

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 – **Rochester Institute of Technology**
Aug 2021 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 $[\text{Fe}/\text{H}] \sim -2$** , 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., Matijević, 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 **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 **NASA Hubble Fellow**
- 2021 **2022 Recipient of the Dissertation Award in Nuclear Physics, American Physics Society - Division of Nuclear Physics**
- 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 **Earty-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)**