

# ANNUAL REPORT

September 1, 2011 – August 31, 2012

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NUCLEAR ENGINEERING AND  
RADIOLOGICAL SCIENCES

University of Michigan

**The Regents of the University of Michigan**

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## Table of Contents

<b>SUMMARY OF ACTIVITIES.....</b>	<b>4</b>
<b>FACULTY HONORS AND AWARDS .....</b>	<b>5</b>
<b>STUDENT ORGANIZATIONS.....</b>	<b>6</b>
<b>CURRICULUM.....</b>	<b>8</b>
CURRICULUM CHANGES.....	8
COURSES OFFERED*.....	9
COURSE ENROLLMENTS .....	11
<b>STUDENT ACADEMICS, HONORS, AND EMPLOYMENT .....</b>	<b>12</b>
DEGREES AWARDED BY ACADEMIC YEAR.....	17
DOCTORAL THESES TITLES .....	18
FALL ENROLLMENT .....	21
EMPLOYMENT STATISTICS AND CONTINUING EDUCATION .....	23
INTERNSHIPS.....	26
EMPLOYMENT PATTERNS OF GRADUATES.....	29
<b>NERS COLLOQUIA    FALL 2010 .....</b>	<b>32</b>
<b>RESEARCH ACTIVITIES .....</b>	<b>34</b>
FISSION SYSTEMS AND RADIATION TRANSPORT.....	34
MATERIALS.....	38
PLASMAS AND FUSION.....	44
RADIATION MEASUREMENTS AND IMAGING.....	50
<b>FISCAL YEAR 2010 RESEARCH EXPENDITURES.....</b>	<b>57</b>
RESEARCH EXPENDITURES ATTRIBUTED TO AN EXTERNAL SPONSOR.....	57
<b>PUBLICATIONS.....</b>	<b>68</b>
FISSION SYSTEMS AND RADIATION TRANSPORT.....	68
MATERIALS.....	73
PLASMAS AND FUSION.....	78
RADIATION MEASUREMENTS AND IMAGING.....	83
<b>SERVICE .....</b>	<b>90</b>
<b>PERSONNEL.....</b>	<b>98</b>
<b>ADVISORY BOARD .....</b>	<b>107</b>

# Summary of Activities

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This is the 15<sup>th</sup> annual Report of the Nuclear Engineering and Radiological Sciences Department. The purpose of this report is to provide a record of teaching, research and service activities of the department.

NERS Department faculty offered a total of 52 courses including special topics, independent study and doctoral research. Our undergraduate enrollment is stable at a very high level with 45 students registered in NERS250, Fundamentals of Nuclear Engineering and Radiological Sciences (our introductory sophomore level course) and 46 students in NERS311, (our junior level course). The NERS department awarded 34 BSE degrees and 17 Engineering Physics degrees. MS and MSE degrees were granted to 42 students. There were 15 Ph.D. graduates from NERS during this reporting period.

NERS Department continues to attract the highest quality students. Currently, NERS graduate students have earned some 50 prestigious graduate fellowships from the National Science Foundation (4), DoE, NNSA, NRC, DoD, NPSC and DHS. Undergraduate students garnered some 52 scholarships. The number of undergraduate student internships continues to expand. There has been a great increase in the number of students gaining international experience. NERS undergraduates and graduate students have also received numerous awards.

NERS faculty taught a class in China that exposed students to several nuclear reactor construction sites and nuclear facilities. NERS faculty participated in panel discussions in the US and China to discuss the implications of the nuclear incident at Fukushima, Japan.

NERS faculty members continue to be recognized in the college, nationally and internationally. Several NERS faculty appeared in national media to provide insights into the Fukushima, Daichi nuclear reactor situation as it developed.

Faculty research expenditures increased to nearly 15 million dollars on some 178 research projects from government and industry. A gift of 5 million dollars from Dr. J. Robert Beyster will fund the construction of new laboratories in the former Ford Nuclear Reactor building.

Due to the efforts of our outstanding faculty, students and staff, the future of the Nuclear Engineering and Radiological Sciences Department is extremely bright.

# Faculty Honors and Awards

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(January 1, 2011 – December 31, 2011)

**Alex F. Bielajew**

Nuclear Engineering and Radiological Sciences

*Faculty Achievement Award*

**John E. Foster**

NASA

*Faculty Fellow Award*

**Karl Krushelnick**

Optical Society of America

*Fellow*

# Student Organizations

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## **ALPHA NU SIGMA SOCIETY**

In 1983, a chapter of the Alpha Nu Sigma Society, the national honor society for nuclear science and engineering, was formed at the University of Michigan. Approximately 120 undergraduate and graduate students have been inducted into the Alpha Chapter of the Alpha Nu Sigma Society at Michigan since 1983. The honor society emphasizes nuclear education by tutoring current students, and providing outreach activities to educate high school students and the community.

Since 1993, the chapter has recognized a faculty member for contributions to undergraduate and graduate education.

## **AMERICAN NUCLEAR SOCIETY**

The University of Michigan American Nuclear Society (ANS) Student Section, formed in 1955, was the first student branch in the country. Since its inception, the branch has been involved in numerous activities to increase public awareness of the benefits of nuclear technology and its role in the future. One of the primary roles of the ANS student branch has been to provide professional development opportunities to students by organizing talks from the industry and by providing support to students attending national and regional ANS conferences, as well as hosting conferences of their own. Furthermore, the section organizes several social activities such as holiday parties, intramural sports teams, recreational activities, outreach, and community service.

Faculty Advisor: John Foster

## **HEALTH PHYSICS SOCIETY**

Formed in 1992, the University of Michigan Student Branch of the Health Physics Society was among the charter groups of student branches. The Health Physics Society is dedicated to the development, dissemination, and application of both the scientific knowledge of and the practical means for radiation protection, with an emphasis on protection of people and the environment from unnecessary exposure to radiation. The student branch has been involved in a number of professional activities, parties, seminars, and public relations activities, including tours, teacher training workshops and visits to high schools for the dissemination of basic information about radiation and radiation health effects.

Faculty Advisor: Kim Kearfott

## **THE INSTITUTE OF NUCLEAR MATERIALS MANAGEMENT (INMM)**

The INMM student chapter at the University of Michigan offered a potpourri of club activities, including guest speakers, social events, and much more.

We strive to provide an open forum for graduate students and others interested in nuclear materials management. This past academic year, the chapter organized a total of eight prominent guest speakers from national labs, universities and other organizations who shared their research and experience covering a variety of nuclear material management topics. In addition, the INMM chapter hosted several social events, such as trivia nights and miniature gold outings. The chapter website has been extensively remodeled (<http://sitemaker.umich.edu/inmm/home>). This July, a total of 16 presentations will be given by UM NERS students and faculty at the INMM Annual Meeting which is the preeminent conference for nuclear materials management research.

# Curriculum

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## CURRICULUM CHANGES

The following changes were made during AY 2010-2011:

- NERS 490 (Special Topics) was made a repeatable course. This was necessary since more faculty were offering special topics courses. Additionally, this allows faculty to pilot courses before they become permanent.
- NERS 531 (Nuclear Waste Management) was cross-listed with Earth and Environmental Sciences 529 (formerly Geological Sciences).
- NERS 583 (Applied Radiation Dose Assessment) was reduced from four to three credits. There was a reduction in course material, which was being taught in other courses.
- NERS 590 (Special Topics) was increased from 1-3 credits to 1-4 credits.
- NERS 621 (Nuclear Waste Forms) was cross-listed with Earth and Environmental Sciences 629.



## COURSES OFFERED

<b>COURSE NO.</b>	<b>COURSE TITLE</b>	<b>TERM</b>	<b>CREDIT HRS</b>
NERS 211/ENSCEN 211	Intro to Nuclear Engineering & Radiological Sciences	I, II	4
NERS 250	Fundamentals of Nuclear Engineering & Radiological Sciences	II	4
NERS 311	Elements of Nuclear Engineering & Radiological Sci I	I	3
NERS 312	Elements of Nuclear Engineering & Radiological Sci II	II	3
NERS 315	Nuclear Instrumentation Laboratory	II	4
NERS 421	Nuclear Engineering Materials	I	3
NERS 425	Applications of Radiation	II	4
NERS 441	Nuclear Reactor Theory I	I	4
NERS 442	Nuclear Power Reactors	II	4
NERS 462	Reactor Safety Analysis	I	3
NERS 471	Introduction to Plasmas	I	3
NERS 472	Fusion Reactor Technology	II	2
NERS 481/BioE 481/ENSCEN 484	Engineering Principles of Radiation Imaging	II	2
NERS 484/BioE 484	Radiological Health Engineering Fundamentals	I	4
NERS 490	Special Topics in Nuclear Engineering & Radiological Sciences	All	TBA
NERS 499	Research in Nuclear Engineering & Radiological Sciences	All	1-3
NERS 511	Quantum Mechanics in Neutron-Nuclear Reactions	II	3
NERS 512	Interaction of Radiation and Matter	II	3
NERS 515	Nuclear Measurements Laboratory	I	4
NERS 518	Advanced Radiation Measurements and Imaging	I (Alt Yrs)	2
NERS 521	Radiation Effects in Nuclear Materials	I	3
NERS 522	Nuclear Fuels	II (Alt Yrs)	3
NERS 531	Nuclear Waste Management	II (Alt Yrs)	3
NERS 543	Nuclear Reactor Theory II	I	3
NERS 551	Nuclear Reactor Kinetics	II	3
NERS 554	Radiation Shielding	II	4

<b>COURSE NO.</b>	<b>COURSE TITLE</b>	<b>TERM</b>	<b>CREDIT HRS</b>
NERS 211/ENSCEN 211	Intro to Nuclear Engineering & Radiological Sciences	I, II	4
NERS 250	Fundamentals of Nuclear Engineering & Radiological Sciences	II	4
NERS 311	Elements of Nuclear Engineering & Radiological Sci I	I	3
NERS 312	Elements of Nuclear Engineering & Radiological Sci II	II	3
NERS 315	Nuclear Instrumentation Laboratory	II	4
NERS 421	Nuclear Engineering Materials	I	3
NERS 425	Applications of Radiation	II	4
NERS 441	Nuclear Reactor Theory I	I	4
NERS 442	Nuclear Power Reactors	II	4
NERS 462	Reactor Safety Analysis	I	3
NERS 471	Introduction to Plasmas	I	3
NERS 472	Fusion Reactor Technology	II	2
NERS 481/BioE 481/ENSCEN 484	Engineering Principles of Radiation Imaging	II	2
NERS 484/BioE 484	Radiological Health Engineering Fundamentals	I	4
NERS 490	Special Topics in Nuclear Engineering & Radiological Sciences	All	TBA
NERS 499	Research in Nuclear Engineering & Radiological Sciences	All	1-3
NERS 511	Quantum Mechanics in Neutron-Nuclear Reactions	II	3
NERS 512	Interaction of Radiation and Matter	II	3
NERS 515	Nuclear Measurements Laboratory	I	4
NERS 518	Advanced Radiation Measurements and Imaging	I (Alt Yrs)	2
NERS 521	Radiation Effects in Nuclear Materials	I	3
NERS 522	Nuclear Fuels	II (Alt Yrs)	3
NERS 531	Nuclear Waste Management	II (Alt Yrs)	3
NERS 543	Nuclear Reactor Theory II	I	3
NERS 551	Nuclear Reactor Kinetics	II	3
NERS 554	Radiation Shielding	II	4

\*Roman numeral indicates term(s) the course will be offered. Fall term, I; Winter term, II; Spring/Summer terms, III A/B.

