Erika M. **Holmbeck**

PhD Physics · 2021 Hubble Fellow

Carnegie Observatories

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Summary

My interdisciplinary research focuses on understanding heavy-element production through the astrophysical rapid neutron-capture ("*r*"-) process. I observe metal-poor stars with high-resolution spectroscopy and determine elemental abundances from stellar spectra. I also use nucleosynthesis simulations to investigate both the nuclear and astrophysical effects on heavy-element production by the *r*-process.

Appointments

Sep 2021 – **The Observatories of the Carnegie Institution for Science**
NASA Hubble Fellow
Distilling Stellar Signatures to Characterize the Astrophysical Production Site of the Heavy Elements
Supervisor: Joshua Simon

Sep 2020 – Aug 2021 **Rochester Institute of Technology**
Postdoctoral Researcher (Center for Computational Relativity and Gravitation)
Reconstructing Neutron Star Merger Properties from Metal-Poor Stars
Supervisor: Richard O'Shaughnessy

Education

Aug 2020 **University of Notre Dame**
Ph.D. Physics (GPA: 3.94)
"The Looking Glass and Beyond: Using Observations and Modeling of Stellar Actinide Abundances as a Window into r-Process Events"
Advisors: Profs. Rebecca Surman and Timothy C. Beers

Jun 2014 **University of California Los Angeles**
B.S. Astrophysics (GPA: 3.81), *Cum laude*, Departmental Honors, Dean's Honors List
"New Members of Nearby Moving Groups"
Advisors: Profs. Benjamin Zuckerman and Smadar Naoz

First-author Publications

Refereed (5)

2021 **Reconstructing Masses of Merging Neutron Stars from Stellar *R*-Process Abundance Signatures, Holmbeck, E. M.**, Frebel, A., McLaughlin, G. C., et al. 2021, ApJ, 909, 21.

2020 **The *R*-Process Alliance: Fourth Data Release from the Search for *r*-Process-Enhanced Stars in the Galactic Halo, Holmbeck, E. M.**, Hansen, T. T., Beers, T. C., et al. 2020, ApJS, 249, 30.

2019 **Actinide-rich and Actinide-poor *r*-Process Enhanced Metal-Poor Stars do not Require Separate *r*-Process Progenitors, Holmbeck, E. M.**, Frebel, A., McLaughlin, G. C., et al. 2019b, ApJ, 881, 5.

Actinide Production in the Neutron-Rich Ejecta of a Neutron Star Merger, Holmbeck, E. M., Sprouse T. M., Mumpower, M. R., et al. 2019a, ApJ, 870, 23.

2018 **The *R*-Process Alliance: 2MASS J09544277+5246414, the Most Actinide-Enhanced *R*-II Star Known, Holmbeck, E. M.**, Beers, T. C., Roederer, I. U., et al. 2018, ApJL, 859, L24.

Conference Proceedings (2)

2020 **Characterizing *r*-Process Sites through Actinide Production,** **Holmbeck, E. M.**, Surman, R., Frebel, A., et al. 2020, JPCS: Nuclear Physics in Astrophysics IX (NPA-IX), 1668, 15.

2017 **J2038—0023: The First Bright *R*-Process Enhanced Star Identified in the RAVE Survey,** **Holmbeck, E. M.**, Placco, V. M., Beers, T. C., et al., 2017, Proceedings of the 14th Symposium on Nuclei in the Cosmos (NIC2016), 020612.

Co-authored Publications

Refereed (13)

2021 **The *R*-Process Alliance: Chemodynamically Tagged Groups of Halo *r*-process-enhanced Stars Reveal a Shared Chemical-evolution History,** Gudin, D., Shank, D., Beers, T. C., ..., **Holmbeck, E. M.**, ..., et al. 2021, ApJ, 908, 79.

2020 **Detection of Pb II in the Ultraviolet Spectra of Three Metal-Poor Stars,** Roederer, I. U., Lawler, J. E., **Holmbeck, E. M.**, et al. 2020, ApJL, 902, L24.

