, S.; **Halverson, S.**; Redman, S. L., Proceedings of the SPIE, Volume 8446, 84468J, 2012

Development of a New, Precise Near-infrared Doppler Wavelength Reference: A Fiber Fabry-Perot Interferometer, **Halverson, S.**; Mahadevan, S.; Ramsey, L.; Redman, S.; Nave, G.; Wilson, J. C.; Hearty, F.; Holtzman, J., Proceedings of the SPIE, Volume 8446, 84468Q, 2012

The habitable-zone planet finder: a stabilized fiber-fed NIR spectrograph for the Hobby-Eberly Telescope, Mahadevan, S.; Ramsey, L.; Bender, C.; Terrien, R; Wright, J. T.; **Halverson, S.**; Hearty, F.; Nelson, M.; Burton, A; Redman, S.; Osterman, S.; Diddams, S.; Kasting, J.; Endl, M.; Deshpande, R.; Proceedings of the SPIE, Volume 8446, 84461S, 2012

Performance of the Apache Point Observatory Galactic Evolution Experiment (APOGEE) high-resolution near-infrared multi-object fiber spectrograph, Wilson, J. C.; Hearty, F.; Skrutskie, M. F.; Majewski, S. R.; Schiavon, R. et al. **Halverson, S. (80th author)**, Proceedings of the SPIE, Volume 8446, 84460H 2012

Predicting migration system dynamics with conditional and posterior probabilities, Andris, C. ; **Halverson, S.** ; Hardisty, F.,Spatial Data Mining and Geographical Knowledge Services (ICSDM), 2011 IEEE International Conference, pg 192 - 197

Infrared radial velocimetry with TEDI: performance development, Edelstein, J.; Muirhead, P.; Wright, J. T.; Covey, K.; Erskine, D.; Muterspaugh, M.; Lloyd, J.; **Halverson, S.**; Marckwordt, M.; Mondo, D., Proceedings of the SPIE, Volume 7735, 773583, 2010

Precise infrared radial velocimetry with the Triplespec Exoplanet Discovery Instrument: current performance and results, Muirhead, P.; Edelstein, J.; Wright, J. T.; Erskine, D. J.; Muterspaugh, M. W.; Covey, K. R.; Marckwordt, M. R.; **Halverson, S.**; Mondo, D.; Lloyd, J. P., Proceedings of the SPIE, Volume 7735, 77357X, 2010

Precision Radial Velocities in the Near Infrared with TEDI, Lloyd, J. P.; Czeszumska, A.; Edelstein, J.; Erskine, D.; Feuerstein, M.; **Halverson, S.**; Marckwordt, M.; Mercer, T.; Muirhead, P.; Schwehr, J.; Muterspaugh, M.; Wishnow, E.; Wright, J., Transiting Planets, Proceedings of the International Astronomical Union, IAU Symposium, Volume 253, p. 157-161

Dispersed interferometry for infrared exoplanet velocimetry, Edelstein, J.; Muterspaugh, M.; Erskine, D.; Marckwordt, M.;Feuerstein, M. Mercer, T.; Czeszumska, A.; Schwer, J.; **Halverson, S.**; Lloyd, J.; Muirhead, P.; Wright, J..; Herter, T., Proceedings of the SPIE, Volume 7014, 70147F, 2008

Non-refereed materials

The Habitable-zone Planet Finder (HPF): Achieving high precision radial velocities and mitigating stellar activity noise, Mahadevan, S.; Ramsey, L. W.; Terrien, R.; Robertson, P.; Marchwinski, R. C.; Hearty, F.; Levi, E.; Stefansson, G.; Bender, C. F.; **Halverson, S.**; Roy, A.; Nelson, M.; Schwab, C.,American Astronomical Society, AAS Meeting 225, #258.23, 2015

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Preliminary Data Reduction Methods for TEDI: The Triplespec Exoplanet Discovery Instrument, **Halverson, S.**; Muirhead, P.; Muterspaugh, M.; Edelstein, J., Bulletin of the American Astronomical Society, Vol. 42, p.287, 2010

The SIM Exoplanet Analysis Experiment, an Undergraduate Perspective, **Halverson, S.**; Muterspaugh, M.; Howard, A.; Wright, J.; Sirk, M., Bulletin of the American Astronomical Society, Vol. 41, p.357, 2009

Refereed tinyurl.com/RefereedHalverson (**3 first author articles**, 3 second author, 11 total)

Non-Refereed tinyurl.com/NonRefereedHalverson (**6 first author articles**, 3 second author, 32 total)

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