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Higher Education

Ph.D. Department of Physics and Astronomy, University of North Carolina at Chapel Hill, 1998

Thesis: Freezeout and Neutrinos in r -Process Nucleosynthesis

Advisor: Jonathan Engel

M.S. Department of Physics and Astronomy, Michigan State University, 1995

B.A. *Summa Cum Laude* in Physics, State University of New York College at Geneseo, 1993

Experience

Professor University of Notre Dame, 2018-

Associate Professor University of Notre Dame, 2014-2018

Professor Union College, 2011-2014

Visiting Associate Professor University of Notre Dame, 2011-2013

Associate Professor Union College, 2005-2011

Visiting Assistant Professor North Carolina State University, 2002-2003, 2008

Assistant Professor Union College, 2000-2005

Visiting Assistant Professor Union College, 1998-2000

Scholarships and Fellowships

Board of Governors Fellowship for Science and Technology, UNC-Chapel Hill, 1995-1998

College of Natural Science Recruitment Fellowship, Michigan State University, 1993-1994

Barry Goldwater National Scholarship, 1991-1993

Distinctions, Honors, and Awards

Fellow, American Physical Society, 2016

Stillman Prize for Excellence in Teaching, Union College campuswide teaching award, 2007

Physics Department Teaching Assistant Award, UNC-Chapel Hill, 1997

Outstanding Teaching Assistant, American Association of Physics Teachers, 1997

Refereed Publications

† *postdoctoral researcher*

★ *graduate student*

* *undergraduate*

[74] “Using excitation-energy dependent fission yields to identify key fissioning nuclei in r -process nucleosynthesis”, N. Vassh†, R. Vogt, R. Surman, J. Randrup, T.M. Sprouse★, M.R. Mumpower, P. Jaffke, D. Shaw*, E.M. Holmbeck★, Y. Zhu, G.C. McLaughlin, *submitted to Journal of Physics G*.

[73] “FRIB and the GW170817 kilonova”, A. Aprahamian, R. Surman, A. Frebel, G.C. McLaughlin, A. Arcones, A.B. Balantekin, J. Barnes, T.C. Beers, E.M. Holmbeck★, J. Yoon, M. Brodeur, T.M. Sprouse★, N. Vassh†, J.A. Cizewski, J.A. Clark, B. Côté, S.M. Couch, M. Eichler, J. Engel, R. Ezzeddine, G.M. Fuller, S.A. Giuliani, R. Grzywacz, S. Han, C.J. Horowitz, A. Kankainen, O. Korobkin, A.A. Kwiatkowski, J.E. Lawler, J. Lippuner, E. Litvinova, G.J. Mathews, M.R. Mumpower, S. Naimi, W. Nazarewicz, E. O’Connor, B.W. O’Shea, A. Perego, G. Perdikakis, D. Radice, S. Richers, L.F. Roberts, C. Robin, I.U. Roederer, D.M. Siegel, N. Schunck, A. Spyrou, Y. Zhu [arXiv:1809.00703] (2018).

[72] “Actinide Production in Neutron-Rich Ejecta of a Neutron Star Merger”, E.M. Holmbeck★, R. Surman, T.M. Sprouse★, M.R. Mumpower, N. Vassh†, T. Beers, T. Kawano, *submitted to the Astrophysical Journal* [arXiv:1807.06662].

[71] “ r -Process Nucleosynthesis: Connecting Rare-Isotope Beam Facilities with the Cosmos”, C.J. Horowitz, A. Arcones, B. Côté, I. Dillmann, W. Nazarewicz, I.U. Roederer, H. Schatz, A. Aprahamian, D. Atanasov, A. Bauswein, J. Bliss, M. Brodeur, J.A. Clark, A. Frebel, F. Foucart, C.J. Hansen, O. Just, A. Kankainen, G.C. McLaughlin, J.M. Kelly, S.N. Liddick, D.M. Lee, J. Lippuner, D. Martin, J. Mendoza-Temis, B.D. Metzger, M.R. Mumpower, G. Perdikakis, J. Pereira, B.W. O’Shea, R. Reifarth, A.M. Rogers, D.M. Siegel, A. Spyrou, R. Surman, X. Tang, T. Uesaka, M. Wang, *submitted to Journal of Physics G* [arXiv:1805.04637].

[70] “ β -delayed fission in r -process nucleosynthesis”, M.R. Mumpower, T. Kawano, T.M. Sprouse★, N. Vassh†, E.M. Holmbeck★, R. Surman, P. Möller, *submitted to the Astrophysical Journal* [arXiv:1802.04398].

[69] “Californium-254 and Kilonova Light Curves”, Y. Zhu, R.T. Wollaeger, N. Vassh†, R. Surman, T.M. Sprouse★, M.R. Mumpower, P. Möller, G.C. McLaughlin, O. Korobkin, T. Kawano, P.J. Jaffke, E.M. Holmbeck★, C.L. Fryer, W.P. Even, A.J. Couture, J. Barnes, *Astrophysical Journal Letters* **863**, L23 (2018) [arXiv:1806.09724].

[68] “Precision Mass Measurements of Neutron-Rich Neodymium and Samarium Isotopes and Their Role in Understanding Rare-Earth Peak Formation”, R. Orford, N. Vassh†, J.A. Clark, G.C. McLaughlin, M.R. Mumpower, G. Savard, R. Surman, A. Aprahamian, F. Buchinger, M.T. Burkey, D.A. Gorelov, T.Y. Hirsh, J.W. Klimes, G.E. Morgan, A. Nystrom, K.S. Sharma, *Physical Review Letters* **120**, 262702 (2018).

[67] “Precision Mass Measurements on Neutron-Rich Rare-Earth Isotopes at JYFLTRAP: Reduced Neutron Pairing and Implications for r -Process Calculations”, M. Vilen, J.M. Kelly, A. Kankainen, M. Brodeur, A. Aprahamian, L. Canete, T. Eronen, A. Jokinen, T. Kuta, I.D. Moore, M.R. Mumpower, D.A. Nesterenko, H. Penttilä, I. Pohjalainen, W.S. Porter, S. Rinta-Antila, R. Surman, A. Voss, J. Äystö, *Physical Review Letters* **120**, 262701 (2018) [arXiv:1801.08940].

