

Benjamin R. Betzler Ph.D.

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SUMMARY

Outcome-focused reactor physics nuclear engineer with demonstrated experience and performance on successful research and development (R&D) programs for a variety of sponsors, including the Department of Energy Office of Nuclear Energy (DOE-NE), the National Nuclear Security Administration (NNSA), and the Nuclear Regulatory Commission. Experience collaborating with and leading diverse multi-organization teams and communicating with sponsors and staff. Recognized expertise in both methods development and reactor analysis and design, with specialized knowledge of Monte Carlo radiation transport methods, advanced reactor systems, and light water reactor modeling and simulation. Programmatic roles include the modeling and simulation technical area lead of the DOE-NE Molten Salt Reactor Campaign and design and analysis area lead of the DOE-NE Transformational Challenge Reactor Program.

EDUCATION

University of Michigan, Ann Arbor, MI, 2014

Doctor of Philosophy, Nuclear Engineering and Radiological Sciences (Fission)

Dissertation title: *Calculating Alpha Eigenvalues and Eigenfunctions with a Markov Transition Rate Matrix Monte Carlo Method*

Advisor: William R. Martin

University of Michigan, Ann Arbor, MI, 2010

Master of Science in Engineering, Nuclear Engineering and Radiological Sciences

University of Michigan, Ann Arbor, MI, 2008

Bachelor of Science in Engineering, Nuclear Engineering and Radiological Sciences

RESEARCH INTERESTS

Numerical methods for solving neutron transport problems: Monte Carlo transport, α -eigenvalue methods, time-dependent transport, and matrix methods and applications of Markov processes. Reactor physics and fuel cycle methods development and analysis for advanced reactor systems: molten salt reactors, gas-cooled fast reactors, nuclear thermal propulsion reactors, high-temperature gas-cooled reactors, fast burst reactor systems, and accelerator-driven subcritical systems. Design optimization methods, code verification and validation, dose and shielding, dynamic systems simulation, and applications of neutron importance.

RESEARCH EXPERIENCE

Oak Ridge National Laboratory, May 2014 – present

R&D Staff, Jan. 2019 – present

Supervisor: Germina Ilas, Lead, Neutronics Team, Jan. 2019 – present

- Developed reactor physics and fuel cycle models of the Molten Salt Demonstration Reactor to provide irradiated salt data for safeguards and source term analyses.
- Led the design area of the DOE-NE Transformational Challenge Reactor Program, collaborating with material science, facility & licensing, and reactor design staff.
- Led high-fidelity as-built reactor physics analysis in support of High Flux Isotope Reactor (HFIR) fuel characterization and operations.

RESEARCH
EXPERIENCE
(CONTINUED)**Oak Ridge National Laboratory (*continued*)**, May 2014 – present*Associate R&D Staff*, May 2016 – Dec. 2018

Supervisor: Germina Ilas, Lead, Neutronics Team, May 2018 – Dec. 2018

Kevin T. Clarno, Group Leader, Reactor Physics, Mar. 2018 – Apr. 2018

Stephen M. Bowman, Group Leader, Reactor Physics, May 2016 – Feb. 2018

- Led a multidisciplinary team of nuclear and mechanical engineers to design a reactor built using advanced manufacturing techniques.
- Led a multi-laboratory effort to develop the DOE-NE Molten Salt Reactor Campaign modeling and simulation plan, communicating with industry, academia, laboratory staff, and leadership in other DOE-NE programs.
- Calculated fuel salt content and developed models of molten salt reactor fueling, storage, and processing systems for safeguards characterization and analysis.
- Developed molten salt reactor neutronics and fuel cycle analysis tools for the SCALE code package, leading the integration in ORIGEN, NEWT, and TRITON.
- Coordinated the modeling and simulation effort of the DOE-NE Molten Salt Reactor Campaign, supporting dose estimation, dynamic modeling, and chemistry modeling.
- Developed design optimization tools and performed design studies of a HFIR low-enriched uranium core with the Shift Monte Carlo tool.
- Collaborated with Transatomic Power Corporation to perform neutronic and fuel cycle analysis and design optimization for their molten salt reactor design.