## COURSE ENROLLMENTS

<b>COURSE</b>	<b>TITLE</b>	<b>FA '11</b>	<b>WN '12</b>	<b>Sp/Su '12</b>
NERS 211	Introduction to Nuclear Engr and Radiological Sci	70	90	
NERS 250	Fundamentals of Nuclear Engr and Radiological Sci		45	
NERS 311	Elements of Nuclear Engr and Radiological Sci I	46		
NERS 312	Elements of Nuclear Engr and Radiological Sci II		44	
NERS 315	Nuclear Instrumentation Laboratory		42	
NERS 421	Nuclear Engr Materials	5		
NERS 425	Applications of Radiation		35	
NERS 441	Nuclear Reactor Theory I	42		
NERS 442	Nuclear Power Reactors		25	
NERS 462	Reactor Safety Analysis	30		
NERS 471	Introduction to Plasmas	24		
NERS 481	Engr Principles of Radiation Imaging (BioE 481)		29	
NERS 484	Radiological Health Engr Fundamentals (BioE 484)	41		
NERS 490	Special Topics in Nuclear Engr and Radiological Sci	36	52	
NERS 499	Research in Nuclear Engr & Radiological Sci	9	10	
NERS 515	Nuclear Measurements Laboratory	16		
NERS 521	Radiation Effects in Nuclear Materials	16		
NERS 522	Nuclear Fuels		30	
NERS 531	Nuclear Waste Management		32	
NERS 543	Nuclear Reactor Theory II	26		
NERS 551	Nuclear Reactor Kinetics		26	
NERS 554	Radiation Shielding		23	
NERS 561	Nuclear Core Design and Analysis I		14	
NERS 571	Intermediate Plasma Physics I	21		
NERS 572	Intermediate Plasma Physics II		12	
NERS 575	Plasma Generation and Diagnostics Lab (EECS 519)		14	
NERS 578	Physical Processes in Plasmas (EECS 517)	12		
NERS 580	Computation Proj in Radiation Imaging (BioM 580)		20	
NERS 585	Transportation of Radioactive Materials	19		
NERS 586	Applied Radiological Measurements		15	
NERS 644	Transport Theory	8		
NERS 674	High Intensity laser-Plasma Interaction	6		
NERS 590	Special Topics in Nuclear Engr & Radiological Sci II	84	12	
NERS 599	Master's Project	10	7	
NERS 799	Special Projects	15	15	
NERS 990	Dissertation-Precandidate	6	15	1
NERS 995	Dissertation-Candidate	61	57	4

# Student Academics, Honors, and Employment

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## Undergraduate Scholarships for 2011-2012

American Nuclear Society Undergraduate Scholarship Award

Timothy Burke, Geoffrey Gunow, Nicholas Holmes, Michael Jarrett, Joowan Kwak, Derek Lax, Dylan Rittman, Jason vonEhr

American Nuclear Society Incoming Freshman Scholarship Award

David Cinquegrani

Budd Student Aid Fund

Radha Arghal

Chihiro Kikuchi Scholarship

Emily Cizmas, Michael Jarrett

Class of 1912E, 1913E & 1915E Scholarship

Barclay Oudersluys

Class of 1930E Memorial Scholarship

Tyler deVries-Wallace

Class of 1931E Scholarship

Marissa Mantey

College of Engineering General Fund

Ryan Leon, Daniel Nunez

Dhillon-Randhawa Family Educational Fund

Drew Johnson

Exelon Corporation

Alexandra Niska Burja

Feeley Family Endowed Scholarship

Bianca Jones

Ivah L. DaLee Scholarship

Drew Johnson

James D. Butt Scholarship Fund

Daniel Nunez

James A. and Hazel Lee Hughes Fellowship

Sean Carney

James A. and Judith McDivitt Scholarship

Marissa Mantey

John S. King Scholarship Fund

Edward Harvey

Joseph Boyer Scholarship

Anthony Riggins

Nuclear Regulatory Commission Scholarship

Timothy Burke, Daniel Chudnow, Nicholas Holmes, Michael Jarrett, Derek Lax, Joseph Lelli, Jacob Levy, Alexandra Niska Burja, Sean O'Neal, Adam Schutt, Jason vonEhr, Erik Walker

Sarah W. Lardner Financial Assistance Fund for Exceptional Circumstances

Roderick Smith

Second Year Undergraduate Merit Scholarship

Adam Berkovec, Joseph Foy, Marisa Leney, Charles Matrosic, Barclay Oudersluys, Dylan Rittman

Simon Mandelbaum Scholarship

Lee Gunderson

William Kerr Scholarship Fund

David Goodman, Aaron Graham, Alexandra Niska Burja, Scott Richards, Alexander Schwab, Tyler deVries-Wallace

## **Undergraduate Honors and Awards for 2011-2012**

Arthur B Singleton Prize

Rachel Bielajew

New Student Achievement Award

Aledoni Keci, Daniel Nunez

Outstanding Undergraduate Student Award-Engineering Physics

Ethan Stark

Outstanding Undergraduate Student Award-NERS

Lee Gunderson

Rising Student Achievement Award

Jejuan Toney

Undergraduate Achievement Award

Alexander Brooks

UROP Outstanding Symposium Poster

Alexander Rhodes

## **Graduate Fellowships for 2011-2012**

American Nuclear Society Graduate Awards

Robert Steinbock, Travis Trahan

College of Engineering Dean's/Named Fellowship

Sean Carney, Timothy Grunloh

College of Engineering Regent's Fellowship

Marc Paff

Michigan Institute for Plasma Science and Engineering

Sarah (Nowak) Gucker, Ian Rittersdorf, Will Schumaker, Sang-Heon Song, Adam Steiner

NASA Graduate Student Research Program-Marshall Space Flight Center

Eric Gillman, Ben Yee

National Academy for Nuclear Training in Nuclear Engineering Fellowship

Joseph Lelli

National Physical Sciences Consortium Fellowship

Ayesha Athar, Sonal Patel, Adam Steiner

National Science Foundation Fellowship

Elizabeth Beckett, Steven Brown, Aimee Hubble, Jeffrey Katalenich

Natural Sciences and Engineering Research Council of Canada

Eva Sunny

Nuclear Regulatory Commission Fellowship

Andrew Bielen, Adam Kraus, Bryan Toth, Andrew Ward, Diana Woodyatt

Rackham Barbour Fellowship

Shikha Prasad

Rackham Engineering Award Fellowship

David Yager-Elorriaga

Rackham Graduate Student Research Grant

Will Schumaker, Jeffrey Katalenich

Rackham Pre-Doctoral Fellowship

Geehyun Kim, Bradley Sommers

Rackham Presidential Scholarship

Peng Zhang, Blake Kelley

Society of Women Engineers

Elizabeth Beckett, Alexis Kaplan

U.S. Department of Energy Computational Science Graduate Fellowship

Travis Trahan

U.S. Department of Energy Forensics Fellowship

Jennifer Dolan, Alexis Kaplan, Eric Miller

U.S. Department of Energy Nuclear Energy University Program

Tim Drzewiecki, Seth Johnson, Christopher Perfetti, Bruce Pierson, Aaron Wysocki

U.S. Department of Energy National Nuclear Security Administration Stewardship Science Graduate Fellowship

Mark Norsworthy, Thomas Saller, Zachary Whetstone

U.S. Department of Defense National Defense Science and Engineering Fellowship

Aimee Hubble, Jeffrey Katalenich

U.S. Department of Defense Science, Mathematics, and Research for Transformation Scholarship

Matt Orians, Adam Nelson

## **Graduate Honors and Awards for 2011-2012**

College of Engineering Distinguished Achievement Award

Brendan Kochunas

College of Engineering Distinguished Leadership Award

Yvan “Andy” Boucher, Stephen Raiman

2011 COE Symposium Session Winners

Jeffrey Katalenich (1<sup>st</sup>); Matt Weiss, Wei Tian (2<sup>nd</sup>)

IEEE Nuclear and Plasma Sciences Society Graduate Scholarship Award

Peng Zhang

INMM Award: J.D. Williams Student Paper Award (2<sup>nd</sup> place)

Eric Miller

Korean Language Outstanding Student Achievement Award

Tiberius Moran

Korean Language Outstanding Student Achievement Award (LSA)

Tiberius Moran

NERS Special Recognition for Service to the Department

Douglas Fynan

NPSS 2012 Graduate Scholarship Award

Peng Zhang

Rackham Graduate Lipschutz, Ayers Host, and Olcott Smith Award

Jennifer L. Dolan

Rackham Presidential Award

Blake Kelly, Peng Zhang

Towner Prize for Outstanding PhD Research

Peng Zhang

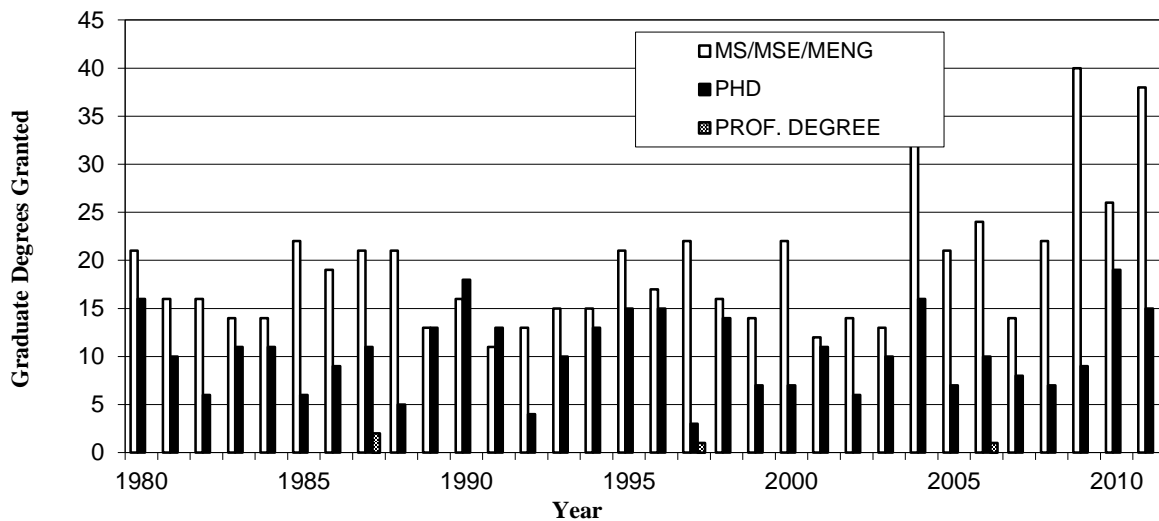
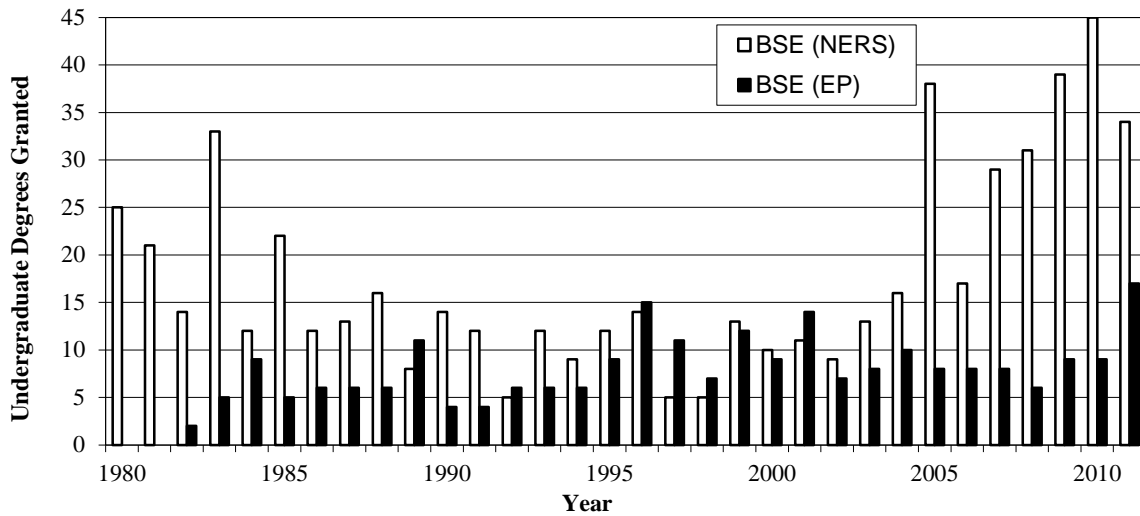


# DEGREES AWARDED BY ACADEMIC YEAR

September 2011 – August 2012

Degree	Number
BSE in Nuclear Engineering and Radiological Sciences	34
BSE in Engineering Physics	17
MSE and MS in Nuclear Engineering and Radiological Sciences*	42
PhD in Nuclear Engineering and Radiological Sciences, Nuclear Science	15
Professional Degree (Nuclear Engineer)	0

