

Erika M. Holmbeck

PHD PHYSICS · NHFP HUBBLE FELLOW

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My research leverages high-resolution spectroscopy of metal-poor stars with nucleosynthesis simulations to investigate both the nuclear and astrophysical effects on heavy-element production by the rapid neutron-capture (“r”) process

APPOINTMENTS

2021 – **The Observatories of the Carnegie Institution for Science**

NASA HUBBLE FELLOWSHIP PROGRAM (NHFP) HUBBLE FELLOW

Distilling Stellar Signatures to Characterize the Astrophysical Production Site of the Heavy Elements

Supervisor: Joshua Simon

2020 – 2021 **Rochester Institute of Technology**

POSTDOCTORAL RESEARCHER

Reconstructing Neutron Star Merger Properties from Metal-Poor Stars

Supervisor: Richard O’Shaughnessy

EDUCATION

Aug 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 **University of Notre Dame**

M.S. PHYSICS

“The Stellar Actinide Boost and its r-Process Implications”

Jun 2014 **University of California Los Angeles**

B.S. ASTROPHYSICS, *Cum laude*, DEPARTMENTAL HONORS, DEAN’S HONORS LIST

“New Members of Nearby Moving Groups”

Advisors: Profs. Benjamin Zuckerman and Smadar Naoz

PUBLICATION SUMMARY

A full list of publications can be found on [ADS](#) [🔗](#).

Journal publications: 8 first-author (2 in review), 20 co-author

Other papers: 2 first-author conference proceedings, 2 co-author white papers

h-index: 15

Total citations: 734

TEACHING

2022 **Mentor**, Carnegie Observatories: Carnegie Astrophysics Summer Student Internship Program (CASSI)

2019 **Teaching Assistant and Lab Technician**, Holy Cross College and Westville Correctional Facility

Lecturer, JINA-CEE First Frontiers Summer School

2017 – 2019 **Private Tutor**, University of Notre Dame, Department of Physics

2015 – 2017 **Teaching Assistant and Lead Technician**, University of Notre Dame, Jordan Hall of Science Observatory

HONORS, GRANTS & FELLOWSHIPS

- 2022 **Dissertation Award in Nuclear Physics**, American Physics Society - Division of Nuclear Physics
- 2021 **NHFP Hubble Fellow**, Space Telescope Science Institute
- 2020 **Graduate Research and Dissertation Award**, Physics Department, University of Notre Dame
- 2019 **Grant Award: “Astronomy for Physicists and Physics for Astronomers Summer School,”** JINA-CEE
Award: Best Poster, Nuclear Physics in Astrophysics Conference IX
Grant Award: Graduate Student Union (GSU) Conference Presentation, University of Notre Dame
- 2018 **Grant Award: Zahm Research Travel**, University of Notre Dame
- 2017–2019 **Early-Lennox Graduate Student Fellow**, University of Notre Dame
- 2015–2020 **Arthur J. Schmitt Leadership Fellow**, University of Notre Dame

AWARDED PROPOSALS & TELESCOPE TIME

- 2022 **Magellan 6.5-m Clay** (PI) — 10 nights
Hubble Space Telescope Cycle 30 (Co-I) — 60 orbits
- 2021 **Facility for Rare Isotope Beams (No. 21080)** (Co-author) — 128 beam on target hours
- 2019 **Hubble Space Telescope Cycle 27** (Co-I) — 17 orbits
- 2018 **Hubble Space Telescope Cycle 26** (Co-I) — 47 orbits
- 2017–2022 **Additional time awarded as Co-I**
- 45+ nights on the du Pont 100-in telescope, Las Campanas Observatory, Chile
 - 70+ nights on the Harlan J. Smith 107-in telescope, McDonald Observatory, Texas, USA
 - 25+ nights on the Magellan 6.5-m (Clay) telescope, Las Campanas Observatory, Chile

STUDENT SUPERVISION

- 2023 **Audrey Dunn**, University of California Los Angeles (Research Course Credit)
- 2022 **Rafael Cottom**, Santa Barbara City College (Carnegie Astrophysics Summer Student Internship Intern)
- 2021– **Audrey Lund**, University of Michigan (undergraduate research)
- 2018 **Phuong Hoang**, University of Hanoi (University of Notre Dame REU Student)
Tino Wells, University of Washington (University of Notre Dame REU Student)