Postdoctoral Research Associate, May 2014 – Apr. 2016

Supervisor: Stephen M. Bowman, Group Leader, Reactor Physics

- Performed depletion and criticality analysis of boiling water reactor spent fuel assemblies with different operating conditions for burnup credit analysis.
- Performed core design and analysis of a prismatic fluoride salt-cooled advanced demonstration reactor concept using Serpent and PARCS.
- Developed tools and performed neutronic analysis for fast and thermal spectrum molten salt reactors to characterize them for the fuel cycle options campaign.
- Designed a small nuclear rocket engine using accident tolerant fuel in KENO and performed optimization studies on packing fractions, fuel loads, and core geometry.
- Performed depletion simulation, neutronic analysis, and developed Python scripts in support of the HFIR LEU conversion program and HFIR operations.
- Tested the depletion and lattice physics performance of SCALE modules (TRITON, Polaris, NEWT, and KENO) for light water reactor geometries.
- Developed a Python script and built TRITON inputs to automatically generate the 1,470 ORIGEN cross section libraries released with updated versions of SCALE.

University of Michigan, *Research Assistant*, Aug. 2008 – Apr. 2014

Advisor: William R. Martin, Professor

- Simulated the Fort St. Vrain gas-cooled reactor with MCNP, using RELAP5 to analyze thermal hydraulic feedback. Wrote Python scripts for writing and updating MCNP and RELAP5 inputs, including high-fidelity models of TRISO particle fuel.
- Modeled ~20 Fort St. Vrain pulsed neutron and other startup experiments with MCNP and performed sensitivity studies on design parameter uncertainties.

Los Alamos National Laboratory, *Research Assistant*, Summer 2012

Advisor: Dr. Brian Kiedrowski, Research Scientist, X Division

- Wrote a research Monte Carlo code in MATLAB to calculate α eigenvalues and eigenfunctions of infinite media using a transition rate matrix method akin to the fission matrix method. This method improves upon the k - α iteration in MCNP.

RESEARCH
EXPERIENCE
(CONTINUED)**Oak Ridge National Laboratory, Research Assistant (NESLS), Summer 2010**

Mentor: Daniel L. Pinkston, Nuclear Engineer, High Flux Isotope Reactor

- Calculated heat deposited in the HFIR reactivity control system with MCNP to investigate causes of control cylinder clad corrosion, spalling, and failure.
- Analyzed the burnup of control cylinder absorbers and cladding with ORIGEN and determined the axial heat flux distribution with simple heat transfer models.

MENTORING
EXPERIENCE**Oak Ridge National Laboratory***Research Mentor, May 2015 – present*

- Jin Whan Bae, post-master's research associate, advised on LWR fuel cycle simulation and reactor physics analysis of the High Flux Isotope Reactor, 2019 – present.
- Sarah E. Creasman, University of Tennessee Master's candidate, co-advised on source term analysis of the Molten Salt Demonstration Reactor, 2018 – present.
- Ilham Variansyah, University of Michigan Ph.D. candidate, advised on Monte Carlo methods for α -eigenvalue and time-dependent problems, 2018 – present.
- Briana D. Hiscox, post-master's research associate, advised on gas-cooled fast reactor benchmarking and design optimization methods development, 2018 – present.
- Ilham Variansyah, graduate research assistant, advised on design optimization method development and implementation for HFIR LEU designs, 2018.
- Andrei Rykhlevskii, graduate research assistant, advised on fast spectrum molten salt reactor neutronic and fuel cycle analysis with SCALE/TRITON and Serpent, 2018.
- Naiki A. Kaffezakis, undergraduate research assistant, co-advised on SCALE and Serpent modeling and simulation of the High Flux Isotope Reactor, 2018.
- Ilham Variansyah, graduate research assistant, co-advised on MCNP modeling and Shift depletion simulation for High Flux Isotope Reactor LEU designs, 2017.
- Jennifer R. Hedgecoth, U.S. Navy Midshipman Bowman Scholar, advised on MCNP modeling of pebble-bed high temperature molten salt reactors, 2017.
- Brianna M. Kaufmann, U.S. Navy Midshipman Bowman Scholar, advised on fuel depletion and shuffling for pebble-bed high temperature molten salt reactors, 2017.
- Zachary G. Skirpan, U.S. Navy Midshipman Bowman Scholar, advised on fuel cycle modeling and simulation for the molten salt breeder reactor, 2017.
- Łukasz Koszok, graduate research assistant, co-advised on automating the generation of cross section library group structures for advanced reactors, 2016 – 2017.
- Abdalla Abou Jaoude, graduate research assistant, co-advised on MCNP modeling and VESTA depletion simulations of High Flux Isotope Reactor LEU designs, 2015.