[66] “Masses and lifetimes for r -process nucleosynthesis: FRIB outlook”, R. Surman, M.R. Mumpower, International Symposium on Capture Gamma-Ray Spectroscopy and Related Topics (CGS16), Shanghai, China, edited by Yang Sun, *EPJ Web of Conferences* **178**, 04002 (2018).

- [65] “The Origin of r -process Elements in the Milky Way”, B. Côté, C.L. Fryer, K. Belczynski, O. Korobkin, M. Chruślińska, N. Vassh[†], M.R. Mumpower, J. Lippuner, T.M. Sprouse*, R. Surman, R. Wollaeger, *Astrophysical Journal* **855**, 99 (2018) [arXiv:1710.05875].
- [64] “The BRIKEN Project: Extensive Measurements of β -delayed Neutron Emitters for the Astrophysical r Process”, J.L. Tain, J. Agramunt, D.S. Ahn, A. Algora, J.M. Allmond, H. Baba, S. Bae, N.T. Brewer, R. Caballero Folch, F. Calvino, P.J. Coleman-Smith, G. Cortes, T. Davinson, I. Dillmann, C. Domingo-Pardo, A. Estrade, N. Fukuda, S. Go, C. Griffin, R. Grzywacz, J. Ha, O. Hall, L. Harkness-Brennan, T. Isobe, D. Kahl, M. Karny, G.G. Kiss, M. Kogimtzis, A. Korgul, S. Kubono, M. Labiche, I. Lazarus, J. Lee, J. Liu, G. Lorusso, K. Matsui, K. Miernik, F. Montes, B. Moon, A.I. Morales, N. Nepal, S. Nishimura, R.D. Page, Z. Podolyak, V.F.E. Pucknell, B.C. Rasco, P.H. Regan, A. Riego, B. Rubio, K.P. Rykaczewski, Y. Saito, H. Sakurai, Y. Shimizu, J. Simpson, P.A. Söderström, D.W. Stracener, T. Sumikama, R. Surman, H. Suzuki, M. Takechi, H. Takeda, A. Tarifeno-Saldivia, S.L. Thomas, A. Tolosa-Delgado, V.H. Phong, P. Woods, *Acta Physica Polonica B* **49** 417 (2018).
- [63] “RAVE J203843.2-002333: The first highly r -process-enhanced star identified in the RAVE survey”, V. Placco, E. Holmbeck*, A. Frebel, T. Beers, R. Surman, A. Ji, R. Ezzeddine, S. Points, C. Kaleida, T. Hansen, C. Sakari, A. Casey, *Astrophysical Journal* **844**, 18 (2017) [arXiv:1706.02934].
- [62] “Reverse engineering nuclear properties from rare earth abundances in the r process”, M. Mumpower, G.C. McLaughlin, R. Surman, and A.W. Steiner, *Journal of Physics G* **44**, 034003 (2017) [arXiv:1609.09858].
- [61] “Neutron-capture rates for explosive nucleosynthesis: the case of $^{68}\text{Ni}(n, \gamma)^{69}\text{Ni}$ ” A. Spyrou, A.C. Larsen, S.N. Liddick, F. Naqvi, B.P. Crider, A.C. Dombos, M. Guttormsen, D.L. Bleuel, A. Couture, L. Crespo Campo, R. Lewis, S. Mosby, M. Mumpower, G. Perdikakis, C.J. Prokop, S.J. Quinn, T. Renstrom, S. Siem, R. Surman, *Journal of Physics G* **44**, 044002 (2017).
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- [59] “Beta decay of deformed r -process nuclei near $A = 80$ and $A = 160$, including odd- A and odd-odd nuclei, with the Skyrme finite-amplitude method”, T. Shafer, J. Engel, C. Fröhlich, G.C. McLaughlin, M. Mumpower, R. Surman, *Physical Review C* **94** 055802 (2016) [arXiv:1606.05909].
- [58] “Black hole spin influence on accretion disk neutrino detection”, O.L. Caballero, T. Zielinski, G.C. McLaughlin, R. Surman, *Physical Review D* **93**, 123015 (2016) [arXiv:1510.06011].
- [57] “Uncorrelated Nuclear Mass Uncertainties and r -process Abundance Predictions”, R. Surman, M.R. Mumpower, A. Aprahamian, *Acta Physica Polonica B* **47**, 673 (2016).
- [56] “Experimental Neutron Capture Rate Constraint Far from Stability”, S.N. Liddick, A. Spyrou, B.P. Crider, F. Naqvi, A.C. Larsen, M. Guttormsen, M. Mumpower, R. Surman, G. Perdikakis, D.L. Bleuel, A. Couture, L. Crespo Campo, A.C. Dombos, R. Lewis, S. Mosby, S. Nikas, C.J. Prokop, T. Renstrom, B. Rubio, S. Siem, S.J. Quinn, *Physical Review Letters* **116**, 242502 (2016).
- [55] “The impact of individual nuclear properties on r -process nucleosynthesis”, M. Mumpower[†], R. Surman, G.C. McLaughlin, and A. Aprahamian, *Progress in Particle and Nuclear Physics* **86**, 86-126 (2016) [arXiv:1508.07352].
- [54] “The impact of individual nuclear masses on r -process abundances”, M. Mumpower[†], R. Surman, D.-L. Fang, M. Beard, P. Möller, T. Kawano, and A. Aprahamian, *Physical Review C* **92**, 035807 (2015) [arXiv:1505.07789].

