

# Erika M. Holmbeck

PH.D. · NUCLEAR ASTROPHYSICIST

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## SUMMARY

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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

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Aug 2020 – **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

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Apr 2020 **University of Notre Dame**  
PH.D. PHYSICS  
*“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

Feb 2019 **M.S. PHYSICS (GPA: 3.94)**  
*“The Stellar Actinide Boost and its *r*-Process Implications”*  
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

## RESEARCH AND TEACHING

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2015 – 2020 **University of Notre Dame, Department of Physics**  
GRADUATE RESEARCH ASSISTANT, ADVISED BY PROF. REBECCA SURMAN  
**r*-Process Nucleosynthesis*  
GRADUATE RESEARCH ASSISTANT, ADVISED BY PROF. TIMOTHY C. BEERS  
*Identifying *r*-II Stars in the Milky Way Halo*

2019 **Holy Cross College and Westville Correctional Facility**  
TEACHING ASSISTANT FOR PROF. LARA ARIELLE PHILLIPS  
*Lab Technician for Westville Education Initiative*

2015 – 2017 **University of Notre Dame, Department of Physics**  
TEACHING ASSISTANT FOR PROF. PETER GARNAVICH  
*Lead Technician for the Jordan Hall of Science Observatory*

## PUBLICATIONS

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### FIRST AUTHOR (7)

- 2020 **Reconstructing Masses of Merging Neutron Stars from Stellar *R*-Process Abundance Signatures**, **Holmbeck, E. M.**, Frebel, A., McLaughlin, G. C., et al. 2020, arXiv:2010.01621 (*submitted to ApJ*).
- 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.
- 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.
- 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. 2019, 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. 2019, 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.
- 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-AUTHOR (12)

- 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, arXiv:2009.14251
- 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.
- $\beta$ -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.

## ORAL PRESENTATIONS

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### INVITED (9)

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”

### CONTRIBUTED (9)

2020 **Fall Meeting of the APS Division of Nuclear Physics (Virtual)** — *New Orleans, LA*

“WHICH NEUTRON STAR MERGERS SYNTHESIZED THE *r*-PROCESS ELEMENTS?”

**235th Meeting of the AAS** — *Honolulu, HI*

“THE ACTINIDE BOOST AND ITS *r*-PROCESS IMPLICATIONS”

2019 **Fall Meeting of the APS Division of Nuclear Physics** — *Crystal City, VA*

“ACTINIDE-RICH OR ACTINIDE-POOR, SAME *r*-PROCESS PROGENITOR”

**JINA-CEE Frontiers in Nuclear Astrophysics** — *Michigan State University, MI*

“ACTINIDE-RICH OR ACTINIDE-POOR, SAME *r*-PROCESS PROGENITOR”

**Notre Dame GPS Annual Conference** — *University of Notre Dame, IN*

“ACTINIDE-BOOST STARS MIGHT NOT SUGGEST A SEPARATE R-PROCESS SITE”

**R-Process Sources in the Universe** — *Arizona State University, AZ*

“ACTINIDE-BOOST STARS MAY NOT SUGGEST A SEPARATE  $r$ -PROCESS SITE”

2018 **Fifth Joint Meeting of the Nuclear Physics Divisions of the APS and JPS** — *Waikoloa, HI*

“ACTINIDE PRODUCTION IN NEUTRON STAR MERGERS”

2017 **Annual FIRE (Fission In R-process Elements) Meeting** — *Lawrence Livermore National Laboratory, CA*

“IMPACT OF NEW LANL FISSION RATES ON THE R-PROCESS”

**JINA-CEE Frontiers in Nuclear Astrophysics: Junior Researchers Workshop** — *MSU, MI*

“THE HUNT FOR  $r$ -II STARS: CONSTRAINING THE EARLY  $r$ -PROCESS THROUGH HIGH-RESOLUTION SPECTROSCOPIC FOLLOW-UP ON THE RAVE SURVEY”

## POSTER PRESENTATIONS

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2019 **Nuclear Physics in Astrophysics IX** — *Schloß Waldthausen, Frankfurt, Germany*

“CHARACTERIZING  $r$ -PROCESS SITES THROUGH ACTINIDE PRODUCTION” - *Winner of the Best Poster Award*

2018 **JINA-CEE Frontiers in Nuclear Astrophysics** — *University of Notre Dame, IN*

“THE R-PROCESS ALLIANCE HUNT FOR  $r$ -II STARS”

2017 **LANL FIESTA Fission School & Workshop** — *Sante Fe, NM*

“SEARCHING FOR NEW HIGHLY  $r$ -PROCESS-ENHANCED STARS IN THE HALO OF THE MILKY WAY”

2016 **Graduate Physics Students (GPS) Fall Conference** — *University of Notre Dame, IN*

“A BRIGHT  $r$ -II STAR DETECTED BY HIGH-RESOLUTION FOLLOW-UP OF THE RAVE SURVEY”

**Nuclei in the Cosmos XIV** — *Niigata, Japan*

“A BRIGHT  $r$ -II STAR DETECTED BY HIGH-RESOLUTION FOLLOW-UP OF THE RAVE SURVEY”

2014 **American Astronomical Society Meeting #224** — *Boston, MA*

“IDENTIFYING NEW MEMBERS OF NEARBY MOVING GROUPS”

## AWARDS AND FELLOWSHIPS

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2019 **Best Poster Award (Nuclear Physics in Astrophysics IX)** (500€)

**Graduate Student Union (GSU) Conference Presentation Grant** (\$350)

2018 **Zahm Research Travel Grant** (\$2,000)

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

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

## SKILLS

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*Proficient* Python,  $\text{\LaTeX}$ , bash (Unix/Linux), IRAF, MOOG, SMH

*User-level* C++, Fortran, HTML, CSS

## STUDENT SUPERVISION

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2018 **Phuong Hoang**, University of Hanoi (REU)

## MEMBERSHIPS

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- 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)**

## ACTIVITIES AND OUTREACH

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- 2019 **Lead Physics lab teaching assistant for the Moreau College Initiative at Westville Correctional Facility**
- 2019 **Cofounder and organizer of the JINA-CEE First Frontiers Summer School**
- 2017 – 2018 **Graduate Student Union (GSU) Representative for the Department of Physics**
- 2017 – 2019 **Private Tutor for Physics I and II**
- 2016 **Teaching Assistant for Sensing our World 2016: Mission to Mars**
  - Exhibitor for Our Universe Revealed: Hands-On Physics and Astroblast!**
  - Exhibitor for JINA-CEE Art 2 Science Camp**