\*13 students continuing in doctoral program



## DOCTORAL THESES TITLES

***For Degrees Conferred September 2011 – August 2012***

Name	Thesis Title	Advisor
Stephen Asbury	Multi-Grid Genetic Algorithms for Optimal Radiation Shield Design	James P. Holloway
Eric Gillman	Cathode-spot ejected ceramic powder resulting in plasma electron depletion and applications for communications blackout mitigation	John E. Foster
Manhee Jeong	Delay-Line 3D Position Sensitive Radiation Detection	David K. Wehe
Seth Johnson	Anisotropic Diffusion Approximations for Time-dependent Particle Transport	Edward Larsen
William "Willy" Kaye	Energy and Position Reconstruction in Pixelated CdZnTe Detectors	Zhong He
Adrienne Lehnert	A Flag-Based Algorithm for Explosives Detection in Sea-Land Cargo Containers using Active Neutron Interrogation	Kimberlee Kearfott
Eric Miller	Fissile Material Characterization with Time-Correlated Pulse-Height Analysis	Sara Pozzi
Christopher Perfetti	Advanced Monte Carlo Methods for Eigenvalue Sensitivity Coefficient Calculations	William R. Martin
Janelle Penisten Wharry	The mechanism of radiation-induced segregation in ferritic-martensitic alloys	Gary Was
Shikha Prasad	Variance Reduction with MCNPX-PoliMi	Sara Pozzi Edward Larsen
Miesher Rodrigues	High-Flux Experiments and Simulations of Pulse-Mode Position-Sensitive CdZnTe Pixelated Detectors	Zhong He
Nicholas Touran	A Modal Expansion Equilibrium Cycle Perturbation Method for Optimizing High Burnup Fast Reactors	John C. Lee
Andrew Ward	A Newton-Krylov Solution to the Coupled Neutronics-Porous Medium Equations	Thomas Downar
Brandon Weatherford	Development and Study of an Electron Cyclotron Resonance Waveguide Plasma Cathode for Electric Propulsion Applications	John E. Foster
Yuefeng Zhu	Digital Signal Processing Methods for Pixelated 3-D Position Sensitive Room-Temperature Semiconductor Detectors	Zhong He

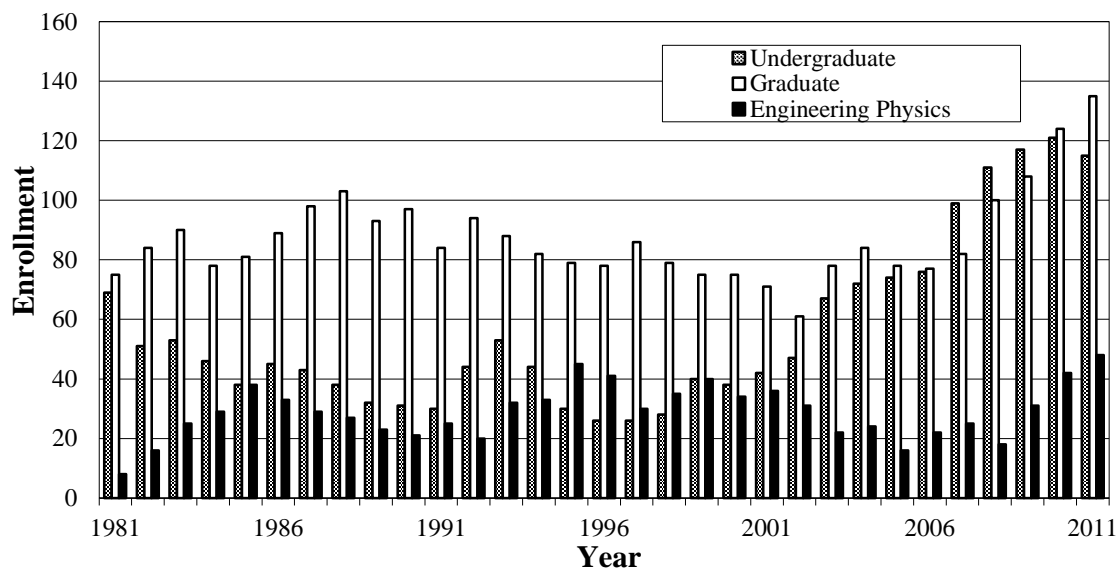
**Theses in Progress September 2012-August 2013**

<b>Name</b>	<b>Thesis Title</b>	<b>Advisor</b>
Yvan "Andy" Boucher	Analysis of CdZnTe Detector Performance for Improving the Polaris System	Zhong He
Paul Cummings	Computational Methods for Simulating Synchrotron-Like Radiation Generation in Laser-Wakefield-Acceleration Experiments	Karl Krushelnick Alexander Thomas
Jennifer Dolan	Development of a Measurement System to Safeguard Fissile Material with Fast Neutron Detection Multiplicity Counting	Sara Pozzi
Timothy Drzewiecki	Adjoint Based Uncertainty Quantification for the Operational and Transient Simulation in HTGRs	Thomas Downar
Adam Hoffman	The Application of Method of Characteristics to the Time-Dependent Neutron Transport Equation	John C. Lee
Aimee (Covert) Hubble	Experimental and Computational Assessment of Plasma Transport through Magnetic Cusps	John E. Foster
Jeffrey Katalenich	Fabrication and Characterization of Microspheres in a Tungsten Matrix for Space Nuclear Power Applications	Michael Hartman
Blake Kelley	A Consistent 2D/1D Approximation of the 3D Boltzmann Equation: Analysis and Implementation	Thomas Downar
Brendan Kochunas	A Multiple-Grid Parallel Algorithm for the 3-D Method of Characteristics Solution of the Boltzmann Transport Equation	Edward Larsen Thomas Downar
Tiberius Moran	Modeling Turbulent Radiative Shocks with Applications to High-Energy-Density Physics and Astrophysics	James P. Holloway
Matt Orians	Low Power Thermal Reactor for Deep Space Probes	Michael Hartman
Lloyd Rhoads	Non-Linear Model Based Predictive Control of a HTGR Plant Coupled to a Hydrogen Production Facility	James P. Holloway
Will Schumaker	Pump-Probe Experiments Using a Laser Wakefield Accelerator	Karl Krushelnick Alexander Thomas
Eva Sunny	On-the-Fly Temperature-Dependent Resonance Scattering for Epithermal Neutrons in Monte Carlo Methods	William R. Martin
Crystal Thrall	Development of thallium-bromide for room temperature gamma-ray spectroscopy	Zhong He
Bryan Toth	Stochastic Properties of the Monte Carlo	William R. Martin

	Fission Source Iteration and Source Convergence Acceleration Using Linear Extrapolation	
Benjamin Yee	The energetics of a pulsed nanosecond discharge	John E. Foster
Peng Zhang	Effects of Surface Roughness on Electrical Contact, RF Heating and Field	YY Lau

## FALL ENROLLMENT

Year	Undergraduate	Graduate	Engineering Physics
1980	68	88	0
1981	69	75	8
1982	51	84	16
1983	53	90	25
1984	46	78	29
1985	38	81	38
1986	45	89	33
1987	43	98	29
1988	38	103	27
1989	32	93	23
1990	31	97	21
1991	30	84	25
1992	44	94	20
1993	53	88	32
1994	44	82	33
1995	30	79	45
1996	26	78	41
1997	26	86	30
1998	28	79	35
1999	40	75	40
2000	38	75	34
2001	42	71	36
2002	47	61	31
2003	67	78	22
2004	72	84	24
2005	74	78	16
2006	76	77	22
2007	99	82	25
2008	111	100	18
2009	117	108	31
2010	121	124	42
2011	115	135	35



# EMPLOYMENT STATISTICS AND CONTINUING EDUCATION

## Place of First Employment of Graduates September 2011 – August 2012

### Undergraduate Students

	<b>Employer</b>	<b>BSE Students</b>
	DTE Energy	David Collins
	Factset	Jill Newton
	General Electric	Lu Huang
	HUF Manufacturing	Wilson Pappo
	Norfolk Naval Shipyards	Yusuf Yanikoglu
	Nuclear Regulatory Commission	Heather Ploeg
	Peace Corps, Uganda	Hudson Rowland
	Scott Forge	Julia Brennan
	Employment Outside Profession	Ryan Grof
	Unknown	Marissa Mantey
		Alexander Briggs
		Shreyas Hirekhan
		Alexander Schwab
		Jejuan Toney

	<b>University</b>	<b>BSE Students</b>
	Brown University	Wenyan Yang
	City University of New York	William Mayer
	Clemson University	Amy Meldrum
	Columbia University	Rex Brown
	Drexel University	Abraham Lin
	MIT	Marc Lecerf
		Jeffrey Liu
		Mohammad Khalid
		Geoffrey Gunow
		Derek Lax
	Princeton University	Lee Gunderson
	Stanford University	Marc Jankowski
		Benjamin Isaacoff
		Yigong Zhang
		Nathan Golovich
		Jennifer Steers
		Scott Haselschwardt
		Nicholas Holmes
		Paul Stanfield
		Neil Arthur

University of Tennessee

University of Texas  
Other Graduate Schools

Timothy Burke  
Daniel Chudnow  
Edward Harvey  
Brian Lefevre  
Jacob Levy  
Matthew Marcatth  
Colin Nordman  
Adam Schutt  
Leonardi Tjayadi  
Tyler deVries-Wallace  
Congyi Li  
Erik Walker  
Jolly Spencer  
Adam Higuera  
Alexander McMillan  
Ryan Thorwarth  
Yiheng Luo

### Graduate Students

#### Employer

Bechtel  
  
Brazilian Navy  
  
Global Simulation Engineering Systems  
Huntington Ingalls  
International Atomic Energy Agency  
Japan Ground Self-Defense Force  
KAPL  
  
L-3 Communications  
  
Niowave, Inc  
Norfolk Naval Shipyard  
Nuclear Regulatory Commission  
Rensselaer Polytech Institute  
Returned to China  
Rolls Royce  
Sandia National Laboratory  
University of Michigan, NERS

US Navy NUPOC

#### Employer

Boise State University

#### MS/MSE Students

Navneet Gill  
Robert Steinbock  
Gustavo Brito Gibrail  
Odilon Rodrigues Filho  
Raymond Wang  
Benjamin Wu  
Bonita Goh  
Kiyotaka Ide  
Joseph Karbowski  
Kyle Kissoff  
Blake Griffin  
Paul Saunders  
Dyle Henning  
Andrew Patton  
Diana Woodyatt  
Andrew Pavlou  
Yi Liao  
Charles Cassidy  
Peter Subaiya  
Marc Becchetti  
Joseph Lelli  
Heeho Park  
Brian Wieger  
Brice Taylor

#### PhD Students

Janelle Penisten Wharry



India University  
Korean University  
Naval Research Laboratory  
Oak Ridge National Laboratory

Sandia National Laboratory  
TBD  
TerraPower  
TIBCO Software  
Toshiba Medical Research Institute  
University of Michigan, NERS  
University of Michigan, NERS/H2D

University of Washington

**University (Continuing PhD)**

North Carolina State University

Penn State University  
University of Michigan, NERS

University of New Mexico  
University of Tennessee-Knoxville

Shikha Prasad  
Manhee Jeong  
Eric Gillman  
Seth Johnson  
Christopher Perfetti  
Brandon Weatherford  
Eric Miller  
Nicholas Touran  
Stephen Asbury  
Miesher Rodrigues  
Andrew Ward  
William Kaye  
Yuefeng Zhu  
Adrienne Lehnert

**MS/MSE Students**

Jack Linkous  
Kyle Weinfurther  
Johnathon Koglin  
Cassarrah Brown  
Shyam Dwaraknath  
Sarah Nowak Gucker  
Michael Hamel  
Zhaohan He  
Bruce Pierson  
Alexis Poitrasson-Riviere  
Thomas Saller  
Adam Steiner  
Shane Stimpson  
Michael Vargas  
Matthew Weis  
Mitchell Young  
Erin Dughie  
Congyi Li