- [53] “Symmetric and Standard Matter-Neutrino Resonances Above Merging Compact Objects”, A. Malkus, G.C. McLaughlin, and R. Surman, *Physical Review D* **93**, 045021 (2016) [arXiv:1507.00946].
- [52] “Variances in r-process predictions from uncertain nuclear rates”, M. Mumpower[†], R. Surman, and A. Aprahamian, *Journal of Physics: Conference Series* **599**, 012031 (2015).
- [51] “The impact of uncertain nuclear masses near closed shells on the r -process abundance pattern”, M. Mumpower[†], R. Surman, D.-L. Fang, M. Beard, A. Aprahamian, *J. Phys. G Focus Section: Enhancing the interaction between nuclear experiment and theory through information and statistics* **42**, 034027 (2015).
- [50] “The Sensitivity of r -Process Nucleosynthesis to Individual β -Delayed Neutron Emission Probabilities”, R. Surman, M. Mumpower[†], and A. Aprahamian, *JPS Conference Proceedings: Proceedings of the Conference on Advances in Radioactive Isotope Science (ARIS2014)*, 010010 (2015).
- [49] “Neutrinos and the synthesis of heavy elements: the role of gravity”, O.L. Caballero, R. Surman, and G.C. McLaughlin, *EPJ Web of Conferences: Proceedings of the Fifteenth International Symposium on Capture Gamma-Ray Spectroscopy and Related Topics (CGS15)* **93**, 03002 (2015).
- [48] “The impact of global nuclear mass model uncertainties on r -process abundance predictions”, M. Mumpower[†], R. Surman, and A. Aprahamian, *EPJ Web of Conferences: Proceedings of the Fifteenth International Symposium on Capture Gamma-Ray Spectroscopy and Related Topics (CGS15)* **93**, 03003 (2015).
- [47] “Sensitivity studies for the main r process: nuclear masses”, A. Aprahamian, I. Bentley, M. Mumpower[†], R. Surman, *AIP Advances* **4**, 041101 (2014).
- [46] “Sensitivity studies for the main r process: β -decay rates”, M. Mumpower[†], J. Cass*, G. Passucci*, R. Surman, A. Aprahamian, *AIP Advances* **4**, 041009 (2014).
- [45] “Sensitivity studies for the weak r process: neutron capture rates”, R. Surman, M. Mumpower[†], R. Sinclair, K.L. Jones, W.R. Hix, G.C. McLaughlin, *AIP Advances* **4**, 041008 (2014).
- [44] “Production of ^{56}Ni in black hole-neutron star merger accretion disk outflows”, R. Surman, O.L. Caballero, G.C. McLaughlin, O. Just, H.-Th. Janka, *J. Phys. G Focus Section: Nucleosynthesis and the neutrino* **41**, 044006 (2014).
- [43] “The Influence of Neutrinos on the Nucleosynthesis of Accretion Disk Outflows”, O.L. Caballero, A.C. Malkus, G.C. McLaughlin, R.A. Surman, *J. Phys. G Focus Section: Nucleosynthesis and the neutrino* **41**, 044004 (2014).
- [42] “Sensitivity studies for r -process nucleosynthesis in three astrophysical scenarios”, R. Surman, M. Mumpower[†], J. Cass*, I. Bentley, A. Aprahamian, G.C. McLaughlin, *Proceedings of the International Nuclear Physics Conference*, EPJ Web of Conferences **66**, 07024 (2014) [arXiv:1309.0059].
- [41] “Beta-decay study of neutron-rich bromine and krypton isotopes”, K. Miernik, K.P. Rykaczewski, R. Grzywacz, C.J. Gross, D.W. Stracener, J.C. Batchelder, N.T. Brewer, L. Cartegni, A. Fijalkowska, J.H. Hamilton, J.K. Hwang, S.V. Ilyushkin, C. Jost, M. Karny, A. Korgul, W. Królas, S.H. Liu, M. Madurga, C. Mazzocchi, A.J. Mendez II, D. Miller, S.W. Padgett, S.V. Paulauskas, A.V. Ramayya, R. Surman, J.A. Winger, M. Wolińska-Cichocka, E.F. Zganjar, *Physical Review C* **88**, 014309 (2013).
- [40] “The sensitivity of r -process nucleosynthesis to the properties of neutron-rich nuclei”, R. Surman, M.R. Mumpower[†], J. Cass*, A. Aprahamian, *Proceedings of the Fifth International Conference on Fission and Properties of Neutron-Rich Nuclei*, editors J.H. Hamilton and A.V. Ramayya, World Scientific, p. 538-545 (2014) [arXiv:1309.0058].

- [39] “Beta decay and the r process”, J. Cass*, G. Passucci*, R. Surman, A. Aprahamian, *Proceedings of Science*, **NIC-XII** 154 (2012).
- [38] “The sensitivity of the r -process to nuclear masses”, S. Brett, I. Bentley, N. Paul, R. Surman, A. Aprahamian, *European Physical Journal A* **48**, 184 (2012) [arXiv:1211.7310].
- [37] “Neutrino oscillations above black hole accretion disks: Disks with electron-flavor emission”, A. Malkus, J.P. Kneller, G.C. McLaughlin, R. Surman, *Physical Review D* **86**, 085015 (2012).
- [36] “Influence of neutron capture rates in the rare earth region on the r -process abundance pattern”, M. Mumpower, G.C. McLaughlin, R. Surman, *Physical Review C* **86**, 035803 (2012) [arXiv:1204.0437].
- [35] “The Rare Earth Peak: An Overlooked r -Process Diagnostic”, M. Mumpower, G.C. McLaughlin, R. Surman, *Astrophysical Journal* **752**, 117 (2012) [arXiv:1202.1758].
- [34] “New half-lives of neutron-rich Zn and Ga isotopes measured with electromagnetic separation”, M. Madurga, R. Surman, I.N. Borzov, R. Grzywacz, K.P. Rykaczewski, C.J. Gross, D. Miller, D.W. Stracener, J.C. Batchelder, N.T. Brewer, L. Cartegni, J.H. Hamilton, J.K. Hwang, S.H. Liu, S.V. Ilyushkin, C. Jost, M. Karny, A. Korgul, W. Królas, A. Kuźniak, C. Mazzocchi, A.J. Mendez II, K. Miernik, S.W. Padgett, S.V. Paulauskas, A.V. Ramayya, J.A. Winger, M. Wolińska-Cichocka, E.F. Zganjar, *Physical Review Letters* **109**, 112501 (2012).
- [33] “Formation of the Rare Earth Peak: Gaining Insight into Late-time r -Process Dynamics”, M. Mumpower, G.C. McLaughlin, R. Surman, *Physical Review C* **85**, 045801 (2012) [arXiv:1109.3613].
- [32] “Neutrino Spectra from Accretion Disks: Neutrino General Relativistic Effects and the Consequences for Nucleosynthesis”, O.L. Caballero, G.C. McLaughlin, R. Surman, *Astrophysical Journal* **745**, 170 (2012) [arXiv:1105.6371].
- [31] “Beta-decay of nuclei around ^{90}Se : Search for signatures of an $N = 56$ sub-shell closure relevant to the r process”, M. Quinn, A. Aprahamian, J. Pereira, R. Surman, O. Arndt, T. Baumann, A. Becerril, T. Elliot, A. Estrade, D. Galaviz, T. Ginter, M. Hausmann, S. Hennrich, R. Kessler, K.-L. Kratz, G. Lorusso, P.F. Mantica, M. Matos, F. Montes, B. Pfeiffer, M. Portillo, H. Schatz, F. Schertz, L. Schnorrenberger, E. Smith, A. Stolz, W.B. Walters, A. Woehr, *Physical Review C* **85**, 035807 (2012).
- [30] “Neutron capture rates and r -process nucleosynthesis”, R. Surman, M. Mumpower, G.C. McLaughlin, R. Sinclair, W.R. Hix, K.L. Jones, *Proceedings of the 14th International Symposium on Capture Gamma-Ray Spectroscopy and Related Topics*, World Scientific (2011) [arXiv:1309.0057].
- [29] “Nucleosynthesis of Nickel-56 from Gamma-Ray Burst Accretion Disks”, R. Surman, G.C. McLaughlin, N. Sabbatino*, *Astrophysical Journal* **743**, 155 (2011) [arXiv:1112.2673].
- [28] “The influence of collective neutrino oscillations on a supernova r process”, H. Duan, A. Friedland, G.C. McLaughlin, R. Surman, *Journal of Physics G* **38**, 035201 (2011) [arXiv:1012.0532].
- [27] “Neutron capture in the r process”, R. Surman, G.C. McLaughlin, M. Mumpower, W.R. Hix, K. Jones, *Proceedings of Science*, **NIC-XI** 284 (2010).
- [26] “Neutron Capture Rates and the Rare Earth Peak”, M. Mumpower, G.C. McLaughlin, R. Surman, *Proceedings of Science*, **NIC-XI** 273 (2010).
- [25] “Nucleosynthesis from Black Hole Accretion Disks”, G.C. McLaughlin, L. Caballero, R. Surman, *Proceedings of Science*, **NIC-XI** 31 (2010).
- [24] “Gamma-ray burst black hole accretion disks as a site for the νp process”, L.-T. Kizivat, G. Martinez-Pinedo, K. Langanke, R. Surman, G.C. McLaughlin, *Physical Review C* **81**, 025802 (2010).

