Seven M. **Rasmussen**

Educator · Writer · Science Communicator

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Education

Ph.D. in Physics — *Notre Dame, IN, USA*

University of Notre Dame — *Jun. 2015 - May. 2020*

- Thesis: I obtained elemental abundances of metal-poor (ancient) stars and used these data to learn about several facets of the early Universe.

B.S. in Physics & Astrophysics with Honors — *Tallahassee, FL, USA*

Florida State University — *Aug. 2011 - May. 2015*

- Senior Thesis: I explored the relationship between microwave and X-ray flux for a variety of active galactic nuclei and other quasi-stellar objects.

Work Experience

Professor (Part-time) — *Tacoma, WA, USA*

Tacoma Community College — *Sep. 2023 - present*

- I teach physics, astronomy, and astrobiology to a diverse range of students.

Post-doctoral Research Fellow — *Seattle, WA, USA*

University of Washington | Virtual Planet Laboratory — *Mar. 2022 - Apr. 2023*

- I simulated the capabilities of the next generation of ground-based and space-based telescopes to determine the most effective ways to characterize terrestrial exoplanets.

Post-doctoral Research Fellow — *Ann Arbor, MI, USA*

University of Michigan — *Aug. 2020 - present*

- I characterized Hot Jupiters with high-resolution multi-phase spectroscopy and worked to improve the statistical methodology behind the detection of molecular species in planetary atmospheres.

Visiting Scholar — *Cambridge, MA, USA*

Massachusetts Institute of Technology — *Aug. 2018 - April 2020*

- I worked with Prof. Sara Seager and Prof. Anna Frebel to construct a survey to search for the oldest exoplanets and to theorize a new way to understand the initial mass function of proto-Galactic stellar systems.

Grants & Awards

$11,650	**Keck PI Data Award**, NASA	*2021*
$1,000	**ExoExplorers Speaking Award**, JPL	*2021*
$1,500	**Conference Travel Award**, University of Geneva	*2019*
$1,000	**Professional Development Travel Award**, ND Graduate School	*2019*
$200	**Conference Presentation Grant**, ND Graduate Student Union	*2019*
$150	**Conference Presentation Grant**, ND Graduate Student Union	*2016*
Award	**Most Outreach Performed in 2018-2019 School Year**, ND Physics Outreach Committee	*2018*

Talks

Conference:

The Drake Equation (INVITED) — *Portland, OR*

Life in Seven Numbers: The Drake Equation Revealed — *Jan. 2023*

- Presented an general audience overview of present and future of astrobiology.

Direct Imaging with HabWorlds — *Seattle, WA*

A HabWorlds Strategy for Characterizing Earth Analogs — *Jan. 2023*

- Presented a novel method for distinguishing gaseous planets from rocky planets using haze scattering properties

Exoplanet Spectroscopy — *Ann Arbor, MI*

Improving High-Resolution Cross-Correlation Spectroscopy with Novel Techniques — *Nov. 2021*

- Presented new normalization and smoothing algorithms for improving exoplanet atmosphere detection significances.

Select Invited Colloquia & Seminars

- **McMaster University**, Hamilton, ON — *Jun 2022*
- **UMass Lowell**, Lowell, MA — *Mar 2022*
- **UMass Amherst**, Amherst, MA — *Feb 2022*
- **NASA Goddard**, Greenbelt, MD — *Nov 2021*
- **Lawrence Technological University**, Detroit, MI — *Nov 2021*
- **Harvard Center for Astrophysics**, Cambridge, MA — *Oct 2021*
- **George Mason University**, Washington DC — *Sep 2021*
- **NOIRLab**, Tucson, AZ — *Sep 2021*
- **University of Wisconsin**, Madison, WI — *Mar 2021*
- **University of Colorado**, Boulder, CO — *Feb 2021*
- **San Diego State University**, San Diego, CA — *Dec 2020*
- **University of California Santa Cruz**, Santa Cruz, CA — *Nov 2020*
- **Rhodes College**, Memphis, TN — *Oct 2020*
- **Fordham University**, New York City, NY — *Oct 2020*
- **Carnegie Observatories**, Pasadena, CA — *Jan 2020*