# INTERNSHIPS

## Undergraduate

Bryan Eyers	Argonne National Laboratory	IL
Klaus Fan	China Financial Futures Exchange	China
Darren Lim	DTE Energy	MI
David Collins	DTE Energy	MI
Jill Newton	DTE Energy	MI
Theresa Wilson	Entergy DC Cook Plant	MI
Wilson Pappo	General Electric	PA
Erik Walker	Knolls Atomic Power Laboratory	NY
Eric Welch	L-3 Communications	PA
Dylan Rittman	Los Alamos National Laboratory	NM
Matthew Marcath	Los Alamos National Laboratory	NM
Timothy Burke	Los Alamos National Laboratory	NM
Joseph Foy	Mathnasium	MI
Abraham Lin	NASA Glenn Research Center	GA
Marc Jankowski	Nava Solar	MI
Rianna Penn	Naval Research Laboratory	DC
Heather Ploeg	Norfolk Shipyards	VA
Hudson Rowland	Nuclear Regulatory Commission	IL
Carl Stanhope	Oklahoma State University REU Program	OK
Drew Johnson	Pacific Northwest National Laboratory	WA
Julia Brennan	Peace Corps	Uganda
Daniel Nunez	Pennsylvania State University REU Program	PA
Jacquelyn Wojewoda	Pennsylvania State University REU Program	PA
Marissa Mantey	Religious Community	GA
Geoffrey Gunow	Schlumberger	NJ
Andrew Winters	Schmude Oil Company	MI
Ryan Grof	Scott Forge	IL
Rachel Bielajew	Study Abroad-SJTU	China
Neil Herman	Study Abroad-SJTU	China
Justin Herter	Study Abroad	France
Teresa Tombelli	Study Abroad	France
David Cinquegrani	Study Abroad	Germany
Alexander McSpaden	Study Abroad	Germany
Alexis Schwerin	Study Abroad	Germany
Marisa Leney	Study Abroad	Spain
Daniel Chudnow	TerraPower	WA
Andrew Gahan	University of Michigan, CAEN	MI
Sheng Wang	University of Michigan, ME	MI
Aaron Graham	University of Michigan, NERS	MI
Alison Christopherson	University of Michigan, NERS	MI
Emily Cizmas	University of Michigan, NERS	MI
Jason von Ehr	University of Michigan, NERS (Downar)	MI
Jejuan Toney	University of Michigan, NERS (Ewing)	MI

Joshua Herzog	University of Michigan, NERS (Foster)	MI
Adam Schutt	University of Michigan, NERS (Gilgenbach)	MI
Mackenzie Roman	University of Michigan, NERS (Gilgenbach)	MI
Ryan Leon	University of Michigan, NERS (Gilgenbach)	MI
Shane Jurek	University of Michigan, NERS (Gilgenbach)	MI
Steven Exelby	University of Michigan, NERS (Gilgenbach)	MI
Aledoni Keci	University of Michigan, NERS (Hammig)	MI
Edward Harvey	University of Michigan, NERS (Hartman)	MI
Douglas Kripke	University of Michigan, NERS (Martin)	MI
Michael Mills	University of Michigan, Physics	MI
William Mayer	University of Michigan, Physics	MI
Ethan Stark	University of Michigan, Solid State Electronics Lab	MI
Molly Flynn	University of Michigan, Space Physics Research Lab	MI
Evan Noon	University of Michigan, SURE Program	MI
Chen Lu	University of Michigan, SURE Program (EECS)	MI
Matthew Warnez	University of Michigan, SURE Program (ME)	MI
Adam Berkovec	University of Michigan, SURE Program (NERS)	MI
Benjamin Baumgarten	University of Michigan, SURE Program (NERS)	MI
Brandon Lafleur	University of Michigan, SURE Program (NERS)	MI
Brian Lefevre	University of Michigan, SURE Program (NERS)	MI
David Goodman	University of Michigan, SURE Program (NERS)	MI
Derek Lax	University of Michigan, SURE Program (NERS)	MI
Linyu Lin	University of Michigan, SURE Program (NERS)	MI
Matthew Scarpelli	University of Michigan, SURE Program (NERS)	MI
Michael Jarrett	University of Michigan, SURE Program (NERS)	MI
Yuan Gao	University of Michigan, SURE Program (NERS)	MI
Benjamin Isaacoff	University of Michigan, Physics	MI
Brett Hasson	US Navy	
Jonathan Buday	US Navy	
Morris Cramer	US Navy	CT
Cameron Miller	Westinghouse	PA
Alexandra Niska Burja	Xcel Energy Monticello Nuclear Generating Plant	MN

## Graduate

Argonne National Laboratory	Akshay Dave
	Adam Kraus
DTE Energy	Colin Nordsman
Idaho National Laboratory	Michael Rose
L-3 Communications	Ian Rittersdorf
Lawrence Livermore National Laboratory	Johnathon Koglin
	Jack Linkous
Los Alamos National Laboratory	Benjamin Betzler
	Eric Baker
	Sean Carney
	Alexis Kaplan
	Daniel Walter
NASA Glenn Research Center	Benjamin Yee

Oak Ridge National Laboratory

Sandia National Laboratory

Westinghouse

Yuxuan Liu

Mitchell Young

Ayesha Athar

Thomas Saller

Kyle Weinfurther

Matthew Weis

Dana Miranda

## EMPLOYMENT PATTERNS OF GRADUATES

### *New Graduates: September 2011 – August 2012*

	BS	MS/MSE	PhD
<b>Federal Government</b>			
Department of Defense			
Naval Research Laboratory			1
Norfolk Naval Shipyard	1	1	
US Navy NUPOC Program		1	
Department of Energy			
Knolls Atomic Power Laboratory		2	
Oak Ridge National Laboratory			2
Sandia National Laboratory		1	1
Nuclear Regulatory Commission	1	1	
<b>Electrical and Nuclear Utilities</b>			
DTE Energy	2		
<b>Nuclear Reactor Manufacturers</b>			
Bechtel		2	
General Electric	1		
<b>Consulting Firms</b>			
<b>Entrepreneurial</b>	1		
H2D			1
<b>Other Industrial and Medical Organizations</b>			
Factset	1		
Global Simulation Engineering		1	
HUF Manufacturing	1		
Huntington Ingalls		1	
L-3 Communications		2	
Niowave, Inc		1	
Scott Forge	1		
TerraPower			1
TIBCO Software			1
Toshiba Medical Research Institute			1
University of Washington Medical School			1
<b>Foreign Governments</b>			
Academic Institution: Grad, Post Doc, and Faculty			2
International Atomic Energy Agency		1	
Military		3	
<b>Academic Institutions: Grad, Post Doc, and Faculty</b>			
Boise State University			1
Brown University	1		
City University of New York	1		
Clemson University	1		

Columbia University	1		
Drexel University	1		
MIT	5		
North Carolina State University		2	
Pennsylvania State University		1	
Princeton University	1		
Rensselaer Polytech Institute		1	
Stanford University	2		
University of California-Berkeley	1		
University of California-Davis	1		
University of California-Los Angeles	1		
University of California-Santa Barbara	1		
University of Michigan, AERO	1		
University of Michigan, EECS	1		
University of Michigan, NERS	11	17	2
University of New Mexico		1	
University of Tennessee	2	1	
University of Texas	1		
Unknown Graduate Schools	4		
<b>Employment Outside the Profession</b>	2	1	
<b>Returned to Home Country and Unknown</b>	4	1	1
<b>TOTALS</b>	51	42	15

### *42-Year Summary: September 1970 – August 2012*

	BS	MS	M ENG	PhD	Pro
<b>Federal Government</b>					
Armed Forces	68	23	1	8	
Civilian Employees	6	3		17	
Department of Commerce				7	
Department of Defense		1			
Department of Energy	12	55	4	117	
Department of Transportation				2	
Environmental Protection Agency			2		
NASA		1			
Nuclear Regulatory Commission	1	6	1		1
Waste Management Federal Services		1			
<b>Electrical and Nuclear Utilities</b>	90	49	1	9	
<b>Nuclear Reactor Manufacturers</b>	45	53		21	1
<b>Architecture-Engineering Firms</b>	19	29	1	5	
<b>Consulting Firms</b>	10	7	6	12	

<b>Entrepreneurial</b>	2			1	
<b>Other Industrial and Medical Organizations</b>	34	53	5	66	
<b>Foreign Governments</b>	1	20	3	15	4
<b>Academic Institutions</b>					
Faculty and Staff	7	11	2	63	
Graduate Schools and Post Doctorate Work	482	428	10	58	
<b>Employment Outside the Profession</b>	19	11		2	
<b>Returned to Home Country and Unknown</b>	119	50	7	34	3
<b>Fulbright Award</b>	1				
<b>TOTALS</b>	915	795	42	432	9

DATE	SPEAKER	TITLE
Sept. 9	Ron Gilgenbach University of Michigan, NERS	Department Welcome
Sept. 26	Wataru Mizumachi Information System on Occupational Exposure Committee	The Nuclear Renaissance and Lessons Learned from the Fukushima Daiichi Nuclear Power Plant Accidents
Sept. 23	Ju Li Massachusetts Institute of Technology	Plumbers Wonderland Found on Graphene (Richard K. Osborn Lecture – Stamps Auditorium – Joint Colloquium with MSE)
Sept. 30	Y.Y. Lau University of Michigan, NERS	Effects of Surface Roughness on Electrical Contact, RF Heating, and Field Enhancement
Oct. 6	Tom Sutton Knolls Atomic Power Laboratory	Progress in the Usage of Monte Carlo for Reactor Design and Analysis
Oct. 14	No Colloquium	Fall Study Break
Oct. 21	Shripad Revankar Purdue University	Safety Analysis of Coupled HTR and Chemical Processing Plants
Oct. 28	John Kelly Deputy Assistant Secretary, DOE	Department of Energy Nuclear Energy R&D Roadmap (NERS Alumni Society Merit Award)
Nov. 4	Bob Hill Argonne National Laboratory	U.S. Nuclear Fuel Cycle Research Development
Nov. 11	Fausto Franceshini Westinghouse	The Nuclear Fuel Cycle – Research and Development at Westinghouse
Nov. 25	No Colloquium	Thanksgiving Recess
Dec. 2	Rico Chandra Arktis Radiation Detectors, CERN	He-4 Scintillation Detectors for Security Applications
Dec. 9	Lee Mason NASA Glenn Research Center	Nuclear Reactors for Space Power and Propulsion



<b>DATE</b>	<b>SPEAKER</b>	<b>TITLE</b>
Jan. 20	Former Students: Yuni Dewaraja, Siaka Yusuf, and Ram Venkataraman	Tribute to Ron Fleming
Feb. 10	Rick Wright Westinghouse	The Westinghouse Small Modular Reactor
Feb 17	Josh Jarrell Oak Ridge National Laboratory	Overview of the ORNL code DENOVO, Adaptive Quadrature Methods
Feb. 24	NERS Grad Students	To Be Determined
Mar. 2	No Colloquium	Winter Break
Mar. 9	NERS Faculty	Prospective Graduate Visits
Mar. 16	Brandon Blackburn Raytheon	Topic: Active Interrogation
Mar. 23	NERS Faculty	Prospective Graduate Visits
Mar. 30	Louise Willingale UM NERS, CUOS	Experiments Using the High Intensity OMEGA EP Laser System
Apr. 13	Clair Sullivan Central Intelligence Agency	Low-Resolution Gamma-Ray Spectroscopy with Wavelet Analysis

# Research Activities

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## FISSION SYSTEMS AND RADIATION TRANSPORT

### **“PARCS Code Development for LWR”**

PI: Thomas Downar

Sponsor: Nuclear Regulatory Commission

\$440,000/2011

### **“HTR Development of PARCS Code”**

PI: Thomas Downar

Sponsor: Nuclear Regulatory Commission

\$290,000/2011

### **“HTR Methods Development”**

PI: Thomas Downar

Sponsor: Department of Energy, Nuclear Engineering University Program (NEUP)

\$180,000/2011

### **“RBWR Transient Analysis”**

PI: Thomas Downar

Sponsor: Department of Energy, Nuclear Engineering University Program (NEUP)

\$103,000/2011

### **“RBWR Thorium Fuel Cycle”**

PI: Thomas Downar

Sponsor: Department of Energy, Nuclear Engineering University Program (NEUP)

\$93,000/2011

### **“Cross Section Methods Development”**

PI: Thomas Downar

Sponsor: Oak Ridge National Laboratory

\$80,000/2011

**“Multiphysics Code Integration (VRI)”**

PI: Thomas Downar

Sponsor: CASL

\$140,000/2011

**“Transport Methods (RTM)”**

PI: Thomas Downar

Sponsor: CASL

\$240,000/2011

**“High Fidelity Code Calculations (AMA)”**

PI: Thomas Downar

Sponsor: CASL

\$75,000/2011

**“Advanced LWR Methods Development”**

Co-PI: Thomas Downar

Sponsor: Department of Energy, NEUP

\$90,000/2011

**“Multi-scale Multi-physics Methods Development for the Calculation of Hot-spots in the NGNP”**

PI: Thomas Downar, Co-PI: William Martin

Sponsor: Department of Energy, NEUP

\$447,000; 10/1/2009 – 9/30/2012

**“Hybrid Monte Carlo/Deterministic Radiation Transport Simulations for Source-Detector Problems”**

PI: Edward Larsen

Sponsor: Department of Energy

\$320,000; 9/1/2009 – 8/31/2012

The technical goal of this project is to develop and implement new hybrid Monte Carlo/Deterministic methods in the commercial ATTILA (neutron/photon) transport code, so that this code can better simulate radiation detection problems of interest for homeland security problems.