University of Michigan*Research Mentor, Fall 2010 – Fall 2012*

- Timothy P. Burke, undergraduate research assistants, mentored on MCNP microsphere particle modeling of the Fort St. Vrain gas-cooled reactor.
- Wilson N. Pappo, undergraduate research assistant, mentored on fuel data analysis for the Fort St. Vrain gas-cooled reactor.

FUNDING
AWARDS &
ROLES

Fundamental Studies of Materials Degradation in Molten Chloride Salts, 2017 – 20
Oak Ridge National Laboratory Laboratory Directed R&D (LDRD)
Principal Investigator: S. S. Raiman
With: J. W. McMurray, C. W. Abney, R. T. Mayes, J. R. Keiser, **B. R. Betzler**

Molten Salt Reactor Neutronics Tools, 2016
Department of Energy Technology Commercialization Fund
Principal Investigator: **B. R. Betzler**
With: J. J. Powers, N. R. Brown, and B. T. Rearden

Optimization and Assessment of the Neutronics and Fuel Cycle Performance of the Transatomic Power Molten Salt Reactor Design, 2016
Gateway for Accelerated Innovation in Nuclear (GAIN), DOE Office of Nuclear Energy NE Voucher Program Request for Assistance
Principal Investigator: L. C. Dewan (Transatomic Power Corporation)
With: **B. R. Betzler**, J. J. Powers, and A. Worrall

TEACHING
EXPERIENCE

Oak Ridge National Laboratory
University of Michigan Educational Ambassador, Oct. 2018 – present

- Participated in recruitment and outreach visits on behalf of the laboratory.

SCALE Training Team Member, Aug. 2015 – present

- Lectured for week-long SCALE reactor physics, depletion, and sensitivity and uncertainty courses to colleagues in academia and industry (6 courses with ~10 students per course).
- Lectured for SCALE workshop at M&C 2017 (~20 students).
- Answered questions on SCALE help regarding reactor physics tools and data.

University of Michigan
Guest Lecturer, Fall 2013

- Taught a few guest classes for senior-level nuclear reactor theory (~35 students).

Graduate Student Instructor, Fall 2012

- Graded, held office hours, and lectured a few classes for senior-level nuclear reactor theory (~35 students).

Relevant Coursework

- Graduate level course in teaching engineering at a university level, Fall 2012.

AWARDS

Best Team Paper, 2015 MeV Summer School
Future Experimentation: Sensitivity Analysis and Uncertainty Quantification to Optimize Design and Implementation

Best Paper in Reactor Physics, 2010 ANS Student Conference
MCNP5 Analysis of the Fort St. Vain High-Temperature Gas-Cooled Reactor

ANS Student Design Competition Finalist, 2010
Irradiation of Food Using Spent Nuclear Fuel