Accepted Proposals (Select)

PI hrs: 342 • Co-I hrs: 430

Co-I	Gemini-S | IGRINS Observing Time Proposal, *"The final puzzle piece: Completing the picture of the most-studied JWST hot Jupiter exoplanet with Gemini-S/IGRINS"* **(12 hrs)**	*2022*
PI	McDonald Observatory Observing Time Request McD22-c, *"An Ancient Box of Chocolates: Follow-up of High-Priority Metal-Poor Stars Identified from S-PLUS Photometry"* **(50 hrs)**	*2022*
Co-I	Gemini-S | IGRINS Observing Time Proposal, *"Tracing the Day-Night Structure of WASP-76b with Multi-Phase High-Resolution Spectroscopy"* **(20 hrs)**	*2022*
Co-I	IRTF | iSHELL Observing Time Proposal, *"Search for variation of minor species in Venus' Atmosphere"* **(3 hrs)**	*2022*
PI	Gemini North | MAROON-X Observing Time Proposal, *"Dayside Spectroscopy of 55 Cancri e: A Keystone Observation in the Emerging Field of Rocky Planet Atmospheres"* **(3.5 hrs)**	*2022*
Co-I	Gemini South | IGRINS Observing Time Proposal, *"A Rose in the Hot Neptune Desert: Constraining the Composition and Thermal Structure of LTT 9779b"* **(12.5 hrs)**	*2022*
PI	Gemini South | IGRINS Observing Time Proposal, *"Phase-Resolved High-Spectral Resolution Investigation of Ultra-Hot Jupiters"* **(9 hrs)**	*2021*
Co-I	Gemini South | IGRINS Observing Time Proposal, *"Exploring the Atmospheric Evaporation of a Terrestrial Exoplanet" (PI: S. Gandhi)* **(3 hrs)**	*2021*
PI	Magellan Observing Time Proposal, *"New Worlds Around Ancient Stars: Exploring the History of Planet Formation with the SEAMSTRESS Survey"* **(20 hrs)**	*2021*
PI	Keck Observing Time Proposal (NASA), *"Phase-Resolved High-Spectral Resolution Investigation of Ultra-Hot Jupiters"* **(10 hrs — $11,650)**	*2021*
PI	NOIRLab Observing Time Proposal, *"New Worlds Around Ancient Stars: Exploring the History of Planet Formation with the SEAMSTRESS Survey"* **(40 hrs)**	*2021*
PI	Magellan/MIKE Institutional Proposal (U. Michigan), *"Finding New Worlds Around Ancient Stars"* **(10 hrs)**	*2020*
PI	NOIRLab Observing Time Proposal, *"New Worlds Around Ancient Stars: Exploring the History of Planet Formation with the SEAMSTRESS Survey"* **(200 hrs)**	*2020*
Co-I	Magellan/PFS Institutional Proposal (MIT), *"New Worlds Around Ancient Stars: Exploring the History of Planet Formation with the SEAMSTRESS Survey" (PI: A. Frebel))* **(10 hrs)**	*2020*
Co-I	Magellan/PFS Institutional Proposal (MIT), *"New Worlds Around Ancient Stars: Exploring the History of Planet Formation with the SEAMSTRESS Survey" (PI: A. Frebel)* **(10 hrs)**	*2019*
Co-I	McDonald Observatory Observing Time Request McD19-2, *"The nature and astrophysical site(s) of the r-process" (PI: C. Sneden)* **(50 hrs)**	*2019*
Co-I	McDonald Observatory Observing Time Request McD19-1, *"The nature and astrophysical site(s) of the r-process" (PI: C. Sneden* **(50 hrs)**	*2019*
Co-I	McDonald Observatory Observing Time Request McD18-3, *"The nature and astrophysical site(s) of the r-process" (PI: C. Sneden* **(50 hrs)**	*2018*
Co-I	South African Large Telescope Long Term Proposal, *"Detailed Study of CEMP Stars Identified in the RAVE Survey" (PI: E. Depagne* **(150 hrs)**	*2017-2018*

Books and White Papers

Life in Seven Numbers: The Drake Equation Revealed (BOOK)

Princeton University Press — *Oct 2024*

- This pop science book takes the reader on a journey through the search for life viewed through the lens of the Drake Equation.