- [23] “Detecting neutrinos from black hole-neutron star mergers”, O.L. Caballero, G.C. McLaughlin, R. Surman, *Physical Review D* **80**, 123004 (2009) [arXiv:0910.1385].
- [22] “Neutron Capture Rates near $A \sim 130$ which Effect a Global Change to the r -process Abundance Distribution”, R. Surman, J. Beun, G.C. McLaughlin, W.R. Hix, *Physical Review C* **79**, 045809 (2009) [arXiv:0806.3753].
- [21] “Neutron capture on ^{130}Sn during r -process freeze-out”, J. Beun, J.C. Blackmon, W.R. Hix, G.C. McLaughlin, M.S. Smith, R. Surman, *Journal of Physics G* **36**, 025201 (2009) [arXiv:0806.3895].
- [20] “ r -Process Nucleosynthesis in Black Hole - Neutron Star Mergers”, R. Surman, G.C. McLaughlin, M. Ruffert, H.-Th. Janka, W.R. Hix, *Proceedings of Science*, **NIC-X** 149 (2008).
- [19] “ r -Process Nucleosynthesis in Hot Accretion Disk Flows from Black Hole-Neutron Star Mergers”, R. Surman, G.C. McLaughlin, M. Ruffert, H.-Th. Janka, W.R. Hix, *Astrophysical Journal* **679**, L117 (2008) [arXiv:0803.1785].
- [18] “Fission Cycling in a Supernova r -process”, J. Beun, G.C. McLaughlin, R. Surman, W.R. Hix, *Physical Review C* **77**, 035804 (2008).
- [17] “Nucleosynthesis in Outflows from Kerr Black Hole Accretion Disks”, R. Surman, G.C. McLaughlin, N. Sabbatino*, W.R. Hix, *First Stars III*, edited by B.W. O’Shea, A. Heger, and T. Abel (2008).
- [16] “The Role of Neutrinos in r -Process Nucleosynthesis in Supernovae and Gamma-ray Bursts”, R. Surman, J. Beun, G.C. McLaughlin, W.R. Hix, S. Kane*, *Journal of Physics G* **35**, 014059 (2007).
- [15] “Supernova Neutrinos: The Accretion Disk Scenario”, G.C. McLaughlin, R. Surman, *Physical Review D* **75**, 023005 (2007) [arXiv:astro-ph/0605281].
- [14] “Element production in the Outflow from Black Hole Accretion Disks”, R. Surman, G.C. McLaughlin, W.R. Hix, *Proceedings of Science*, **NIC-IX** 035 (2006).
- [13] “Neutrinos, Fission Cycling, and the r process”, J. Beun, G.C. McLaughlin, R. Surman, W.R. Hix, *Proceedings of Science*, **NIC-IX** 140 (2006).
- [12] “Nucleosynthesis in the Outflow from Gamma Ray Burst Accretion Disks”, R. Surman, G.C. McLaughlin, W.R. Hix, *Astrophysical Journal* **643**, 1057 (2006) [arXiv:astro-ph/0509365].
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- [10] “Neutrino Scattering, Absorption, and Annihilation above the accretion disks of Gamma Ray Bursts”, J.P. Kneller, G.C. McLaughlin, R. Surman *Journal of Physics G* **32**, 443 (2006).
- [9] “Prospects for obtaining an r process from Gamma Ray Burst Disk Winds”, G.C. McLaughlin, R. Surman, *Nucl. Phys. A* **758**, 189 (2005) [arXiv:astro-ph/0407555].
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- [5] “Changes in r -process abundances in late times”, R. Surman, J. Engel, *Physical Review C* **64**, 035801 (2001) [arXiv:nucl-th/0103049].
- [4] “Beta-decay from closed-neutron-shell r -process waiting point nuclei”, J. Engel, M. Bender, J. Dobaczewski, W. Nazarewicz, R. Surman, *Physical Review C* **60**, 014302 (1999) [arXiv:nucl-th/9902059].
- [3] “Low energy resonance strengths for proton capture of Mg and Al nuclei”, D.C. Powell, C. Iliadis, A.E. Champagne, S. Hale, V. Hansper, R.A. Surman, K.D. Veal, *Nucl. Phys. A* **644**, 263 (1998).
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- [1] “Source of the rare-earth element peak in r -process nucleosynthesis”, R. Surman, J. Engel, J. Bennett, B.S. Meyer, *Phys. Rev. Lett.* **79**, 1809 (1997) [arXiv:astro-ph/9701007].