Kikuchi Scholarship, 2006
Merit-based Scholarship

PROFESSIONAL AFFILIATIONS & SERVICE	<p>American Nuclear Society, 2013 – present <i>Technical Program Committee Member</i>, Reactor Physics Division, 2018 – present <i>Member</i>, Reactor Physics Division, 2013 – present <i>Member</i>, Mathematics and Computation Division, 2013 – present</p> <p>Oak Ridge/Knoxville American Nuclear Society, 2015 – present <i>Immediate Past Chair</i>, 2018 – 2019 <i>Chair</i>, 2017 – 2018 <i>Vice Chair</i>, 2016 – 2017 <i>Secretary</i>, 2015 – 2016</p> <p>Conference & Workshop Organization Activities, 2015 – present <i>Asst. General Chair</i>, International High-Level Radioactive Waste Management, 2019 <i>Session Chair</i>, Molten Salt Reactor Research at Universities, 4th Annual Molten Salt Reactor Workshop, 2018 <i>Session Chair</i>, Fast Reactors and Molten Salt Reactors, GLOBAL, 2017 <i>Session Chair</i>, Reactor Physics, Mathematics & Computation (M&C), 2015</p> <p>Editorial and Review Activities, 2016 – present <i>Reviewer</i>, American Nuclear Society Annual Meetings, 2019 – present <i>Reviewer</i>, Nuclear Science and Engineering, 2 reviews p.a., 2018 – present <i>Reviewer</i>, Annals of Nuclear Energy, 4 reviews p.a., 2018 – present <i>Reviewer</i>, Nuclear Engineering and Technology, 1 review p.a., 2018 – present <i>Reviewer</i>, Nuclear Engineering and Design, 1 review p.a., 2016 – present</p>
SKILLS	<p>Environments: Mac, Linux, Windows Programming Languages: working knowledge of Python and Fortran, basic knowledge of C++, Java, HTML, JavaScript, and Perl Transport Software: MCNP, SCALE (KENO, TRITON, NEWT, ORIGEN, Polaris), Shift, VESTA, Serpent, OpenMC, GenPMAXS, PARCS Documentation & Analysis: \LaTeX, gnuplot, MATLAB/Octave, MS Office</p>
PUBLICATIONS SUMMARY & LIST	<p>Author or coauthor of 12 peer-reviewed journal articles (8 as first author, 2 submitted) Author or coauthor of over 45 conference proceedings and summaries Over 45 presentations[†] at conferences (17), workshops, meetings, and universities Author or coauthor of over 30 technical reports View publications at Google Scholar</p>

REFEREED JOURNAL ARTICLES |

- ◇ **B. R. Betzler**, D. Chandler, D. H. Cook, E. E. Davidson, and G. Ilas, “Design Optimization Methods for High-Performance Research Reactor Core Design,” *Nucl. Eng. Des.*, (in preparation).
- ◇ **B. R. Betzler**, F. Heidet, B. Feng, C. Rabiti, T. Sofu, and N. R. Brown “Modeling and Simulation Needs for Molten Salt Reactor Licensing,” *Nucl. Eng. Des.*, (submitted).
- ◇ M. S. Greenwood, **B. R. Betzler**, A. L. Qualls, J. S. Yoo, and C. Rabiti, “A Dynamic System Model of the Molten Salt Demonstration Reactor,” *Nucl. Technol.*, (submitted).
- ◇ E. E. Davidson, **B. R. Betzler**, R. Gregg, and A. Worrall, “Modeling a Fast Spectrum Molten Salt Reactor in a Systems Dynamics Fuel Cycles Code,” *Ann. Nucl. Energy*, (in press).
- ◇ D. Chandler, **B. R. Betzler**, D. H. Cook, G. Ilas, and D. G. Renfro, “Neutronic and Thermal-Hydraulic Feasibility Studies for High Flux Isotope Reactor Conversion to Low-Enriched Uranium Silicide Dispersion Fuel,” *Ann. Nucl. Energy*, **130**, pp. 277–292 (2019). doi: 10.1016/j.anucene.2019.02.037