The *R*-Process Alliance: The Peculiar Chemical Abundance Pattern of RAVE J183013.5—455510, Placco, V. M., Santucci, R. M., Yuan, Z., ..., **Holmbeck, E. M.**, ..., et al., 2020, ApJ, 897, 78.

2019 **Using excitation-energy dependent fission yields to identify key fissioning nuclei in *r*-process nucleosynthesis,** Vassh, N., Vogt, R., Surman, R.,Randrup, J., Sprouse, T. M., Mumpower, M. R., Jaffke, P. J., Shaw, D., **Holmbeck, E. M.**, Zhu, Y., McLaughlin, G. C., 2019, Journal of Physics G Nuclear Physics, 46, 065202.

The R-Process Alliance: Spectroscopic Follow-up of Low-metallicity Star Candidates from the Best & Brightest Survey, Placco, V. M., Santucci, R. M., Beers, T. C., ..., **Holmbeck, E. M.**, ..., et al., 2019, ApJ, 870, 122.

2018 **The *R*-Process Alliance: First Release from the Southern Search for *r*-Process Enhanced Stars in the Galactic Halo,** Hansen, T. T., **Holmbeck, E. M.**, Beers, T. C., et al. 2018, ApJ, 858, 92.

β-Delayed Fission in *R*-Process Nucleosynthesis, Mumpower M. R., Kawano T., Sprouse T. M., Vassh N., **Holmbeck, E. M.**, Surman R., Möller P., 2018, ApJ, 869, 14.

Californium-254 and Kilonova Light Curves, Zhu, Y., Wollaeger, R. T., Vassh, N., Sprouse, T. M., Mumpower, M. R., Möller, P., McLaughlin, G. C., Korobkin, O., Kawano, T., Jaffke, P. J., **Holmbeck, E. M.**, Fryer, C. L., Even, W. P., Couture, A. J., Barnes, J., 2018, ApJL, 863, L23.

The *R*-Process Alliance: Discovery of the First Metal-poor Star with a Combined *r*- and *s*-process Element Signature, Gull, M., Frebel, A., Cain, M. G., Placco, V. M., Ji, A. P., Abate, C., Ezzeddine, R., Karakas, A. I., Hansen, T. T., Sakari, C., **Holmbeck, E. M.**, Santucci, R. M., Casey, A. R., Beers, T. C., 2018, ApJ, 862, 174.

The *R*-Process Alliance: First Release from the Northern Search for *r*-process-enhanced Metal-poor Stars in the Galactic Halo, Sakari, C. M., Placco, V. M., Farrell, E. M., ..., **Holmbeck, E. M.**, ..., et al., 2018, ApJ, 868, 110.

The *R*-Process Pattern of a Bright, Highly *r*-Process-Enhanced, Metal-Poor Halo Star at [Fe/H] ~ -2, Sakari, C. M., Placco, V. M., Hansen, T., **Holmbeck, E. M.**, et al. 2018, ApJL, 854, L20.

Spectroscopic Validation of Low-metallicity Stars from RAVE, Placco, V. M., Beers, T. C., Santucci, R. M., Chanamé, J, Sepúlveda, M. P., Coronado, J., Points, S. D., Kaleida, C. C., Rossi, S., Kordopatis, G.; Lee, Y-S., Matijeviç, G., Frebel, A., Hansen, T. T., **Holmbeck, E. M.**, Rasmussen, K. C., Roederer, I. U., Sakari, C. M., Whitten, D. D., 2018, AJ, 155, 256.

2017 **RAVE J203843.2—002333: The First Highly *r*-Process-Enhanced Star Identified in the RAVE Survey,** Placco, V. M., **Holmbeck, E. M.**, Frebel, A., et al. 2017, ApJ, 844, 18.