**“A New 2D-Transport 1D-Diffusion Approximation of the Boltzmann Transport Equation”**

PI: Edward Larsen, Co-PI: Thomas Downar

Sponsor: Department of Energy

\$391,000; 10/2009 – 9/2012

The technical goals of this project are to develop (i) an improved theoretical understanding of the current 2D/1D method in the DECART code, which is employed for the simulation of high temperature reactors, and (ii) to develop and implement an improved version of this method that will enable DECART to consistently simulate realistic 3-D neutron transport problems.

**“The Suppression of Energy Discretization Errors in Multigroup Transport Calculations”**

PI: Edward Larsen, Co-PI: William Martin

Sponsor: Department of Energy

\$483,000; 10/2009 – 9/2012

The technical goal of this project is to develop an efficient numerical algorithm for performing multigroup discrete ordinates calculations for multigroup problems containing thousands of energy groups. We are pursuing this goal by applying multigrid techniques, which were developed in the mathematical community for elliptic problems.

**“Creation of a Full-Core HTR Benchmark with the Fort St. Vrain Initial Core and Validation of the DHF Method with Helios for NGNP Configurations”**

Co-PI: William Martin, John Lee

Sponsor: Department of Energy, Nuclear Engineering University Program (NEUP)

\$421,288; 10/1/2009 – 12/31/2011

This project has developed benchmark computer models based on the physics test data from the Fort St. Vrain high-temperature gas-cooled reactor. The calculations included coupled MCNP5/RELAP5-3D simulations at rated power and MCNP5 simulations of pulsed neutron experiments at zero power.

B. R. Betzler, E. E. Sunny, J. C. Lee, W. R. Martin, “Coupled Nuclear-Thermal-Hydraulic Calculations for Fort St. Vrain Reactor,” Proc. 14<sup>th</sup> International Topical Meeting on Nuclear Reactor Thermalhydraulics (NURETH-14), September 25-29, 2011, Toronto, Canada.

**“Bayesian Network for Reliability Analysis of Dynamical Systems”**

PI: John Lee

Sponsor: Idaho National Laboratory

\$44,941; 1/13/2011 – 9/30/2011 (Part II)

This project developed a new approach to develop efficient surrogate formulations via the alternating conditional expectation (ACE) algorithm for accident management procedures involving a feel-and-bleed operation. The project demonstrated the feasibility of representing complex time-dependent nonlinear simulations with simple ACE surrogates and macroscopic balance statements.

A. Varuttamaseni, J.C. Lee, R.W. Youngblood, "Bayesian Network Representing System Dynamics in Risk Analysis of Nuclear Systems," *Proc. ANS PSA 2011 International Topical Meeting on Probabilistic Safety Assessment and Analysis* (2011).

**"Implementation of On-the-Fly Doppler Broadening in MCNP5 for Multiphysics Simulation of Nuclear Reactors"**

PI: William Martin, Co-PI: John Lee

Sponsor: Department of Energy, Nuclear Engineering University Program (NEUP)

\$203,000/year; 7/29/2010 – 7/29/2012

G. Yesilyurt and W.R. Martin, "On-the-Fly Doppler Broadening for Monte Carlo Codes," accepted for publication in *Nuclear Science and Engineering* (2011).

**"CASL – Energy Innovation Hub for Nuclear Energy Modeling and Simulation"**

PI: William Martin, Co-PI: Thomas Downar, Ed Larsen, John Lee, Annalisa Manera, Gary Was

Sponsor: Department of Energy, Subcontract through ORNL

\$1,700,000/year; 7/1/2010 – 6/30/2015

A. Hoffman, B. Kochunas, J. C. Lee, "Parallelized Adaptive Time Stepping Using the Step Doubling Method in DeCart," to be presented at the American Nuclear Society Conference, June 2011.

W.R. Martin, "Challenges and Prospects for Whole-Core Monte Carlo Analysis," *Nucl. Eng. Tech.* 44, March 2012.

# MATERIALS

## **“Structure, properties and relaxation of shear bands in metallic glasses”**

PI: M. Atzmon

Sponsor: National Science Foundation, Division of Materials Research

\$426,898; 7/1/2006 – 6/30/2011

In crystalline solids, the atomic scale structure has been understood for a long time. On the other hand, the structure of some nonequilibrium materials is still the subject of current research. In amorphous materials, the density is variable and is a function of the thermomechanical history. Structural relaxation has a significant effect on the properties. Since mechanical deformation introduces shear bands whose density is lower than that of the matrix, it is important to understand their structure and effect on mechanical and transport properties. In recent work, the anelastic deformation of metallic glasses has been used to characterize defects produced by permanent deformation. One significant result is the existence of at least four distinct types of anelastic sites, in contrast to the two types generally-assumed in the glass-science community.

## **“Nuclear Forensics Junior Faculty Award Program”**

PI: Mike Hartman

Sponsor: Department of Homeland Security

\$375,000; 8/1/2010 – 7/31/2013

## **“Nanostructure patterning under energetic particle irradiation”**

PI: Lumin Wang

Sponsor: Department of Energy, Office of Basic Energy Sciences

\$1,198,229; Sept. 2002 – Nov. 2011

\$180,000; One year addition

## **“Evaluation of Materials for Interim Storage of Used Fuel for More than 100 Years”**

PI: Lumin Wang, Co-PI: Mike Hartman

Sponsor: Department of Energy, Nuclear Engineering University Program (NEUP)

\$931,603; 9/1/2010 – 8/31/2013

## **“China Energy Team Project”**

PI: Lumin Wang

Sponsor: University of Michigan GIEU

\$49,600; Oct. 2010 – Aug. 2011

**“Particle-induced Modification of Complex Ceramics”**

PI: Rodney Ewing, Co-PI: Lumin Wang

Sponsor: Department of Energy, Basic Energy Sciences

\$850,000; 2/1/2008 – 1/31/2011

**“Localized Deformation and Intergranular Fracture of Irradiated Alloys under Extreme Environmental Conditions”**

PI: Gary Was

Sponsor: Department of Energy, Basic Energy Sciences

\$844,000; 3 years

**“Ion Irradiation-Induced Degradation of Reactor Structural Materials”**

PI: Gary Was

Sponsor: Institute for Nuclear Safety Systems

\$150,000; 3 years

**“Cladding and Materials for Advanced Nuclear Energy Systems”**

PI: Gary Was

Sponsor: EPRI

\$600,000; 3 years

**“Identifying Mechanisms and Mitigation Strategies for Irradiation Assisted Stress Corrosion Cracking of Austenitic Steels in LWR Core Components”**

PI: Gary Was

Sponsor: Department of Energy, EPRI

\$2,400,000; 5 years

**“Radiation-Induced Segregation and Phase Stability in Candidate Alloys for the Advanced Burner Reactor”**

PI: Gary Was

Sponsor: Department of Energy, Office of Nuclear Energy, Science and Technology NERI

\$750,000; 3 years

The primary objective of this project is to investigate the effect of irradiation on the segregation and phase stability in candidate alloys proposed for application as structural materials for transmutation in the advanced burner reactor. The project will focus on two ferritic-martensitic alloys, and will also include an experimental ODS alloy and an advanced austenitic alloy in a coordinated experimental and modeling effort to investigate the complex electronic-magnetic-elastic interactions between Cr and radiation induced defects controlling radiation induced segregation in F-M alloys. This project will provide a mechanistic understanding of segregation and phase stability that can be used to develop predictive irradiation performance models. It will also provide data, against which forthcoming in-reactor irradiations can be interpreted and understood, as well as guidance and direction for those experiments.

This proposal is centered on the two F-M alloys; T91 and HT-9 as both are viable candidates for the ABTR and form the basis for more advanced alloys for the ABR, and will focus on Cr RIS and phase stability in these alloys under irradiation, as these are potentially limiting processes for their application. However, the full, irradiated microstructure needs to be considered as the radiation effects processes are interrelated. Also included in the work scope is a ferritic ODS alloy because of its superior irradiated microstructure stability and strength. In addition, an advanced austenitic alloy, D9, is included because it is the leading austenitic alloy, and yet it potentially can suffer from RIS (of Si) and the formation of deleterious phases (silicides) that could affect performance. Experiments will be conducted by proton and heavy ion irradiation over the dose range 3-1000 dpa and the temperature range 350-550°C with the inclusion of He at the highest doses. Analysis of RIS, phase microstructure, dislocation microstructure, and hardening will be conducted on all conditions to provide a systematic set of data.

The modeling tasks will involve ab-initio electronic structure calculations to investigate the configuration-dependent binding and migration energies of Cr with vacancy and interstitial defects, including small clusters. These values will enable development of atomistic-based kinetic Monte Carlo models similar to those employed previously to evaluate He diffusion in Fe and specifically designed to investigate the Cr diffusivity by interstitial and vacancy mechanisms. The RIS tendencies of Cr in F-M alloys will be predicted as a function of temperature and dose, based on migration mechanisms and energies obtained from ab-initio calculations. The outcomes of this modeling task will be mechanistic interpretation of the complex Cr RIS behavior, and key diffusional parameters for both continuum level rate theory models and the development predictive RIS models of Cr and Si in F-M alloys.

The combined experimental-modeling program is designed to provide a set of data on the behavior of RIS, phase microstructure, dislocation microstructure, and hardening as a function of dose and temperature in the range 350-550°C and 3-100 dpa. This data will be used to benchmark RIS and dislocation microstructure models developed from ab-initio electronic structure calculations and extended to kinetic Monte Carlo and continuum rate theory (MIK) models.

#### **“Potential for Atom Probe Tomography in Understanding IASCC”**

PI: Gary Was, Co-PI: Z. Jiao

Sponsor: Electric Power Research Institute (EPRI)



\$253,000; 2.5 years

Irradiation assisted stress corrosion cracking (IASCC) refers to intergranular stress corrosion cracking (IGSCC) that is enhanced or accelerated by irradiation over the unirradiated state in light water reactor core components. IASCC has been a problem in the nuclear industry for over 30 years. It is the primary form of core component cracking in boiling water reactors (BWR). It is also an issue of growing importance in pressurized water reactors (PWR). It is probably the most severe potential problem in the supercritical water reactor concept of the DOE Generation IV program. An understanding of the mechanism of IASCC is required in order to provide guidance for the development of mitigation strategies in all these reactors

Conventional tools such as SEM, TEM, AES, etc. have proved very useful in studying IASCC mechanism within their limitations. Atom probe field-ion microscope (AP-FIM) was proposed in the study of the interaction of impurity atoms with defects in the late 1970's. Since then, atom probe has emerged as a complementary tool in studying nuclear structural materials, especially in the field of radiation induced segregation (RIS). Early atom probes are very limited by their design and data collection and processing power. In recent years, atom probes have been improved significantly. Data collection and processing are no longer a bottleneck with modern computers. A large volume of atoms on the order of  $10^5 \text{ nm}^3$  can be analyzed in a significantly short time. The application of atom probe as a complementary tool in the study of IASCC mechanism becomes more practical and important.

The objective of this project is to explore the potential of atom probe tomography (APT) as a tool for understanding the mechanism of irradiation assisted stress corrosion cracking of austenitic alloys in light water reactor core components.