SERVICE & OUTREACH

- 2022– **Member**, NHFP Anti-Racism Initiative
- 2022 **Committee Member**, Carnegie Fellowship Committee
Committee Member, NHFP Symposium Organizing Committee
Mentor, Carnegie Observatories: Carnegie Astrophysics Summer Student Internship Program (CASSI)
Volunteer/Exhibitor, STEM Savvy outreach event
- 2021 **Secretary**, R-Process Alliance
- 2019 **Cofounder and Organizer**, JINA-CEE First Frontiers Summer School
- 2018–2019 **Committee Member**, Graduate Qualification Exam Committee
- 2018 **Volunteer/Exhibitor**, Carnegie Observatories 16th Annual Open House
- 2017–2018 **Representative**, Graduate Student Union (GSU) for the Department of Physics
- 2016 **Teaching Assistant**, Sensing our World 2016: Mission to Mars
Volunteer/Exhibitor, Our Universe Revealed: Hands-On Physics and Astroblast!
Volunteer/Exhibitor, JINA-CEE Art 2 Science Camp

INVITED PRESENTATIONS (23)

- 2022 **Texas A&M University Astronomy Seminar** — *College Station, TX*
“THE ORIGIN OF THE ELEMENTS: WHAT WE CAN LEARN FROM METAL-POOR STARS”
- Michigan State University Astronomy Seminar** — *East Lansing, MI*
“THE ORIGIN OF THE ELEMENTS: WHAT WE CAN LEARN FROM METAL-POOR STARS”
- 2022 JINA-CEE Frontiers in Nuclear Astrophysics** — *South Bend, IN*
“STELLAR ABUNDANCES”
- Anton Pannekoek Institute for Astronomy Colloquium** — *University of Amsterdam, Amsterdam*
“THE ORIGIN OF THE HEAVY ELEMENTS: WHAT WE CAN LEARN FROM METAL-POOR STARS”
- NDT-NPP Seminar** — *Lawrence Livermore National Laboratory, CA*
“STELLAR ACTINIDES AS TRACERS OF HEAVY-ELEMENT NUCLEOSYNTHESIS”
- 2021 **APS Dissertation Award in Nuclear Physics Talk** — *Massachusetts Institute of Technology, MA*
“CONSTRAINING THE r -PROCESS WITH OBSERVATION AND THEORY”
- Institute for Nuclear and Particle Physics** — *Ohio University, OH*
“STELLAR ACTINIDES AS TRACERS OF HEAVY-ELEMENT NUCLEOSYNTHESIS”
- Origins of the Isotopes Workshop** — *IReNA Virtual Workshop*
“THE PRODUCTION OF THE HEAVIEST ELEMENTS THROUGH THE NUCLEAR LENS”
- Yale Astronomy Virtual Colloquium** — *Yale University, CT*
“HEAVY ELEMENT NUCLEOSYNTHESIS IN THE ERA OF MULTI-MESSENGER ASTRONOMY”
- LANL Astrophysics Seminar** — *Los Alamos National Lab, NM*
“STELLAR ACTINIDES AS TRACERS OF HEAVY-ELEMENT NUCLEOSYNTHESIS”
- TCAN Meeting 2021: BNS/BH-NS Merger Workshop** — *Rochester Institute of Technology, NY*
“OBSERVATIONAL SIGNATURES OF HEAVY-ELEMENT NUCLEOSYNTHESIS”
- Star Talks Seminar Series** — *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** — *Texas A&M University, TX*
“HEAVY ELEMENT NUCLEOSYNTHESIS IN THE ERA OF MULTI-MESSENGER ASTRONOMY”
- CCRG Lunch Talks** — *Rochester Institute of Technology, NY*
“THE ASTROPHYSICAL PRODUCTION OF THE HEAVIEST ELEMENTS”
- FLASH Seminar** — *University of California Santa Cruz, CA*
“THE ASTROPHYSICAL PRODUCTION OF THE HEAVIEST ELEMENTS”
- 2020 **Physics Colloquium** — *San Francisco State University, CA*
“THE ASTROPHYSICAL PRODUCTION OF THE HEAVIEST ELEMENTS”
- Physics Colloquium** — *Gonzaga University, WA*
“THE ASTROPHYSICAL PRODUCTION OF THE HEAVIEST ELEMENTS”
- N3AS Seminar** — *University of California Berkeley, CA*
“PROPERTIES OF r -PROCESS-PRODUCING NEUTRON STAR MERGERS: WHAT WE CAN LEARN FROM METAL-POOR STARS”
- Our Universe Revealed** — *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”