The Non-Binary Fraction: Looking Toward the Future of Gender Equity in Astronomy (WHITE PAPER)

Gender Equity (PI) — *Jul. 2019*

- This paper presents a summary of past and current studies of gender in astronomy, most of which either fail to acknowledge the existence of nonbinary people or intentionally omit us from statistical analyses. We then offer a series of recommendations to correct this issue and incorporate a more complex understanding of gender in space science.

Outreach & Service

Speaker	MENSA, *Seattle, WA*	*2022*
Speaker	Skype A Scientist, *Remote*	*2022 -*
Panelist	NOIRLab Galactic TAC, *Tucson, AZ*	*2021 - 2023*
Panelist	NASA Review Panel, *Remote*	*2021 -*
Panelist	LGBTQ2S+ in Astronomy Discussion, *Queens University*	*2021*
Panelist	Speaker on DEI in Astronomy, *Austin, TX*	*2021*
Speaker	Science Speakers Series, *Punahou School*	*2020*
Speaker	Science Speakers Series, *Crossroads Middle School*	*2020*
Mentor	Undergraduate Research Opportunity Program, *University of Michigan*	*2020-2021*
Organizer	Diversity, Equity and Inclusion Committee, *University of Michigan*	*2020-2021*
Mentor	STEMentorship, *AWIS*	*2016-2020*
Demos	Science Alive!, *St. Joseph County Library*	*2016-2020*
Organizer	JINA-CEE Annual Conference, *Frontiers in Nuclear Astrophysics*	*2018-2019*
Presenter	Public Nights, *Morris Observatory*	*2015-2017*

Teaching

Professor

Tacoma, WA

Tacoma Community College — *Sep 2023 — present*

- F23 PHYS 114 (F23 General Physics I)
- F23 ASTR 110 (The Solar System)
- W24 PHYS 114 (General Physics I)
- W24 ASTR 115 (Stars, Galaxies, and the Cosmos)
- W24 PHYS 114 (Learnmark Exchange Program; Special Topics in Physics)
- Sp24 PHYS 114 (General Physics I
- Sp24 SCI 105 (Introduction to Astrobiology)

Graduate Teaching Assistant

Notre Dame, IN

University of Notre Dame — *Aug 2015 — May 2017*

- General Physics I: Held weekly group classwork tutorials, biweekly help sessions, graded quarterly exams
- General Science Courses: Graded exams/homework, held review sessions, proctored exams for Descriptive Astronomy, Earth Focus, Physics II, and Elementary Cosmology
- Lecturer: Substitute for professor absences

Lead Observatory Assistant

Notre Dame, IN

University of Notre Dame — *Aug 2015 — Jan 2017*

- Observatory Duties: Set up telescopes, perform alignments to track target objects, maintain and repair 8" Celestron telescopes
- Astronomy and Cosmology Lab: Lead lab exercises, answer questions, assist students with software (Stellarium) usage
- Supervisor: Advised junior graduate student and undergraduate observatory assistants
- Outreach: Set up for Morris Observatory Public Nights, gave talks to visitors of all ages, lead tours of observatory and observing equipment

Physics Tutor

Tallahassee, FL

Florida State University — *Feb 2014 — Apr 2015*

- Tutored individual students and groups in Elementary Physics I and II
- Assisted students with lower-level mathematics such as trigonometry, pre-calculus
- Attained College Reading & Learning Association (CRLA) Level 1 Certification