- ◇ M. S. Greenwood and **B. R. Betzler**, “Modified Kinetic Model for Neutron Precursors and Fission Product Behavior for Fluid-Fueled Molten Salt Reactors,” *Nucl. Sci. Eng.*, **193**(4), pp. 417–430 (2019). doi: 10.1080/00295639.2018.1531619
- ◇ **B. R. Betzler**, B. C. Kiedrowski, W. R. Martin, and F. B. Brown, “Calculating α Eigenvalues and Eigenfunctions with a Markov Transition Rate Matrix Monte Carlo Method,” *Nucl. Sci. Eng.*, **192**(2), pp. 115–152 (2018). doi: 10.1080/00295639.2018.1497397
- ◇ **B. R. Betzler**, S. Robertson, E. E. Davidson (née Sunny), J. J. Powers, A. Worrall, L. Dewan, and M. Massie, “Fuel Cycle and Neutronic Performance of a Spectral Shift Molten Salt Reactor Design,” *Ann. Nucl. Energy*, **119**, pp. 396–410, (2018). doi: 10.1016/j.anucene.2018.04.043
- ◇ E. E. Davidson (née Sunny), **B. R. Betzler**, D. Chandler, and G. Ilas, “Heat Deposition Analysis for the High Flux Isotope Reactor’s HEU and LEU Core Models,” *Nucl. Eng. Des.*, **322**, pp. 563–576 (2017). doi: 10.1016/j.nucengdes.2017.06.040
- ◇ **B. R. Betzler**, D. Chandler, E. E. Davidson (née Sunny), and G. Ilas, “High Fidelity Modeling and Simulation for a High Flux Isotope Reactor Low-Enriched Uranium Core Design,” *Nucl. Sci. Eng.*, **187**(1), pp. 81–99 (2017). doi: 10.1080/00295639.2017.1292090
- ◇ A. L. Qualls, **B. R. Betzler**, N. R. Brown, J. J. Carbajo, M. S. Greenwood, R. E. Hale, T. J. Harrison, J. J. Powers, K. R. Robb, J. W. Terrell, A. J. Wysocki, J. C. Gehin, and A. Worrall, “Pre-Conceptual Design of a Fluoride High Temperature Salt-Cooled Engineering Demonstration Reactor: Motivation and Overview,” *Ann. Nucl. Energy*, **107**, pp. 144–155 (2017). doi: 10.1016/j.anucene.2016.11.021
- ◇ N. R. Brown, **B. R. Betzler**, J. J. Carbajo, A. J. Wysocki, M. S. Greenwood, C. A. Gentry, and A. L. Qualls, “Pre-Conceptual Design of a Fluoride High Temperature Salt-Cooled Engineering Demonstration Reactor: Core Design and Safety Analysis,” *Ann. Nucl. Energy*, **103**, pp. 49–59 (2017). doi: 10.1016/j.anucene.2017.01.003
- ◇ **B. R. Betzler**, J. J. Powers, and A. Worrall, “Molten Salt Reactor and Fuel Cycle Modeling and Simulation with SCALE,” *Ann. Nucl. Energy*, **101**, pp. 489–503 (2017). doi: 10.1016/j.anucene.2016.11.040
- ◇ **B. R. Betzler**, B. C. Kiedrowski, F. B. Brown, and W. R. Martin, “Calculating Infinite-medium α -eigenvalue Spectra with Monte Carlo using a Transition Rate Matrix Method,” *Nucl. Eng. Des.*, **295**, pp. 639–644 (2015). doi: 10.1016/j.nucengdes.2015.07.052
- ◇ **B. R. Betzler**, W. R. Martin, B. C. Kiedrowski, and F. B. Brown, “Calculating α Eigenvalues of One-Dimensional Media with Monte Carlo,” *Journal of Computational and Theoretical Transport*, **43**(1-7), pp. 38–49 (2014). doi: 10.1080/00411450.2014.909851

REFEREED FULL CONFERENCE PAPERS |

- ◇ **B. R. Betzler**, K. B. Bekar, W. A. Wieselquist, S. W. Hart, and S. G. Stimpson, “Molten Salt Reactor Fuel Depletion Tools in SCALE,” *Proc. GLOBAL International Fuel Cycle Conference*, Seattle, WA, USA, (submitted).
- ◇ **B. R. Betzler**, A. Rykhlevskii, A. Worrall, and K. D. Huff, “Impacts of Fast Spectrum Molten Salt Reactor Characteristics on Fuel Cycle Performance,” *Proc. GLOBAL International Fuel Cycle Conference*, Seattle, WA, USA, (submitted).
- ◇ N. T. Shoman, B. B. Cipiti, and **B. R. Betzler**, “Safeguards and Process Modeling for Molten Salt Reactors,” *Proc. GLOBAL International Fuel Cycle Conference*, Seattle, WA, USA, (submitted).
- ◇ E. Hoffman, B. Feng, **B. R. Betzler**, E. E. Davidson, and A. Worrall, “Technology Characteristics of Transitions to SFR and MSR Fleets,” *Proc. GLOBAL International Fuel Cycle Conference*, Seattle, WA, USA, (submitted).