#### **“Sodium Compatibility for Advanced Reactor Materials”**

PI: Gary Was

Sponsor: Department of Energy, Oak Ridge National Laboratory

\$225,000; 2 years

#### **“Crack-tip Mechanisms Driving Environmental Degradation”**

PI: Gary Was

Sponsor: Department of Energy, Basic Energy Sciences

\$1,500,000 (\$527,000 to UM); 4 years

#### **“Corrosion and Creep of Candidate Alloys in High Temperature He and Steam Environments”**

PI: Gary Was

Sponsor: Department of Energy, Nuclear Energy University Programs

\$747,500; 3 years

**“Aging and Embrittlement of High Fluence Stainless Steel”**

PI: Gary Was, Co-PI: Z. Jiao

Sponsor: NNSA

\$500,000; 2 years

**“Mitigation Strategies for IASCC Using PIA”**

PI: Gary Was, Co-PI: Zhijie Jiao

Sponsor: Electric Power Research Institute

\$400,000; 4 years

**“Localized Deformation and IASCC”**

PI: Gary Was, Co-PI: Zhijie Jiao

Sponsor: Electric Power Research Institute

\$280,000; 3 years

**“Factor of Improvement in IGSCC of Alloy 690 over Alloy 600”**

PI: Gary Was, Co-PI: Zhijie Jiao

Sponsor: Electric Power Research Institute

\$260,000; 3 years

**“Acquisition of a 3 MV Accelerator for Radiation Damage Studies”**

PI: Gary Was

Sponsor: Department of Energy, NEUP

\$900,000; 2.5 years

**“Irradiation Accelerated Corrosion”**

PI: Gary Was

Sponsor: Department of Energy, NEUP, MAI

\$1,600,000; 3 years

**“Structural Materials for Fast Reactors”**

PI: Gary Was

Sponsor: Department of Energy, NEUP

\$1,100,000; 3 years

**“Irradiation Creep of Pyrolytic Carbon”**

PI: Gary Was

Sponsor: INL

\$80,000; 1 year

## PLASMAS AND FUSION

**“An investigation of plasma formation in electromechanically driven free bubbles at resonance in water with applications for the treatment of contaminated water”**

PI: John Foster

Sponsor: National Science Foundation

\$288,000; 9/1/2010 – 8/31/2013

Sponsor: National Science Foundation, REU Supplement

\$6810; 5/1/2011 – 4/30/2012

**“Blackout Mitigation Via Cathode Spot Ejection of Ceramic Quenchant Particulate”**

PI: John Foster

Sponsor: NASA

\$30,000; 5/1/2011 – 4/30/2012

**“High Power High Thrust Ion Thruster”**

PI: John Foster

Sponsor: NASA, EDA

\$199,681; 4/25/2011 – 4/24/2013

**“Water Purification by High Voltage, Nanosecond Plasma”**

PI: John Foster

Sponsor: NASA

\$2000; 8/27/2010 – 12/31/2012

**“Non-intrusive Measurement of Electric Field in Pulsed Nanosecond Discharge for Plasma-aided Combustion”**

PI: John Foster

Sponsor: NASA

\$90,000; 6/8/2009 – 6/8/2012

**“Annular Geometry Ion Engine Discharge Chamber Analysis”**

PI: John Foster

Sponsor: NASA, Aerojet Corporation

\$147,429; 10/1/2011 – 9/30/2012

**“Advanced space water purification and recycling using nonthermal plasmas”**

PI: John Foster

Sponsor: NASA

\$99,767; 9/1/2012 – 8/31/2013

**“Towards plasma purification of wastewater via and underwater DBD”**

PI: John Foster

Sponsor: WERF

\$100,000; 1/1/2012 – 1/12/2013

**“Theoretical and Experimental Investigation of Microwave Plasma Streamers: Structures and Control”**

PI: Natalia Babaeva (EECS), Co-PI: John Foster

\$583,259; 5/1/2012 – 4/30/2015

**“Water purification by high voltage, nanosecond plasma – Phase II”**

PI: Isaiah Blankson (NASA), Co-PI: John Foster

Sponsor: NASA

\$40,000; 4/15/2012 – 9/30/2013

**“Investigation of High Pressure Plasmas for Treatment of Porous Materials”**

PI: Mark Kushner, Co-PI: John Foster

Sponsor: 3M

\$145,000; 12/1/2009 – 12/1/2011

**“A Fusion Hybrid Reactor for Safe Large Power Production”**

PI: Terry Kammash, Co-PI: John Foster

Sponsor: TransPower Inc

\$993,839; 9/1/2012 – 8/31/2015

**“Recyclable transmission line experiments on a linear transformer driver”**

PI: Ron Gilgenbach, Co-PI: Y.Y. Lau, David Chalenski

Sponsor: Sandia National Laboratory

\$124,533; 4/1/2011 – 3/31/2012

**“Ultra-Short Pulse Laser for Advanced Cathodes and Windows for High Power Microwave Sources”**

PI: Ron Gilgenbach, Co-PI: John Foster  
Sponsor: Air Force Office of Scientific Research  
\$149,962; 9/1/2010 – 8/31/2011

**“Phase locking of COTS magnetrons”**

PI: Ron Gilgenbach, Co-PI: Y.Y. Lau  
Sponsor: Office of Naval Research/University of New Mexico  
\$460,000; 7/16/2009 – 7/15/2012

This project studies mode locking of high power microwave devices, in collaboration with the University of New Mexico.

D.H. Simon, Y.Y. Lau, J.W. Luginsland, R.M. Gilgenbach, “An unnoticed property of the cylindrical relativistic Brillouin flow,” *Phys. Plasmas* **19**, 043103 (2012).

**“Innovative Inverted Magnetron Experiment and Theory”**

PI: Ron Gilgenbach, Co-PI: Y.Y. Lau, John Foster  
Sponsor: AFOSR  
\$1,685,538; 4/1/2010 – 2/28/15

R.M. Gilgenbach, Y.Y. Lau, D.M. French, B.W. Hoff, M. Franzi, J.W. Luginsland, “Recirculating planar magnetrons for high-power high-frequency radiation generation,” *IEEE Trans. Plasma Sci.* **39**, 980 (2011).

D.H. Simon, Y.Y. Lau, J.W. Luginsland, R.M. Gilgenbach, “An unnoticed property of the cylindrical relativistic Brillouin flow,” *Phys. Plasmas* **19**, 043103 (2012).

**“Basic Studies of Distributed Discharge Limiters for Counter-HPM”**

PI: Ron Gilgenbach, Co-PI: Y.Y. Lau  
Sponsor: AFOSR Prime  
\$950,000; 3/1/2009 – 2/28/14

P. Zhang, Y.Y. Lau, R.M. Gilgenbach, “Thin film contact resistance with dissimilar materials,” *J. Appl. Phys.* **109**, 124910 (2011).

P. Zhang, Y.Y. Lau, M. Franzi, R.M. Gilgenbach, “Multipactor susceptibility on a dielectric with a biased dc electric field and a background gas,” *Phys. Plasmas* **18**, 053508 (2011).

K.L. Jensen, J. Lebowitz, Y.Y. Lau, J. Luginsland, "Space charge and quantum effects on electron emission," J. Appl. Phys. 111, 054917 (2012).

D. Chernin, I. Rittersdorf, Y.Y. Lau, T.A. Antonsen, B. Levush, "Effects of multiple internal reflections on the small signal gain and phase of a TWT," IEEE Trans. Electron Devices, in the press (2012).

P. Zhang, Y.Y. Lau, R.S. Timsit, "On the spreading resistance of thin film contacts," IEEE Trans. Electron Devices, in the press (2012).

P. Zhang, Y.Y. Lau, W. Tang, M.R. Gomez, D.M. French, J.C. Zier, R.M. Gilgenbach, "Contact Resistance with Dissimilar Materials: Bulk Contacts and Thin Film Contacts," Proc. Of the 57<sup>th</sup> IEEE Holm Conference on Electrical Contacts, paper no. 23, pp. 31-36 (2011).

**"Collimated fast neutron beam generation using intense laser plasma interactions"**

PI: Karl Krushelnick

Sponsor: Naval Research Laboratory, Office of Naval Research  
\$300,000; 2011

**"Active interrogation using radiation generated from intense laser produced electron beams"**

PI: Karl Krushelnick

Sponsor: National Science Foundation, DNDO  
\$1,835,000; 5 years

**"Collaborative Research: Graduate Student Training through Research on Plasma-based Acceleration at Laser Power Up to 300 TW"**

PI: Karl Krushelnick

Sponsor: National Science Foundation  
375,000; 5 years

**"Femtosecond Probing of Magnetic Fields Generated from Ultra-Intense Laser Plasma Interactions"**

PI: Karl Krushelnick

Sponsor: National Science Foundation, Department of Energy  
\$650,000; 3 years

**"Intense Laser Interactions with Low Density Plasmas Using OMEGA EP"**

PI: Karl Krushelnick

Sponsor: Department of Energy, NNSA  
\$380,000; 2 years

**“Generation of Miniature Hohlraum X-ray Sources Using Intense Lasers”**

PI: Karl Krushelnick, Co-PI: Alec Thomas  
Sponsor: Defense Threat Reduction Agency  
\$1,760,000; 1/1/2011 – 12/31/2015

**“Compact laser plasma source of spatially coherent x-rays”**

PI: Karl Krushelnick, Co-PI: Alec Thomas  
Sponsor: DARPA  
\$4,100,000; 6/1/2011 – 5/31/2015

**“Theoretical and Experimental Studies of Magneto-Rayleigh-Taylor Instability”**

PI: Y.Y. Lau, Co-PI: Ron Gilgenbach  
Sponsor: Department of Energy  
\$445,000; 8/15/2009 – 7/14/2012  
Sponsor: National Science Foundation  
\$15,000; 10/1/2009 – 9/30/2012

Studies the growth and stabilization of the Magneto Rayleigh Taylor instability of foil plasmas driven by 1-MA LTD recently built at the University of Michigan.

Y.Y. Lau, J.C. Zier, I.M. Rittersdorf, M.R. Weis, R.M. Gilgenbach, “Anisotropy and feedthrough in magneto-Rayleigh-Taylor instability,” *Phys. Rev. E* **83**, 066405 (2011).

J.C. Zier, R.M. Gilgenbach, D.A. Chalenski, Y.Y. Lau, D.M. French, M.R. Gomez, S.G. Patel, I.M. Rittersdorf, A.M. Steiner, M. Weis, P. Zhang, M. Mazarakis, M.E. Cuneo, M. Lopez, “Magneto-Rayleigh-Taylor instability,” *Phys. Plasmas* **19**, 032701 (2012).

P. Zhang, Y.Y. Lau, I.M. Rittersdorf, M.R. Weis, R.M. Gilgenbach, D. Chalenski, “Effects of magnetic shear on the Magneto-Rayleigh-Taylor instability,” *Phys. Plasmas* **19**, 022703 (2012).

Y.Y. Lau, R.M. Gilgenbach, J.C. Zier, D. Chalenski, D.M. French, M.R. Gomez, S.G. Patel, I.M. Rittersdorf, A. Steiner, M.R. Weis, P. Zhang, M. Mazarakis, M.E. Cuneo, M. Lopez, “Magneto-Rayleigh-Taylor instability: A general model and preliminary experiments,” *AIP Proc. of the Dense Z-Pinch (Biarritz, France, 2011)*, in the press.



**“Advanced RF sources based on nonlinear transmission lines”**

PI: Y.Y. Lau, Co-PI: Ron Gilgenbach

Sponsor: AFOSR

\$300,000; 7/1/2009 – 6/30/2012

**“Non-Linear Optics in Plasmas at Ultra-High Intensities”**

PI: Alec Thomas

Sponsor: National Science Foundation

\$500,000; 1/1/2010 – 12/31/2012

P. Cummings and A.G.R. Thomas, “A computational investigation of the impact of aberrated Gaussian laser pulses on electron beam properties in laser-wakefield acceleration experiments,” *Phys. Plasmas* **18**, 053110 (2011).

C.M. Huntington, A.G.R. Thomas, C. McGuffey, T. Matsuoka, V. Chvykov, G. Kalintchenko, S. Kneip, Z. Najmudin, C. Palmer, V. Yanovsky, A. Maksimchuk, R.P. Drake, T. Katsouleas, K. Krushelnick, “Current Filamentation Instability in Laser Wakefield Accelerators,” *Phys. Rev. Lett.* **106**, 105001 (2011).