Invited Lectures and Addresses

- [105] “The microphysics of the GW170817 kilonova”, colloquium, Department of Physics, University of Massachusetts-Lowell, Lowell, MA, September 2018
- [104] “Nuclear physics issues and the r -process”, invited talk, To 2020 and Beyond: Radionuclide Astronomy, Los Alamos National Laboratory, Los Alamos, NM, August 2018
- [103] “The microphysics of the GW170817 kilonova”, Nuclear and Chemical Sciences colloquium, Lawrence Livermore National Laboratory, Livermore, CA, June 2018
- [102] “Nuclear astrophysics”, invited lectures, Exotic Beam Summer School, Lawrence Berkeley National Laboratory, Berkeley, CA, June 2018
- [101] “Understanding r -process nucleosynthesis through nuclear data”, invited talk, American Astronomical Society Meeting 232, Denver, CO, June 2018
- [100] “Nuclear physics and the r process in the multi messenger era”, invited talk, JINA-CEE Frontiers, University of Notre Dame, Notre Dame, IN, May 2018
- [99] “The microphysics of the GW170817 kilonova”, colloquium, Department of Physics, University of Wisconsin, Madison, WI, May 2018
- [98] “The microphysics of the GW170817 kilonova”, colloquium, Department of Physics, Louisiana State University, Baton Rouge, LA, April 2018
- [97] “The astrophysical origins of the heaviest elements”, colloquium, Department of Physics and Astronomy, Michigan State University, East Lansing, MI, April 2018
- [96] “Nuclear physics and the astrophysical production of the heaviest elements”, Physics/Theoretical Division colloquium, Los Alamos National Laboratory, Los Alamos, NM, March 2018
- [95] “Forging the heaviest elements”, Physics Division colloquium, Argonne National Laboratory, Lemont, IL, February 2018
- [94] “ β -decay data in r -process analysis”, invited talk, FRIB Decay Station Workshop, Michigan State University, East Lansing, MI, January 2018
- [93] “ r -process nucleosynthesis and radioactivity in merger ejecta”, invited talk, KITP Program “Understanding GW170817: The First Double Neutron Star Merger”, Kavli Institute for Theoretical Physics, University of California, Santa Barbara, CA, December 2017
- [92] “The astrophysical origins of the heaviest elements”, Nuclear and Particle Physics colloquium, Massachusetts Institute of Technology, Boston, MA, October 2017
- [91] “Quantifying nuclear physics uncertainties in r -process abundance patterns”, invited talk, 16th International Symposium on Capture Gamma-Ray Spectroscopy and Related Topics (CGS16), Shanghai, China, September 2017
- [90] “Astrophysics and FRIB”, invited review talk, FRIB Day 1 Science at the 2017 Low Energy Community Meeting, Argonne National Laboratory, August 2017
- [89] “Nuclear physics inputs for nucleosynthesis”, Institute of Nuclear Theory Program INT-17-2b Electromagnetic Signatures of r -Process Nucleosynthesis in Neutron Star Binary Mergers, University of Washington, July 2017
- [88] “Nuclear masses and the site of r -process nucleosynthesis”, invited talk, Nuclear Physics in Astrophysics VIII, Catania, Sicily, June 2017
- [87] “Astrophysical Alchemy”, colloquium, Ball State University, Muncie, IN, April 2017
- [86] “The mysterious origins of the heaviest elements”, colloquium, Washington University, St. Louis, MO, March 2017

- [85] “Neutron capture rates and r -process nucleosynthesis”, Institute of Nuclear Theory Program INT-17-1a: Toward Predictive Theories of Nuclear Reactions Across the Isotopic Chart, University of Washington, March 2017
- [84] “Neutrinos and heavy element synthesis”, invited talk, Precision Investigations of the Neutrino Sector, SLAC, Menlo Park, California, March 2017
- [83] “Nuclear masses and the site of r -process nucleosynthesis”, invited talk, Hirscheegg 2017 Neutron star mergers: from gravitational waves to nucleosynthesis, Hirscheegg, Austria, January 2017
- [82] “Nucleosynthesis and neutrino physics in compact object mergers”, invited talk, April Meeting of the American Physical Society, Washington, D.C., January 2017
- [81] “Neutrinos and heavy element synthesis”, invited talk, 8th Symposium on Large TPCs for Low-Energy Rare Event Detection, Paris Diderot University, Paris, France, December 2016
- [80] “The origin of the heaviest elements: an interdisciplinary approach”, invited talk, Fall Meeting of the American Physical Society Division of Nuclear Physics, Vancouver, Canada, October 2016
- [79] “The puzzle of the r -process astrophysical site: a nuclear physics solution?”, invited plenary talk, International Nuclear Physics Conference 2016, Adelaide, Australia, September 2016
- [78] “Astrophysical alchemy: the mysterious origins of the heavy elements”, invited Clare Boothe Luce lecture, University of Dallas, September 2016
- [77] “Connecting nuclear masses to the mysterious origins of the heavy elements”, Institute of Nuclear Theory Program INT-16-2a: Bayesian Methods in Nuclear Physics, University of Washington, July 2016
- [76] “Systematic and Statistical Uncertainties in Simulated r -Process Abundances due to Uncertain Nuclear Masses”, contributed plenary talk, Nuclei in the Cosmos XIV, Niigata, Japan, June 2016
- [75] “Forging the heaviest elements”, astrophysics seminar, Ohio State University, May 2016
- [74] “Nucleosynthesis: FRIB and the origin of the heavy elements”, invited talk, FRIB Theory Alliance Inaugural Meeting, Michigan State University, March 2016
- [73] “The astrophysical r -process: neutrino/nuclear aspects and observational constraints”, astrophysics seminar, University of Notre Dame, February 2016
- [72] “Forging the heaviest elements”, seminar, University of Wisconsin-Madison, February 2016
- [71] “Nuclear data and the r -process abundance pattern”, JINA-CEE Research Seminar, Michigan State University, January 2016
- [70] “Nuclear masses and the r -process abundance pattern”, invited talk, Information and statistics in nuclear experiment and theory (ISNET-3), ECT*, Trento, Italy, November 2015
- [69] “The mysterious origins of the heavy elements”, astrophysics seminar, St. Marys University, Halifax, NS, October 2015
- [68] “ r -Process abundance pattern variations due to nuclear physics uncertainties”, invited talk, Mazurian Lakes Conference on Physics, Piaski, Poland, September 2015
- [67] “Astrophysical alchemy”, CETUP* outreach talk, Black Hills State University, July 2015
- [66] “Neutrino interactions and heavy element synthesis”, Institute of Nuclear Theory Program INT-15-2a: Neutrino Astrophysics and Fundamental Properties, University of Washington, June 2015
- [65] “Nuclear Reaction Rate Needs for Heavy Element Nucleosynthesis”, Institute of Nuclear Theory Program INT-15-58W: Reactions and Structure of Exotic Nuclei, University of Washington, March 2015