- ◇ W. J. Marshall, B. J. Ade, I. C. Gauld, G. Ilas, U. Mertyurek, J. B. Clarity, G. Radulescu, **B. R. Betzler**, S. M. Bowman, and J. S. Martinez-Gonzalez, “Overview of the Recent BWR Burnup Credit Project at Oak Ridge National Laboratory,” *Proc. International Conference on Nuclear Criticality Safety*, Paris, France, (submitted).
- ◇ I. Variansyah, **B. R. Betzler**, D. Chandler, G. Ilas, and W. R. Martin, “Metaheuristic Optimization Tools for High Flux Isotope Reactor Low-Enriched Uranium Core Design,” *Proc. ANS Mathematics & Computation Topical Meeting*, Portland, OR, USA, (accepted).
- ◇ I. Variansyah, **B. R. Betzler**, and W. R. Martin, “An α -Weighted Transition Rate Matrix Method,” *Proc. ANS Mathematics & Computation Topical Meeting*, Portland, OR, USA, (accepted).
- ◇ A. Rykhlevskii, **B. R. Betzler**, A. Worrall, and K. D. Huff, “Fuel Cycle Performance of Fast Spectrum Molten Salt Reactor Designs,” *Proc. ANS Mathematics & Computation Topical Meeting*, Portland, OR, USA, (accepted).
- ◇ A. Worrall, **B. R. Betzler**, S. Croft, M. S. Greenwood, J. Hu, and L. G. Worrall, “Molten Salt Reactor Safeguards: The Necessity of Advanced Modeling and Simulation to Inform on Fundamental Signatures,” *Proc. INMM 60th Annual Meeting*, Palm Desert, California, USA (submitted).
- ◇ A. Worrall, **B. R. Betzler**, G. F. Flanagan, D. E. Holcomb, J. Hu, D. N. Kovacic, A. L. Qualls, and L. G. Worrall, “Molten Salt Reactors and Associated Safeguards Challenges and Opportunities,” *Proc. IAEA Symposium on International Safeguards: Building Future Safeguards Capabilities*, Vienna, Austria, Nov. 5–8 (2018).
- ◇ E. E. Davidson, **B. R. Betzler**, R. Gregg, J. L. Peterson-Droogh, and A. Worrall, “Modeling a Fast Molten Salt Reactor with ORION,” *Proc. 15th NEA Information Exchange Meeting on Actinide and Fission Product Partitioning and Transmutation*, Manchester Hall, Manchester, UK, Sep. 30–Oct. 3 (2018).
- ◇ E. A. Hoffman, B. Feng, **B. R. Betzler**, E. E. Davidson, and A. Worrall, “Impact of Technology Characteristics on Transition to a Fast Reactor Fleet,” *Proc. 15th NEA Information Exchange Meeting on Actinide and Fission Product Partitioning and Transmutation*, Manchester Hall, Manchester, UK, Sep. 30–Oct. 3 (2018).
- ◇ **B. R. Betzler**, D. Chandler, D. H. Cook, E. E. Davidson (née Sunny), and G. Ilas, “High Flux Isotope Reactor Low-Enriched Uranium Core Design Optimization Studies,” *Proc. PHYSOR 2018 – Reactor Physics Paving the Way Towards More Efficient Systems*, Cancún, Mexico, Apr. 22–26 (2018).[†]
- ◇ D. Chandler, **B. R. Betzler**, D. H. Cook, G. Ilas, and D. G. Renfro, “Neutronic and Thermal-Hydraulic Feasibility Studies for High Flux Isotope Reactor Conversion to Low-Enriched Uranium U₃Si₂-Al Fuel,” *Proc. PHYSOR 2018 – Reactor Physics Paving the Way Towards More Efficient Systems*, Cancún, Mexico, Apr. 22–26 (2018).
- ◇ U. Mertyurek, **B. R. Betzler**, M. A. Jessee, and S. M. Bowman, “SCALE 6.2 Reactor Physics Code Accuracy Assessment using ENDF/B-VII.1 Library,” *Proc. PHYSOR 2018 – Reactor Physics Paving the Way Towards More Efficient Systems*, Cancún, Mexico, Apr. 22–26 (2018).[†]
- ◇ **B. R. Betzler**, J. J. Powers, N. R. Brown, and B. T. Rearden, “Molten Salt Reactor Neutronics Tools in SCALE,” *Proc. ANS Mathematics & Computation Topical Meeting*, Jeju, Korea, Apr. 16–20 (2017).[†]
- ◇ B. T. Rearden, **B. R. Betzler**, M. A. Jessee, W. J. Marshall, U. Mertyurek, and M. L. Williams, “Accuracy and Runtime Improvements with SCALE 6.2,” *Proc. ANS Mathematics & Computation Topical Meeting*, Jeju, Korea, Apr. 16–20 (2017).
- ◇ G. Ilas, **B. R. Betzler**, and B. J. Ade, “Study of the Impact of Operating Data on BWR Burnup Credit,” *Proc. PATRAM 2016 – The 18th International Symposium on the Packaging and Transportation of Radioactive Materials*, Kobe, Japan, Sep. 18–23 (2016).
- ◇ **B. R. Betzler**, J. J. Powers, and A. Worrall, “Modeling and Simulation of the Start-Up of a Thorium-Based Molten Salt Reactor,” *Proc. PHYSOR 2016 – Unifying Theory and Experiments in the 21st Century*, Sun Valley, ID, USA, May 1–5 (2016).[†]