Observing Experience

Gemini Observatory — Gemini North Telescope (remote, queued) *Mauna Kea, HI*

MAROON-X *2022-present*

- Projects: high-resolution optical observations of ultra-hot super-Earths

Gemini Observatory — Gemini South Telescope (remote, queued) *Cerro Pachon, Chile*

IGRINS *2021-present*

- Projects: high-resolution infrared observations of ultra-hot Jupiters and sub-Neptunes

Keck Observatory — Keck II Telescope (hands-on + remote) *Mauna Kea, HI*

NIRSPEC *2021-present*

- Projects: high-resolution infrared observations of ultra-hot Jupiters

Las Campanas Observatory — Magellan/Clay Telescope (hands-on + remote) *La Serena, Chile*

MIKE, PFS *2018-present*

- Projects: high-resolution optical spectroscopic observations of metal-poor planet candidate host stars, extremely metal-poor stars, wide binaries. Precision radial velocities of metal-poor planet candidate hosts.

McDonald Observatory — Harlan J. Smith Telescope (hands on) *Fort Davis, TX*

Echelle Spectrograph *2017-2018*

- Projects: high-resolution optical spectroscopic observations of heavy-element-enriched metal-poor stars

Las Campanas Observatory — Dupont Telescope (hands-on) *La Serena, Chile*

Echelle Spectrograph *2016-2018*

- Projects: high-resolution optical spectroscopic observations of heavy-element-enriched metal-poor stars, IR photometric observation of 2017 neutron star merger

Refereed Publications

15 refereed papers • 1192 citations • h-index = 10

Currie, M., Meadows, V., Rasmussen, S. M. *PSJ*

There's More to Life than O2: Simulating the Detectability of a Range of Molecules for Ground-based, High-resolution Spectroscopy of Transiting Terrestrial Exoplanets *2023*

- We discuss new simulations on the feasibility of detecting oxygen on other worlds.

Rasmussen, S. M., Rahman, F., Beltz, H., Savel, A. B., Rauscher, E., et al. *in prep (draft available upon request)*

Simulating the Performance of the WINERED Spectrograph for Phase-Resolved High-Resolution Emission Spectroscopy of Hot Jupiters *2023*

- We present a new simulation suite to help plan observations with the WINERED spectrograph.

Rasmussen, S. M., van Buchem, C., Malik, M., Savel, A. B., Brogi, M., et al. *AJ*

A Nondetection of Iron in the First High-resolution Emission Study of the Lava Planet 55 Cnc e *2023*

- We use MAROON-X observations to put upper limits on the atmospheric pressure of the lava planet 55 Cnc e, finding that if a mineral atmosphere is present, it is likely the result of outgassing and has a pressure below 100 mbar.

Rasmussen, S. M., Brogi, M., Rahman, F., Rauscher, E., Beltz, H., et al. *AJ*

SPORK That Spectrum: Increasing Detection Significances from High-Resolution Exoplanet Spectroscopy with Novel Smoothing Algorithms *2022*

- We present new methodology for improving the normalization and de-noising of telluric-removed exoplanet spectra which leads to higher detection significances and recovered planetary SNR.

Oey, M. S., Castro, N., Renzo, M., Vargas-Salazar, I., Suffak, M., et al. *ApJ*

AvZ 493: A Remarkable Early Oe-Type, Eccentric Binary Star in the SMC *2022*

- We present new observations of the Oe Star AvZ 493, a heartbeat-like star with an unseen companion in the LMC.

Zepeda J., Rasmussen S. M., Beers T. C., Placco V. M., Huang Y., et al. *ApJ*

Metal-Poor Stars from the South African Large Telescope II *submitted*

- We present the final sample of a total of ∼ 200 metal-poor stars selected from the Radial Velocity Experiment (RAVE) and observed with the South African Large Telescope (SALT) (R ∼ 40,000; S/N ∼ 30 at 4500 Å)

Gudin, D., Shank, D., Beers, T. C., Yuan, Z., Limberg, G., et al. *ApJ*

The *R*-Process Alliance: Chemo-Dynamically Tagged Groups of Halo r-Process-Enhanced Stars Reveal a Shared Chemical-Evolution History *2021*

- We present dynamical parameters for 426 metal-poor r-process-enhanced stars and use the FoF clustering algorithm to calculate chemodynamically tagged groups. We find statistically significant similarities in metallicity and heavy element content within groups of tagged star.