**“CAREER: Bright femtosecond x- and y-ray pulse production using ultra intense lasers”**

PI: Alec Thomas

Sponsor: National Science Foundation

\$450,000; 10/1/2011 – 9/31/2016

**“AFOSR Young Investigator Program: Understanding intense laser interactions with solid density plasma”**

PI: Alec Thomas

Sponsor: Department of Defense, Air Force

\$373,603; 10/1/2012 – 9/31/2017

# RADIATION MEASUREMENTS AND IMAGING

## **“Digital 3-Dimensional Position-Sensitive Semiconductor Radiation Detectors”**

PI: Zhong He

Sponsor: Department of Energy, NA-22

\$900,000; 5/1/2010 – 4/30/2013

This project will develop digital acquisition systems for room temperature CZT and alternative semiconductor gamma-ray spectrometers.

## **“Target-Linked Radiation Imaging (TLRI)”**

PI: Zhong He

Sponsor: General Electric Company

\$517,279; 9/1/2009 – 7/26/2011

## **“Development of TlBr and InBr semiconductor gamma-ray spectrometers”**

PI: Zhong He

Sponsor: Domestic Nuclear Detection Office, Radiation Monitoring Devices

\$460,713; 9/22/2008 – 12/31/2011

This project will develop TlBr semiconductor gamma-ray spectrometers as an alternative wide band-gap semiconductor radiation detector due to its high stopping power, wide band-gap, and potentially lower manufacturing cost.

## **“Development of Integrated Real-Time Imaging and Isotope Detection Algorithms for 3-Dimensional Position-Sensitive Semiconductor Gamma-Ray Imaging Spectrometers and Sensor Networks”**

PI: Zhong He

Sponsor: National Science Foundation, DHS-DNDO

\$1,993,290; 9/1/2007 – 8/31/2012

The purpose of this project is to develop real-time gamma-ray imaging techniques and nuclear isotope detection algorithms for 3-D position-sensitive semiconductor imaging spectrometers and sensor networks.

## **“Development of High Resolution 3-Dimensional Position-Sensitive CdZnTe Gamma-Ray Spectrometers”**

PI: Zhong He

Sponsor: Department of Energy, NA-22

\$1,649,998; 9/15/2006 – 9/14/2012

The purpose of this project is to develop room-temperature CZT semiconductor gamma-ray spectrometers, with energy resolution of better than 1% at 662keV.

**“Detection of Shielded Uranium and Plutonium”**

PI: Zhong He

Sponsor: Department of Defense, DTRA

\$460,713; 7/1/2011 – 3/27/2012

Subcontract from Alion Science and Technology

Sponsor: Department of Defense, DTRA

\$5,268,788; 3/31/2006 – 8/31/2011

For more on Professor Zhong He's group, see website at: <http://czt-lab.engin.umich.edu>

**“Radiological Health Engineering Laboratory”**

PI: Kim Kearfott

Sponsor: University Research Opportunities Program (UROP)

\$3,500; 2010 – 2011

**“Science Fiction Movies and Radiation Health Effects”**

PI: Kim Kearfott

Sponsor: University Research Opportunities Program (UROP)

\$1,500; 2010 – 2011

**“Luminescent Self-reading Energy-sensitive Temporal Radiation Monitoring System (LuSEnT)”**

PI: Kim Kearfott

Sponsor: University of Michigan College of Engineering and Office of Technology Transfer

\$32,000; 2012

**“Basic Physics Data: Improved Fission Neutron Data base for Active interrogation of Actinides”**

PI: Sara Pozzi

Sponsor: Department of Energy, Office of Nuclear Energy, Nuclear Engineering University Program

\$690,000; 10/1/2009 – 9/30/2012

This three-year project proposes to build a team of four top universities and of one national laboratory to develop innovative neutron detection system for active interrogation measurements. Many active interrogation methods to detect fissionable material are based on the detection of neutrons from fission induced by fast neutrons or high-energy gamma rays. The energy spectrum of the fission neutrons provides data to identify the fissionable isotope(s) and materials such as shielding between the fissionable material and the detector. The challenges for making confident measurements are the detection of neutrons in the energy ranges of 0.01 – 1 MeV and above 8 MeV. These regions are also where the basic data on the neutron energy spectrum emitted from fission is the least well known. In addition, improvements in the specificity of neutron detectors are required throughout the complete energy range: they must be able to clearly distinguish neutrons from other radiations, in particular gamma rays and cosmic rays. We believe that all of these challenges can be addressed successfully with emerging technologies under development by this collaboration. In particular, the collaboration will address the area of fission neutron emission spectra for isotopes of interest in the advanced fuel cycle initiative.

**“New Detectors, Electronics, and Algorithms for Fast Neutron Spectroscopy in a Scalable Measurement Platform”**

PI: Sara Pozzi

Sponsor: Department of Homeland Security, Domestic Nuclear Detection Office, National Science Foundation

\$2,000,000; 5 years

In this project, novel neutron detection systems based on organic scintillators are being designed, evaluated, and delivered. The systems have the objective of preserving the incoming neutron energy information while maintaining high detection efficiency and allowing neutron/gamma ray discrimination. The information provided by this approach will (i) increase the sensitivity to shielded SNM and (ii) allow the system to differentiate among neutron sources of various types. The project is also helping to develop and train the much-needed next generation of nuclear scientists and engineers by engaging them in cutting-edge research activities.

**“Digital Waveform Sampling of Neutron and Gamma Ray Signals from Scintillators, Stewardship Science Academic Alliance Program”**

PI: Sara Pozzi, Co-PI: Marek Flaska, Shaun Clarke

Sponsor: Department of Energy, National Nuclear Security Administration

\$490,000; 3 years

The objective of the project is to develop and validate new techniques for pulse data analysis that will be used in neutron and gamma ray measurement systems based on the use of various scintillation detectors. A primary goal of the proposed work is to significantly extend the current pulse shape discrimination capabilities to neutron energies well below 1 MeV and perhaps as low as 100 keV. Specifically, the performance of various detection systems will be assessed by using fast waveform digitizers, and the efficiency of neutron and gamma ray detection and energy resolution will be evaluated using the state-of-the-art research facilities at the University of Michigan (UM) and at LANL’s

LANSCE facility. The measurement results will be used to validate Monte Carlo techniques for the simulation of these types of detectors, pioneered by our group at UM.

**“Development of a New Graduate Course in Nuclear Safeguards at the Department of Nuclear Engineering and Radiological Sciences at the University of Michigan”**

PI: Sara Pozzi

Sponsor: Department of Energy

\$139,000; 7/30/2009 – 12/31/2012

This project provides funding for 17 students from the Department of Nuclear Engineering and Radiological Sciences at the University of Michigan to travel to Oak Ridge National Laboratory for a week-long laboratory experience as a part of the course “Nuclear Safeguards.”

**“New University of Michigan Laboratory for Research and Teaching in Nuclear Nonproliferation”**

PI: Sara Pozzi

Sponsor: Department of Energy, NEUP

\$160,000; 9/1/2010 – 8/31/2011

This project provides funding to acquire the equipment for a dual imager developed at UM for neutron and gamma ray imaging of nuclear materials at standoff distances.

**“Digital Fast Neutron Detection System for Simultaneous Time Correlation and Spectrometry”**

PI: Sara Pozzi (UM)

Sponsor: Department of Energy, NNSA, NA-22

\$260,000; 11/2010 – 9/2012

Sandia National Laboratories and the University of Michigan are developing an instrument to acquire energy-dependent, time-correlation data. The instrument will use a liquid organic scintillator as the sensing medium and a high-speed, high-resolution digitizer for data acquisition. The instrument will record neutron detection events versus energy and time. The instrument will improve neutron diagnostic capabilities by enhancing characterization of fission chain reaction dynamics.

**“Mobile Stand-Off Radiation Detection System and Micro-Miniature Digital Gamma Spectroscopy System”**

PI: Sara Pozzi, Co-PI: Marek Flaska, Shaun Clarke

Sponsor: Department of Defense, Defense Threat Reduction Agency

\$830,000; 3 years

Measurements and simulations for a large standoff Compton camera based on scintillation detectors.

### **“A Multisensor Fusion Approach to the Solution of Inverse Radiation Transport Problems”**

PI: Sara Pozzi (UM)

Sponsor: Department of Energy, National Nuclear Security Administration, NA-22

\$285,000; 12/1/2008 – 9/30/2011

The MCNP-PoliMi code system has been used in the past to accurately predict the results of neutron multiplicity measurements using an active well coincidence counter. The goal of this project is to validate MCNP-PoliMi for passive neutron multiplicity analysis. Measurements of a weapons-grade plutonium sphere with various thicknesses of polyethylene shielding were performed at the Nevada Test Site by Sandia National Laboratories personnel, and are used in this project for code validation. The metric chosen for comparing the simulation to the measured data is the Feynman-Y, which characterizes the deviation of the neutron multiplicity distribution from a multiplying medium from that of a Poisson distribution.

### **“Measurement and Characterization of Nuclear Material at Idaho National Laboratory**

PI: Sara Pozzi (UM)

Sponsor: Department of Energy, National Nuclear Security Administration, NA-243

\$75,000; 1 year

### **“Neutron Interrogation for Fuel Cycle Measurements”**

PI: Sara Pozzi (UM), David Chichester (INL)

Sponsor: Department of Energy, NNSA NA

\$101,276; 1/2011 – 9/2011

### **“Energy-Angle Correlation in Spontaneous-and-Induced-Fission Neutron Emissions”**

PI: Sara Pozzi

Sponsor: Department of Energy, NA-22

\$900,000; 6/2011 – 6/2014

Fast and robust methods for detecting, identifying, and characterizing special nuclear material (SNM) are needed in many applications in the nonproliferation and safeguards areas. Fission is a unique nuclear reaction because it emits multiple neutrons with unique energy, angle, and multiplicity distributions. In the case of nuclear materials, such as uranium and plutonium, fission chains develop and the neutron multiplicity distributions can be used for the detection, identification, and characterization of the nuclear material. The development of new measurement systems of interest to the NA-22 mission relies on the use of robust Monte Carlo and deterministic codes for their simulation. The quality and reliability of the prediction of measurement scenarios is in turn directly related to the quality of the nuclear data.

**“Epithermal and Fast Neutron Detection System for Active and Passive Measurement Applications for National Security and Nuclear Energy”**

PI: Sara Pozzi

Sponsor: Department of Energy, Office of Science

\$188,000; 11/2011 – 11/2012

The project will develop a new measurement system, including detectors, electronics, and algorithms, for the measurement of neutrons in the epithermal and fast energy range. The system will be fully scalable and have application to measurements in both passive and active mode that are of interest to national security, nuclear safeguards, and various nuclear energy applications. For instance, the new system can be used to measure fission neutrons from spontaneous and induced fission reactions in various energy ranges. The University of Michigan and Los Alamos National Laboratory have an ongoing collaboration focused on providing much needed neutron energy spectra and multiplicity data for fission in isotopes such as U-235 and Pu-239. The proposed work will significantly expand the existing effort by including neutron detectors that are sensitive to neutrons in the epithermal energy region. The expanded effort will provide the community with a fully scalable measurement system that can be applied to a diverse set of scenarios, ranging from basic nuclear physics experiments to measure fission parameters such as neutron multiplicity and spectra, to nuclear energy applications where parameters from exotic nuclei are studied.

**“Liquid Scintillator Multiplicity Counter”**

PI: Sara Pozzi

Sponsor: Department of Energy, NNSA

\$110,000; 12/9/2011 – 9/30/2012

This research proposal is aimed at developing a liquid scintillator neutron multiplicity counter (LSNMC), with active interrogation capabilities, for safeguards applications. The one-year project will consist of benchtop experiments using available radiation sources and a simulation study aimed at LSNMC design performed with code MCNPX-PoliMi. Counter parameters such as number, size, and placement of detectors will be optimized. Neutron detection efficiency will be characterized. This work is applicable to both passive analyses and active interrogation and focuses on (a) neutron-based measurements of fissionable nuclear materials, and (b) near real-time measurements for process monitoring. Important aspects of long-term, science-based research and development include small-scale experiments, theory development, and advanced modeling and simulation with validation experiments; this project embraces the science-based R&D approach.