- ◇ **B. R. Betzler** and J. J. Powers, “Fully Ceramic Microencapsulated Fuels for Space Reactor Applications,” *Proc. PHYSOR 2016 – Unifying Theory and Experiments in the 21st Century*, Sun Valley, ID, USA, May 1–5 (2016).[†]
- ◇ E. E. Sunny, **B. R. Betzler**, G. Ilas, and D. Chandler, “High-Fidelity Heat Deposition Analysis for the High Flux Isotope Reactor,” *Proc. PHYSOR 2016 – Unifying Theory and Experiments in the 21st Century*, Sun Valley, ID, USA, May 1–5 (2016).
- ◇ G. Ilas, **B. R. Betzler**, D. Chandler, and E. E. Sunny, “High Flux Isotope Reactor Core Analysis - Challenges and Recent Enhancements in Modeling and Simulation,” *Proc. PHYSOR 2016 – Unifying Theory and Experiments in the 21st Century*, Sun Valley, ID, USA, May 1–5 (2016).
- ◇ N. R. Brown, A. L. Qualls, **B. R. Betzler**, J. J. Carbajo, M. S. Greenwood, R. E. Hale, T. J. Harrison, J. J. Powers, and K. R. Robb, “Core Design Characteristics of the Fluoride Salt-Cooled High Temperature Demonstration Reactor,” *Proc. ICAPP 2016 – Nuclear Innovation: Inventing the Future for Existing and New Nuclear Power*, San Francisco, CA, USA, Apr. 17–20 (2016).
- ◇ M. S. Greenwood, N. R. Brown, **B. R. Betzler**, and G. T. Mays, “Summary of the Workshop on Molten Salt Reactor Technologies Commemorating the 50th Anniversary of the Startup of the Molten Salt Reactor Experiment,” *Proc. ICAPP 2016 – Nuclear Innovation: Inventing the Future for Existing and New Nuclear Power*, San Francisco, CA, USA, Apr. 17–20 (2016).
- ◇ **B. R. Betzler**, B. J. Ade, D. Chandler, G. Ilas, and E. E. Sunny, “Optimization of Depletion Modeling and Simulation for the High Flux Isotope Reactor,” *Proc. ANS Mathematics & Computation Topical Meeting*, Nashville, TN, USA, Apr. 19–23 (2015).[†]
- ◇ **B. R. Betzler**, B. C. Kiedrowski, W. R. Martin, and F. B. Brown, “Calculating α Eigenvalue Spectra with Monte Carlo,” *Proc. ANS Nuclear Criticality Safety Topical Meeting*, Wilmington, NC, USA, Sep. 29–Oct. 3 (2013).[†]
- ◇ **B. R. Betzler**, B. C. Kiedrowski, F. B. Brown, and W. R. Martin, “Calculating Infinite-Medium α -Eigenvalue Spectra with a Transition Rate Matrix Method,” *Proc. ANS Mathematics & Computation Topical Meeting*, Sun Valley, ID, USA, May 5–9 (2013).[†]
- ◇ A. T. Pavlou, **B. R. Betzler**, T. P. Burke, J. C. Lee, W. R. Martin, W. N. Pappo, and E. E. Sunny, “Eigenvalue Sensitivity Studies for the Fort St. Vrain High Temperature Gas-Cooled Reactor to Account for Fabrication and Modeling Uncertainties,” *Proc. PHYSOR 2012 – Advances in Reactor Physics*, Knoxville, TN, USA, Apr. 15–20 (2012).
- ◇ **B. R. Betzler**, E. E. Sunny, W. R. Martin, and J. C. Lee, “Coupled Nuclear-Thermal-Hydraulic Calculations for Fort St. Vrain Reactor,” *Proc. NURETH 14 – The 14th International Topical Meeting on Nuclear Reactor Thermalhydraulics*, Toronto, Ontario, Canada, Sep. 25–30 (2011).[†]