- [64] “FRIB and the Origin of the Heavy Elements”, invited talk, 2015 Conference of The National Society of Black Physicists, Baltimore, Maryland, February 2015
- [63] “Nuclear physics and the origin of the heaviest elements”, Physics Division seminar, Argonne National Laboratory, October 2014
- [62] “Astrophysical alchemy: creating the heaviest elements in the galaxy’s biggest explosions”, invited seminar, Conference Experience for Undergraduates, 4th Joint Meeting of the Divisions of Nuclear Physics of the APS and JPS, Waikoloa, Hawaii, October 2014
- [61] “*r*-Process Sensitivities to Neutrino and Nuclear Physics”, invited talk, ECT* Workshop on Nuclear Physics and Astrophysics of Neutron-Star Mergers and Supernovae, and the Origin of *r*-Process Elements, September 2014
- [60] “Astrophysical alchemy: heavy element synthesis in supernovae and compact object mergers”, colloquium, Central Michigan University, Mount Pleasant, Michigan, September 2014
- [59] “Heavy element synthesis in black hole accretion disk outflows”, invited talk, Nuclei in the Cosmos, Debrecen, Hungary, July 2014
- [58] “Sensitivity studies for *r*-process nucleosynthesis”, invited talk, Advances in Radioactive Isotope Science (ARIS) 2014, Tokyo, Japan, June 2014
- [57] “Astrophysical alchemy: creating the heaviest elements in the galaxy’s biggest explosions”, outreach talk, Albany Area Amateur Astronomers, Schenectady, New York, May 2014
- [56] “The sensitivity of *r*-process nucleosynthesis to individual nuclear properties”, invited talk, American Physical Society April Meeting, Savannah, Georgia, April 2014
- [55] “*r*-Process Nucleosynthesis in GRBs”, invited talk, Workshop on Supernovae and Gamma-Ray Bursts, YITP, Kyoto, Japan, November 2013
- [54] “Neutrinos and black hole accretion disk outflow nucleosynthesis”, invited talk, Southeastern Section of the American Physical Society annual meeting, Bowling Green, Kentucky, November 2013
- [53] “Neutrinos and heavy element synthesis”, invited talk, Implications of Neutrino Flavor Oscillations (INFO 13) Workshop, Santa Fe, New Mexico, August 2013
- [52] “Neutrinos and heavy element synthesis”, invited talk, CETUP* program on Neutrino Physics and Astrophysics, Lead, South Dakota, July 2013
- [51] “Nuclear data needs for *r*-process nucleosynthesis”, invited talk, Gordon Research Conference in Nuclear Chemistry, Colby-Sawyer College, June 2013
- [50] “Nuclear data and rapid neutron capture nucleosynthesis”, invited parallel session talk, International Nuclear Physics Conference 2013, Florence, Italy, June 2013
- [49] “Nuclear data and the astrophysical site of the *r* process”, invited talk, 2013 Canadian Association of Physicists Congress, Montreal, Quebec, May 2013
- [48] “Neutrinos and nucleosynthesis in supernovae and collapsars”, invited talk, Fifty-one Ergs Supernova Workshop, North Carolina State University, May 2013
- [47] “The sensitivity of *r*-process nucleosynthesis to beta-delayed neutron emission probabilities”, invited talk, North American Workshop on Beta-delayed Neutron Emission, Oak Ridge National Laboratory, May 2013
- [46] “Nuclear data and the astrophysical site of the *r* process”, invited talk, International Workshop XLI on Gross Properties of Nuclei and Nuclear Excitations, Hirschegg, Austria, January 2013
- [45] “The sensitivity of *r*-process nucleosynthesis to the properties of neutron-rich nuclei”, invited talk, 5th International Conference on Fission and Properties of Neutron-rich Nuclei, Sanibel Island, Florida, November 2012

- [44] “Open questions in r -process and νp -process nucleosynthesis”, invited review talk, Nuclear Astrophysics Town Meeting, Detroit, MI, October 2012
- [43] “Neutrino and nuclear physics in the astrophysical synthesis of the heaviest elements”, colloquium, Department of Physics, University of Notre Dame, August 2012
- [42] “The Rare Earth Peak: an overlooked r -process diagnostic”, Institute of Nuclear Theory Program 12-2a Core Collapse Supernovae: Models and Observable Signals, University of Washington, July 2012
- [41] “Nuclear data for r -process nucleosynthesis”, nuclear physics seminar, Oak Ridge National Laboratory, April 2012
- [40] “Nuclear data for r -process models”, Joint Institute for Nuclear Astrophysics webinar, University of Notre Dame, April 2012
- [39] “Nuclear data for r -process nucleosynthesis”, nuclear physics seminar, National Superconducting Cyclotron Laboratory, Michigan State University, November 2011
- [38] “Neutrinos and Nucleosynthesis”, invited talk, Frontiers in Neutrino Physics, AstroParticule et Cosmologie, Paris, France, October 2011
- [37] “Heavy element synthesis in supernovae and gamma-ray bursts”, colloquium, Department of Physics, Florida State University, September 2011
- [36] “The nuclear physics of r -process nucleosynthesis”, nuclear physics seminar, Department of Physics, Florida State University, September 2011
- [35] “Sterile Neutrinos and Supernova Nucleosynthesis”, invited talk, Sterile Neutrinos at the Crossroads 2011, Center for Neutrino Physics, Virginia Tech, September 2011
- [34] “Neutron capture rates and r -process nucleosynthesis”, invited talk, CGS14: 14th International Symposium on Capture Gamma-Ray Spectroscopy and Related Topics, Guelph, Canada, August 2011
- [33] “Beta decay rates and r -process nucleosynthesis”, invited contribution, Joint ATLAS-HRIBF-NSCL-FRIB Users Meeting, National Superconducting Cyclotron Laboratory, Michigan State University, August 2011
- [32] “Neutrino oscillations and supernova nucleosynthesis”, invited talk, HANSE 2011: Hamburg Neutrinos from Supernova Explosions, DESY, Germany, July 2011
- [31] “Nuclear data and r -process nucleosynthesis”, invited talk, Workshop on “Decay Spectroscopy at CARIBU: Advanced Fuel Cycle Applications, Nuclear Structure, and Astrophysics”, Argonne National Laboratory, April 2011
- [30] “Heavy element synthesis in supernovae and gamma-ray bursts”, colloquium, Department of Astronomy, University of Illinois, March 2011
- [29] “Neutrinos and the r -process in hot astrophysical environments”, nuclear physics seminar, University of Notre Dame, March 2011
- [28] “Heavy element synthesis in supernovae and gamma-ray bursts”, astrophysics colloquium, Rochester Institute of Technology, March 2011
- [27] “Topics in Nuclear Astrophysics”, invited lecturer for five lectures at the Norwegian Centre for International Cooperation in Higher Education/Michigan State University/University of Oslo Nuclear Physics Winter School, Michigan State University, January 3-7, 2011
- [26] “Astrophysical Alchemy: Creating the heaviest elements within the galaxy’s biggest explosions”, colloquium, Hamilton College, January 2011