FIRST-AUTHOR PUBLICATIONS

REFEREED (8)

- 2022 **HD 222925: a New Opportunity to Explore the Astrophysical and Nuclear Conditions of *r*-process Sites**, **Holmbeck, E. M.**, Surman, R., Roederer, I. U., et al. 2022, arXiv:2210.10122 (ApJ, *under review*). [↗](#) [↗](#)
- Nucleosynthesis and observation of the heaviest elements**, **Holmbeck, E. M.**, Sprouse, T. M., Mumpower, M. R. 2022, Eur. Phys. J. A. (*in press*).
- A Nuclear Equation of State Inferred from Stellar *r*-process Abundances**, **Holmbeck, E. M.**, O’Shaughnessy, R., Delfavero, V., Belczynski, K. 2022, ApJ, 926, 196. [↗](#) [↗](#)
- 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. 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. [↗](#) [↗](#)

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**, 14th International Symposium on Nuclei in the Cosmos (NIC2016), 020612. [↗](#)

CO-AUTHORED PUBLICATIONS

REFEREED (20)

- 2022 **Observational Signatures of Transuranic Fission Fragments in Stars**, Roederer, I. U., Vassh, N., **Holmbeck, E. M.**, et al. 2022 (Science, *under review*). [↗](#)
- Constraining inputs to realistic kilonova simulations through comparison to observed *r*-process abundances**, Ristic, M., **Holmbeck, E. M.**, Wollager, R., et al. 2022, arXiv:2206.02273 (Phys. Rev. D, *under review*). [↗](#)
- Discovery of an Ultra Lithium-rich Metal-Poor Red Giant star**, Kowkabany, J., Ezzeddine, R., Charbonnel, C., et al. 2022, arXiv:2209.02184 (ApJ, *under review*). [↗](#)
- The *R*-Process Alliance: Chemo-Dynamically Tagged Groups II. An Extended Sample of Halo *r*-Process-Enhanced Stars**, Shank, D., Beers, T. C., Placco, V. M., et al. 2022, arXiv:2208.09712 (ApJ, *in press*). [↗](#)
- The *R*-Process Alliance: Abundance Universality among Some Elements at and between the First and Second *R*-Process Peaks**, Roederer, I. U., Cowan, J. J., Pignatari, M., et al. 2022, ApJ, 936, 84. [↗](#)
- The *R*-process Alliance: A Nearly Complete *R*-process Abundance Template Derived from Ultraviolet Spectroscopy of the *R*-process-enhanced Metal-poor Star HD 222925**, Roederer, I. U., Lawler, J. E., Den Hartog, E. A., et al. 2022, ApJS, 260, 27. [↗](#)

- Investigation of the $^{10}\text{B}(p, \alpha)^7\text{Be}$ reaction from 0.8 to 2.0 MeV**, Kolk, B. V., Macon, K. T., deBoer, R. J., et al. 2022, Phys. Rev. C., 105, 055802. [↗](#)
- 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., 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., 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., et al. 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., 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., et al., 2018, ApJ, 869, 14. [↗](#)
- Californium-254 and Kilonova Light Curves**, Zhu, Y., Wollaeger, R. T., Vassh, N., Sprouse, T. M., et al. 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., et al. 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., 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., et al. 2018, ApJL, 854, L20. [↗](#)
- Spectroscopic Validation of Low-metallicity Stars from RAVE**, Placco, V. M., Beers, T. C., Santucci, R. M., et al. 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. [↗](#)

WHITE PAPERS (2)

- 2022 **Horizons: Nuclear Astrophysics in the 2020s and Beyond**, Schatz, H., Becerril Reyes, A. D., Best, A., et al. 2022, arXiv:2205.07996. [↗](#)
- 2018 **FRIB and the GW170817 Kilonova**, Aprahamian, A., Surman, R., Frebel, A., et al. 2018, arXiv:1809.00703. [↗](#)