TRANSACTIONS & SUMMARIES |

- ◇ J. W. McMurray, T. M. Bessmann, B. S. Collins, **B. R. Betzler**, M. H. A. Piro, S. S. Raiman, and A. L. Qualls, “Thermodynamics Coupled Molten Salt Reactor Performance Simulations,” *Proc. The Minerals, Metals & Materials Society Annual Meeting (TMS) 2019*, San Antonio, TX, Mar. 10–14 (2019).
- ◇ D. G. Renfro, **B. R. Betzler**, D. Chandler, D. H. Cook, G. Ilas, P. K. Jain, G. Q. Kirk, D. S. Kozlowsky, T. R. Muth, D. L. Pinkston, E. L. Popov, and E. E. Davidson (née Sunny), “Continuing LEU Conversion Activities at the High Flux Isotope Reactor,” *Proc. RERTR 2018 – 39th International Meeting on Reduced Enrichment for Research and Test Reactors*, Edinburgh, Scotland, Nov. 4–7 (2018).
- ◇ **B. R. Betzler**, D. Chandler, E. E. Davidson (née Sunny), and G. Ilas, “Optimized Design Performance Analysis Tools for a High Flux Isotope Reactor Low-Enriched Uranium Core,” *Trans. Am. Nucl. Soc.*, **119** (2018).[†]

- ◇ D. Chandler, **B. R. Betzler**, G. Ilas, D. H. Cook, and D. G. Renfro, “High Flux Isotope Reactor Low-Enriched Uranium Core Designs and Challenges,” *Proc. ANTPC 2018 – Advances in Nuclear Nonproliferation Technology and Policy Conference*, Wilmington, NC, Sep. 23–27 (2018).
- ◇ **B. R. Betzler**, E. E. Davidson, and J. J. Powers, “Molten Salt Reactor Modeling and Simulation,” *Proc. 3rd Fuel Cycle Workshop*, Paris, France, Jul. 9–11 (2018).
- ◇ E. E. Davidson, **B. R. Betzler**, R. Gregg, J. L. Peterson-Droogh, and A. Worrall, “Modeling a Fast Molten Salt Reactor with ORION,” *Proc. 3rd Fuel Cycle Workshop*, Paris, France, Jul. 9–11 (2018).
- ◇ M. S. Greenwood and **B. R. Betzler**, “Kinetic Precursor Drift Flux Model for Fluid-Fueled Molten Salt Reactors,” *Trans. Am. Nucl. Soc.*, **118** (2018).
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- ◇ **B. R. Betzler**, “SCALE Non–Light Water Reactor Development,” *Nuclear Regulatory Commission Program Review Meeting Panel Discussion*, Oak Ridge National Laboratory, Oak Ridge, TN, USA, Feb. (2019).[†]
- ◇ **B. R. Betzler**, “Methods for Research and Advanced Reactor Design and Analysis,” *University of Texas Nuclear and Radiation Engineering Program Research Seminar*, Austin, TX, USA, Feb. (2019).[†]
- ◇ **B. R. Betzler**, “Design Optimization Methods for High Flux Isotope Reactor Low-Enriched Uranium Core Design,” *University of Tennessee Nuclear Engineering Department Colloquium*, Knoxville, TN, USA, Jan. (2019).[†]
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