- [25] “Modeling r -Process Nucleosynthesis in Hot Astrophysical Flows”, invited talk, American Physical Society Division of Nuclear Physics Fall Meeting, Santa Fe, NM, November 2010
- [24] “Astrophysical Alchemy: Creating the heaviest elements within the galaxy’s biggest explosions”, astrophysics seminar, Rensselaer Polytechnic Institute, and colloquium, Union College, September 2010
- [23] “Neutrinos and Nucleosynthesis”, invited talk, NOW 2010 Neutrino Oscillations Workshop, Conca Specchiulla, Italy, September 2010
- [22] “Neutron capture and the r process”, invited talk, EMMI Workshop *Neutron Matter in Astrophysics: From Neutron Stars to the r Process*, GSI, Darmstadt, Germany, July 2010
- [21] “Nucleosynthesis in extreme astrophysical environments”, nuclear physics seminar, Rutgers University, April 2010
- [20] “Nuclear data and r -process nucleosynthesis”, nuclear physics seminar, University of Tennessee, Knoxville, March 2010
- [19] “Nuclear data and r -process nucleosynthesis”, invited talk, COMEX3, Third International Conference on “Collective Motion in Nuclei under Extreme Conditions”, Mackinac Island, MI, June 2009
- [18] “The Astrophysics and Nuclear Physics of r -Process Nucleosynthesis”, seminar, TRIUMF National Laboratory, Vancouver, Canada, October 2008
- [17] “Neutron Capture and the Site of the r Process”, seminar, National Superconducting Cyclotron Laboratory, Michigan State University, September 2008
- [16] “Aspects of the Astrophysics and Nuclear Physics of r -Process Nucleosynthesis”, invited talk, Workshop on Statistical Nuclear Physics and Applications in Astrophysics and Technology, Ohio University, Athens, OH, July 2008
- [15] “Neutrinos from Black Hole Accretion Disks”, astrophysics seminar, North Carolina State University, May 2008
- [14] “Neutrinos from Black Hole Accretion Disks”, high energy physics seminar, Duke University, April 2008
- [13] “The Nuclear Physics of Black Hole Accretion Disks and Outflows”, invited talk, ECT* Workshop on Exotic Modes of Excitation: from Nuclear Structure to Astrophysics, Trento, Italy, October 2007
- [12] “Neutrinos from Black Hole Accretion Disks”, invited talk, Santa Fe Summer Workshop on Implications of Neutrino Flavor Oscillations, Santa Fe, NM, July 2007
- [11] “The Ashes of Gamma-Ray Bursts”, colloquium, Department of Physics and Astronomy, Bucknell University, April 2007
- [10] “The Role of Neutrinos in Supernovae and Gamma-Ray Bursts”, invited talk, Nuclear Physics in Astrophysics III, Dresden, Germany, March 2007
- [9] “Gamma-Ray Bursts: Neutrinos and Nucleosynthesis”, nuclear physics seminar, Institute of Nuclear and Particle Physics, Ohio University, October 2006
- [8] “Neutrinos and Nucleosynthesis in Gamma-Ray Bursts”, contributed plenary talk, Nuclei in the Cosmos IX, Geneva, Switzerland, June 2006
- [7] “Nucleosynthesis from Black Hole Accretion Disks”, seminar, Kavli Institute of Theoretical Physics, *The Supernova Gamma-Ray Burst Connection*, University of California - Santa Barbara, March 2006
- [6] “The Ashes of Gamma-Ray Bursts”, invited Conference Experience for Undergraduates Seminar, American Physical Society Division of Nuclear Physics Fall Meeting, Maui, Hawaii, September 2005

- [5] “Neutrinos and Nucleosynthesis in Supernovae and Gamma-Ray Bursts”, Institute of Nuclear Theory Program INT-05-2a - Underground Science, University of Washington, July 2005
- [4] “Nucleosynthesis in Gamma-Ray Bursts”, invited talk, American Physical Society April Meeting, Tampa, FL, April 2005
- [3] “Neutrinos and Nucleosynthesis in Gamma-Ray Burst Accretion Disks and Outflows”, Institute of Nuclear Theory, Workshop on The Supernova-Gamma Ray Burst Connection, University of Washington, July 2004
- [2] “Supernovae and the Dynamical r Process”, Nuclear and Particle Physics seminar, Rensselaer Polytechnic Institute, November 1999
- [1] “Neutrinos and the Formation of Heavy Elements”, invited talk, Astronomical Society of New York Spring Meeting, April 1999

Grants and Sponsored Programs

“Neutrinos and Nucleosynthesis in Gamma-Ray Bursts”, Single P.I. grant

Department of Energy Office of Science

2005-2007, two-year total \$55k

2007-2010, three-year total \$96k

2010-2013, three-year total \$99k

2013-2016, three-year total \$102k

2017-2018, 16-month total \$65k

“Towards Exascale Astrophysics of Mergers and Supernovae (TEAMS)”

Department of Energy Office of Science

Lead PI: W. Raphael Hix (ORNL)