Invited Presentations

2021 **APS Dissertation Award in Nuclear Physics Talk** (Virtual) — *Massachusetts Institute of Technology, MA*
"Constraining the *r*-process with Observation and Theory"

Institute for Nuclear and Particle Physics (Virtual) — *Ohio University, OH*
"Stellar Actinides as Tracers of Heavy-Element Nucleosynthesis"

Origins of the Isotopes Workshop (Virtual) — *IReNA*
"The Production of the Heaviest Elements through the Nuclear Lens"

Yale Astronomy Virtual Colloquium (Virtual) — *Yale University, CT*
"Heavy Element Nucleosynthesis in the Era of Multi-messenger Astronomy"

LANL Astrophysics Seminar (Virtual) — *Los Alamos National Lab, NM*
"Stellar Actinides as Tracers of Heavy-Element Nucleosynthesis"

TCAN Meeting 2021: BNS/BH-NS Merger Workshop (Virtual) — *Rochester Institute of Technology, NY*
"Observational Signatures of Heavy-Element Nucleosynthesis"

Star Talks Seminar Series (Virtual) — *University of Victoria, B.C., Canada*
"The Origin of the Heavy Elements: What We Can Learn from Metal-Poor Stars"

Virtual Joint Nuclear and Astrophysics Seminar (Virtual) — *Texas A&M University, TX*
"Heavy Element Nucleosynthesis in the Era of Multi-messenger Astronomy"

CCRG Lunch Talks (Virtual) — *Rochester Institute of Technology, NY*
"The Astrophysical Production of the Heaviest Elements"

FLASH Seminar (Virtual) — *University of California Santa Cruz, CA*
"The Astrophysical Production of the Heaviest Elements"

2020 **Physics Colloquium** (Virtual) — *San Francisco State University, CA*
"The Astrophysical Production of the Heaviest Elements"

Physics Colloquium (Virtual) — *Gonzaga University, WA*
"The Astrophysical Production of the Heaviest Elements"

N3AS Seminar (Virtual) — *University of California Berkeley, CA*
"Properties of *r*-Process-Producing Neutron Star Mergers: What We Can Learn from Metal-Poor Stars"

Our Universe Revealed (Virtual) — *University of Notre Dame, IN*
"Cosmic Alchemy: How the Universe Made the Heaviest Elements"

Physics Colloquium — *Andrews University, MI*
"Through the Looking Glass: Understanding the *r*-Process with Stellar Actinide Signatures"

2019 **Nuclear Seminar** — *University of Notre Dame, IN*
"Constraining the *r*-Process with Actinide Production Studies"

***R*-Process Alliance Workshop: Pushing toward the Next Project Phases** — *Massachusetts Institute of Technology, MA*
"Constraining the *r*-Process with Actinide Production Studies"

Astrophysics Seminar — *University of Notre Dame, IN*
"The Stellar Actinide Boost and its *r*-Process Implications"

2018 **JINA-CEE Online Seminar** — *Michigan State University, MI*
"Actinide Production in Neutron Star Mergers: Observation and Theory"

Awards and Fellowships

2021 **2022 Recipient of the Dissertation Award in Nuclear Physics, American Physics Society - Division of Nuclear Physics**

2021 NASA Hubble Fellow

2020 **Graduate Research and Dissertation Award, Physics Department, University of Notre Dame**

2019 **Best Poster Award (Nuclear Physics in Astrophysics IX)**

Graduate Student Union (GSU) Conference Presentation Grant

2018 **Zahm Research Travel Grant**

2017 – 2019 **Eartly-Lennox Graduate Student Fellow, University of Notre Dame**

2015 – 2020 **Arthur J. Schmitt Leadership Fellow, University of Notre Dame**

Memberships

2020 – **Core member of the *R*-Process Alliance**

2016 – **Joint Institute for Nuclear Astrophysics - Center for the Evolution of the Elements (JINA-CEE)**

2015 – 2020 **Society of Schmitt Fellows**

2015 – **American Astronomical Society (AAS)**

2015 – **American Physical Society (APS)**