Holmbeck, E. M., Hansen, T. T., Beers, T. C., Placco, V. M., Whitten, D. D., et al. *ApJ*

The R-Process Alliance: Fourth Data Release from the Search for R-process-enhanced Stars in the Galactic Halo *2020*

- This compilation is the fourth data release from the R-Process Alliance (RPA) search for r-process-enhanced stars and the second release based on" snapshot" high-resolution (R 30,000) spectra collected with the du Pont 2.5 m Telescope.

Rasmussen S. M., Frebel A., Ezzedine R., Ji A., Chiti A., et al. *ApJ*

The R-Process Alliance: A Uranium Abundance Measurement in the r-I Star BD +17 3248 *submitted*

- We report an abundance measurement of uranium in the metal-poor r-process-enhanced star based on a high resolution and high S/N (R $\sim$ 66,000, S/N $\sim$ 900 at 4,000 Å) spectrum taken with the *Magellan*/Clay telescope.

Rasmussen S. M., Zepeda J., Beers T. C., Placco V. M., Depagne E., et al. *ApJ*

Metal-Poor Stars from the South African Large Telescope I *2020*

- We present the first sub-sample of a total of $\sim$ 200 metal-poor stars selected from the Radial Velocity Experiment (RAVE) and observed with the South African Large Telescope (SALT) (R $\sim$ 40,000; S/N $\sim$ 30 at 4500 Å)

Ezzedine R., Rasmussen S. M., Frebel A., Chiti A., Hinojisa K., et al. *ApJ*

The R-process Alliance: MIKE/Magellan Data Release of r-process Enhanced Metal-Poor Stars from the South *2020*

- We present fundamental stellar parameters and detailed chemical abundance analysis of 141 newly 20 identified metal-poor, southern Galactic halo stars, as part of the R-Process Alliance (RPA) effort.

Placco, V. M., Beers, T. C., Santucci, R., Chanamé, Julio, Seúlveda, María Paz, et al. *AJ*

The R-Process Alliance: Spectroscopic Follow-up of Low-metallicity Star Candidates from the Best & Brightest Survey *2019*

- We present results from a medium-resolution (R $\sim$ 2000) spectroscopic follow-up campaign of 1694 bright (V $<$ 13.5), very metal-poor star candidates from the RAdial Velocity Experiment (RAVE).

Placco, V. M., Beers, T. C., Santucci, R., Chanamé, Julio, Seúlveda, María Paz, et al. *AJ*

Spectroscopic Validation of Low-metallicity Stars from RAVE *2018*

- We present results from a medium-resolution (R $\sim\tilde{}$2000) spectroscopic follow-up campaign of 1694 bright (V $<$ 13.5), very metal-poor star candidates from the RAdial Velocity Experiment (RAVE).

Drout, M. R., Piro, A. L., Shappee, B. J., Kilpatrick, C. D., Simon, J. D., et al. *Science*

Light curves of the neutron star merger GW170817/SSS17a: Implications for r-process nucleosynthesis *2017*

- We constrain the radioactively powered transient resulting from the ejection of neutron-rich material. The fast rise of the light curves, subsequent decay, and rapid color evolution are consistent with multiple ejecta components of differing lanthanide abundance.

Yoon, J., Beers, T. C., Placco, V. M., Rasmussen S. M., Carollo, D., et al. *ApJ*

Observational Constraints on First-star Nucleosynthesis. I. Evidence for Multiple Progenitors of CEMP-No Stars *2016*

- We investigate anew the distribution of absolute carbon abundance, A(C) = $\log_\epsilon$(C), for carbon-enhanced metal-poor (CEMP) stars in the halo of the Milky Way, based on high-resolution spectroscopic data for a total sample of 305 CEMP stars.