Institutional PIs: Almgren (LBNL), Burrows (Princeton), Couch (MSU/FRIB), Dubey (ANL), Fryer (LANL), Fuller (UCSD), Kasen (Berkeley), Reddy (Washington), Surman (Notre Dame), Steiner (Tennessee), Zingale (Stony Brook)

Total budget: \$7.25M for five years 2017-2023

Notre Dame budget total: \$259k

“Fission In R-process Elements (FIRE)”

Department of Energy and the National Nuclear Security Agency

Lead PI: Nicolas Schunck (LLNL)

Institutional PIs: Sonzogni (BNL), Kawano (LANL), McLaughlin (NCSU), Surman (Notre Dame)

Total budget: \$2.5M for five years 2016-2021

Notre Dame budget total: \$544k

“Research Hub for Fundamental Symmetries, Neutrinos, and Applications to Nuclear Astrophysics: The Inner Space/Outer Space/Cyber Space Connections of Nuclear Physics (N3AS)”

National Science Foundation

Lead PI: Wick Haxton (Berkeley)

Institutional PIs: Gardner (Kentucky), Carlson (LANL), Qian (Minnesota), McLaughlin (NCSU), DeGouvea (Northwestern), Phillips (Ohio), Balantekin (Wisconsin), Surman (Notre Dame)

Total budget: \$2.28M for five years 2016-2021

Notre Dame budget total: one postdoc for two years

Subcontract of the Outstanding Junior Investigator award of Katherine L. Grzywacz-Jones,

“Spectroscopic Studies Close to ^{100}Sn and ^{132}Sn Using Direct Reactions and Gamma-Ray Measurements”, 2009-2011, \$50k

“Heavy element synthesis in outflows from gamma-ray burst accretion disks”

Research Corporation Cottrell College Science Award, 2004-2006, \$21k

Student and Postdoctoral Supervision

Postdoctoral Researchers

Matthew Mumpower, 2012-2015, co-supervised with Ani Aprahamian
Ph.D. 2012 North Carolina State University
Postdoctoral Researcher, Los Alamos National Laboratory, 2015-2017
Staff Scientist, Los Alamos National Laboratory, 2017-present
Nicole Vassh, 2016-present
Ph.D. 2016 University of Wisconsin
Xilu Wang, 2018-present
Ph.D. 2018 University of Illinois

Graduate Students

Erika Holmbeck, starting 4rd year, co-supervised with Tim Beers
Trevor Sprouse, starting 3rd year

Notre Dame Undergraduate Students

Andrew Toivonen, Summer 2018 and academic year 2018-2019
David Shaw, Summer 2017 and academic year 2017-2018
Lauren Ward, Fall 2016, Fall 2018
Zach Huber, Summer 2016 and academic year 2016-2017
Trevor Sprouse, 2013-2016
Julie Cass, 2011-2012
Giusseppe Passucci, 2011-2012

Courses Taught

PHYS80701: Nuclear Physics, University of Notre Dame
PHYS10320: General Physics II, University of Notre Dame
First-year Physics Seminar, Union College
Introduction to Astronomy, Union College
The Solar System and History of Astronomy, Union College
Introductory Physics (Matter in Motion/Electrodynamics), Union College
Integrated Mathematics/Physics, Union College
Laboratory for Relativity, Quantum, and their Applications, Union College
Intermediate Classical Mechanics, Union College
Particle and Nuclear Physics, Union College

Professional Memberships

American Physical Society (Division of Nuclear Physics, Division of Astrophysics)
American Association for the Advancement of Science

Other Notable Contributions

National Service

American Physical Society Division of Nuclear Physics Executive Committee, 2017-2019
APS DNP Nominations Committee, Vice-Chair 2017-2018, Chair 2018-2019
APS DNP Publications Committee, Vice-Chair 2017-2018, Chair 2018-2019

Executive Board, Facility for Rare Isotope Beams Theory Alliance, 2016-2019
FRIB-TA Fellows Search Committee, 2017-2018
FRIB-TA Bridge Committee, 2018-2019
American Physical Society Division of Nuclear Physics Program Committee, 2013-2015

University/College Service

Faculty Grievance Committee, University of Notre Dame, 2018-
University Parking Committee, University of Notre Dame, 2016-2018
Chair, ad-hoc tenure committee, Union College, Fall 2013
Committee on Teaching, Union College, 2008-2011
Chair, ad-hoc tenure committee, Union College, Fall 2009
Ad-hoc tenure committee, Union College, Fall 2005
Center II junior representative, Faculty Review Board, Union College, 2003-2004

Departmental Service

Department of Physics Committee on Appointments and Promotions, 2018-
Strategic Planning/Department Review Committee, University of Notre Dame, 2015-2017
Physics Diversity Committee, University of Notre Dame, 2016-
Undergraduate Curriculum Committee, University of Notre Dame, 2014-
Graduate Recruitment Committee, University of Notre Dame, 2014-2015
Chair, Department of Physics and Astronomy Search Committee, Union College, 2013-2014
Chair, Physics and Astronomy Assessment Committee, Union College, 2007-2011
Society of Physics Students/ $\Sigma\Pi\Sigma$ National Physics Honor Society advisor, Union College, 2003-2007
Department of Physics and Astronomy Search Committees, Union College, 2001-2011
Department of Physics and Astronomy Curriculum Committee, Union College, 1998-2011

Conference organization

Co-organizer, “FRIB and the GW170817 kilonova”, two-week FRIB Theory Alliance workshop, Michigan State University, East Lansing, Michigan, July 2018
Co-organizer, “The r-process: connecting FRIB with the cosmos”, three-week International Collaborations in Nuclear Theory (ICNT) workshop, Michigan State University, East Lansing, Michigan, June 2016
Organizer and host, inaugural FIRE collaboration meeting, University of Notre Dame, December 2016
Organizer, “Nuclear and Neutrino Physics Inputs for Heavy Element Synthesis”, two-week workshop as part of the CETUP* (Center for Underground Theoretical Physics and Related Areas) summer program, Lead, South Dakota, July 6-17, 2015

Reviews

Reviewed journal articles for

- *The Astrophysical Journal*
- *The Astrophysical Journal Letters*
- *Physical Review C*
- *Journal of Physics G: Nuclear and Particle Physics*
- *Journal of Applied Physics*
- *Monthly Notices of the Royal Astronomical Society*

- *New Astronomy*
- *Physics Letters B*

Reviewed grant proposals for

- The Department of Energy Office of Science
- The National Science Foundation
- Research Corporation