**“Development of Semi-Autonomous Robots for Hazardous Environments”**

PI: David Wehe

Sponsor: Department of Energy

\$4,369,500; 9/1/2004 – 8/31/2012

The University of Michigan extends the capabilities of current mobile robots to provide increased autonomy of remote operations, so that sensors and other technologies can be quickly and safely

delivered to interior and outdoor environments of large expanses. The University of Michigan also develops advanced radiation sensing technologies for use in DOE environments. Current projects include the development of hybrid gamma ray imagers, development of unique digital pulse processing techniques, active interrogation for surveillance and monitoring, and micro-mechanical radiation detectors.



# Fiscal Year 2012 Research Expenditures

(July 1, 2011 – June 30, 2012)

## RESEARCH EXPENDITURES ATTRIBUTED TO AN EXTERNAL SPONSOR

Project Director	Sponsor	Project Title	Project Grant	Expenditures
Atzmon	National Science Foundation	Structure, Properties, and Relaxation of Shear Bands in Metallic Gases	F015539	\$491
Downar	Electric Power Research Institute	Technical Evaluation of the HITACHI Resource-Renewable BWR	N010448	\$12,253
Downar*	Department of Energy	Fellowships	F026647	\$152,657
Downar	Department of Energy - Subcontract	Multi-scale Multi-physics Methods Development for the Calculation	F023726	\$82,465
Downar	DOE – Subcontract	Boiling Water Reactor Stability Analysis	F024591	\$347
Downar	DOE - Subcontract	VHTR Advanced Modeling and Simulation	F024778	(\$14)
Downar	DOE – Subcontract	Sub of F026076-MNM-Taxable Consortium for Advanced Simulation of	F028789	\$153,636
Downar	DOE – Subcontract	Sub of F026076-VRI-Taxable Consortium for Advanced Simulation of	F028790	\$246,501
Downar	DOE – Subcontract	Evaluate Nodalization Schemes in TRACE (TRAC RELAP5)	F029486	\$76,710
Downar	DOE – Subcontract	Transient Safety Analysis of Fast Spectrum TRU Burning LWRs	F029679	\$51,987
Downar	DOE – Subcontract	Sub of F030169-Self-sustaining Thorium Boiling Water Reactors	F030175	\$5,245
Downar	Nuclear Regulatory Commission	PARCS Development and Assessment for the Next Generation	F023763	\$222,056
Downar	NRC	PARCS Maintenance and	F026439	\$268,789

		Support for Light Water Reactors (LWRs)		
Downar	NRC	SubK of F026439-Pennsylvania State University	F026904	\$68,772
Downar	Nuclear Regulatory Commission – Subcontract	Basic Research on High Temperature Gas Reactor Thermal	F021635	\$110,720
Foster*	NASA	Non-Intrusive Measurement of Electric Field in Pulsed Nanosecond	F022929	\$27,118
Foster*	NASA	Water Purification by High Voltage, Nanosecond Plasma	F026216	\$276
Foster*	NASA	Blackout Mitigation Via Cathode Spot Injection of Ceramic Quenchant	F028561	\$29,733
Foster	NASA – Subcontract	High Power High Thrust Ion Thruster	F029055	\$44,318
Foster	NSF	An Investigation of Plasma Formation in Electromechanically Driv	F025922	\$81,819
Foster	NSF	Sub of F025922-REU-An Investigation of Plasma Formation in Electro	F028542	\$350
Foster	NRC	Sub of F024078-Faculty Development Program at UM	F024154	\$60,408
Gilgenbach	Department of Defense-Air Force	Innovative Inverted Magnetron Experiments and Theory	F024883	\$307,721
Gilgenbach	DOD-Air Force	Ultra-Short Pulse Laser for Advanced Cathodes and Windows	F026306	(\$31,000)
Gilgenbach	DOD-Air Force - Subcontract	Basic Studies of Distributed Discharge Limiters for Counter-HPM	F022658	\$178,577
Gilgenbach	DOD-Air Force – Subcontract	STTR Subcontract: Advanced Nonlinear Transmission Lines as...	F025225	\$39,700
Gilgenbach	Department of Defense-Navy – Subcontract	Phase Locking of COTS Magnetrons	F023774	\$185,553
Gilgenbach	DOE – Subcontract	Ionization Dynamics of Wire Z-Pinches	F019326	\$138
Gilgenbach*	DOE – Subcontract	Krell Institute Academic Allowance-Department of Nuclear Eng....	F027410	\$175
Gilgenbach	DOE – Subcontract	Recyclable Transmission Line	F027694	\$84,004

		Experiments on Line at Trans....		
Gilgenbach	L-3 Communications	Support for University Research in Vacuum Electronics	N007747	\$1,803
Gilgenbach	NRC	Department of Nuclear Engineering and Radiological Sciences-Fac	F029069	\$12,671
Hammig	DOD-Defense Threat Reduction Agency	Silicon-Based Examination of Gamma-Ray and Newton...	F016785	\$200,220
Hammig	DOD-DTRA	FAB Sub of F016785-Silicon-Based Examination of Gamma-Ray and Newton	F017656	(\$8,320)
Hammig	DOD-DTRA	Fab of F016785-Chemical Hood NC Assembly Apparatus	F021221	(\$6,286)
Hammig	DOD-DTRA	Suppression of Interface-induced Noise by the Control of Elect	F028581	\$128,919
Hammig	Department of Homeland Security	Silicon-Based 3D Position-Sensitive Scatter Detector	F017068	\$198,166
Hammig	DHS	Sub of F017068-SubK-Galt LLC	F017411	\$69,513
Hammig	DHS – Subcontract	Sub of F028640-PHASE I- Large-area, Wide Band-gap SSPM	F027879	\$7,186
Hammig	DHS – Subcontract	Sub of F028640-PHASE II- Large-area, Wide Band-gap SSPM Detector	F028556	\$135,420
Hartman*	Department of Commerce – National Institute of Standards & Technology	Summer Support Through the SURF Program at the Institute	F027674	\$4,857
Hartman*	DOE – Subcontract	Sub of F026751-YR1-Nuclear Forensics Junior Faculty Award Program	F026368	(\$10,403)
Hartman	DOE – Subcontract	Sub of F026317-Evaluation of Materials for Interim Storage of Spent	F027104	\$83,671
Hartman	DOE – Subcontract	University of Michigan-Nuclear Forensics Junior Faculty	F030116	\$90,446
Hartman	General Electric Company	Sub of N014699-Y1- Experimental Investigation of Gearbox	N014255	\$4,472
Hartman	NRC	Sub of F020758-Dept of	F020990	\$185

		Nuclear Eng & Radiological Eng-Faculty Development		
He	DOD-DTRA	Advance Room-Temperature 3-D Semiconductory-Ray Imaging	M000570	\$176,771
He	DOD-DTRA – Subcontract	Target-Linked Radiation Imaging (TLRI)	F024644	\$90,459
He	DOD-DTRA – Subcontract	Detection of Shielded Uranium and Plutonium	F029209	\$452,724
He	DOD-Other – Subcontract	Detection of Shielded Uranium and Plutonium	F015358	\$84,051
He	DOD-Other – Subcontract	Fab of F015358-Detection of Shielded Uranium and Plutonium	F018191	(\$159,307)
He	DOD-Other – Subcontract	Sub of F015358-PO Sub-Detection of Shielded Uranium and Plutonium	F018477	\$636,237
He	DOE	Development of High Resolution 3-Dimensional Position-Sensitive....	F016320	\$287,892
He	DOE	Digital 3-Dimensional Position-Sensitive Semiconductor Radiation	F025135	\$251,536
He	DHS	Sub of F023748-YR4- Development of Integrated Real-Time Imaging and	F026458	\$23,154
He	DHS	Sub of F023748-YR4- Development of Integrated Real-Time Imaging and	F026504	\$17,474
He	DHS	Sub of F023748-YR5- Development of Integrated Real-Time Imaging	F028725	\$177,792
He	DHS	Sub of F023748-YR5- Development of Integrated Real-Time Imaging	F028918	\$148,941
He	DHS – Subcontract	Development of HgS and HgO Semiconductor Gamma-Ray	F023213	(\$1,113)
He	DHS – Subcontract	Development of TlBr and InBr semiconductor Gamma-Ray Spec	F023713	\$61,741
Holloway	DOD-DTRA	Genetic Algorithms to Identify Optimal Material Arrangement for....	F020456	\$40,198
Holloway	DOE	Sub of F019844-Center for Radiative Shock Hydrodynamics (CRASH)	F019849	\$343,390

Jiao	EPRI	Mitigation Strategy for IASCC in Austenitic Stainless Steels	N013529	\$103,415
Krushelnick	DOD – Advanced Research Projects Agency	Compact Laser Plasma Source of Spatially Coherent	F029130	\$247,726
Krushelnick	DOD – Navy	High Energy Neutron Beams from Intense Laser Plasma Interactions	F028951	\$120,911
Krushelnick	NSF	Sub of F028951-FAB-High Energy Neutron Beams from Intense Laser Plasma	F029358	\$34,133
Larsen	DOE – Subcontract	The Suppression of Energy Discretization Errors in Multigroup	F024273	\$115,703
Larsen	DOE – Subcontract	Hybrid Monte Carlo/Deterministic Radiation Transport Simulations	F024315	\$60,230
Larsen	DOE – Subcontract	An Asymptotic “2D-Transport, 1D-Diffusion” Approximation of the	F024414	\$160,100
Larsen	DOE – Subcontract	Sub of F026076-MNM-Taxable Consortium for Advanced Simulation of	F028788	\$181,702
Lau	DOD – Air Force	Advanced RF Sources Based on Novel Nonlinear Transmission	F023644	\$148,914
Lau	DOE	Theoretical and Experimental Studies of the Magneto-Rayleigh	F023838	\$93,957
Lau	NSF	Theoretical and Experimental Studies of the Magneto-Rayleigh	F023789	\$6,864
Lee	DOE – Subcontract	Bayesian Network for Reliability Analysis of Dynamical Systems-II	F027416	\$9,034
Lee	DOE – Subcontract	Sub of F026076-MNM-Taxable Consortium for Advanced Simulation of	F028791	\$162,451
Lee	DOE – Subcontract	Sub of F029451-RTM-SUP Consortium for Advanced Simulation of Light	F030363	\$103
Lee	Korea Atomic Energy Research Institute	Realistic Nuclear Plant Safety Analysis Representing?	N014641	\$8,518
Manera	DOE – Subcontract	Sub of F029451-Consortium for Advanced Simulation of Light Water	F029619	\$34,708

Manera	DOE – Subcontract	Sub of F029451-THM-Consortium for Advanced Simulation of Light Water	F030369	\$1,446
Martin	DOE – Subcontract	Creation of a Full-Core HTR Benchmark with the Fort S. Vrain	F023756	\$114,523
Martin	DOE – Subcontract	Consortium for Advanced Simulation of Light Water Reactors (CASL)	F026076	(\$649,461)
Martin	DOE – Subcontract	Implementation of On-the-fly Doppler Broadening in MCNP5	F026319	\$179,939
Martin	DOE – Subcontract	SubK of F026319-Argonne National Laboratory	F027819	\$62,029
Martin	DOE – Subcontract	Sub of F026076-MNM-Taxable Consortium for Advanced Simulation of	F028785	\$315,355
Martin	DOE – Subcontract	Sub of F029451-MPO-Consortium for Advanced Simulation of Light Water	F028786	\$73,823
Martin	DOE – Subcontract	Sub of F026076-VRI-Taxable Consortium for Advanced Simulation of Light Water	F028787	\$73,823
Martin	DOE – Subcontract	Sub of F026076-University of Wisconsin-Taxable	F028792	\$80,519
Martin	DOE – Subcontract	Consortium for Advanced Simulation of Light Water Reactors-Non-Tax	F029451	\$223,569
Martin	DOE – Subcontract	Sub of F029451-RTM-PRT Consortium for Advanced Simulation of Light	F030366	\$44,708
Martin	DOE – Subcontract	Sub of F029451-RTM-SUP Consortium for Advanced Simulation of Light	F030367	\$44,270
Martin*	National Academy for Nuclear Training	Graduate Fellowships in Nuclear Engineering	N008693	\$24,999
Martin*	NRC	Department of Nuclear Engineering and Radiological Sciences	F020760	\$154,831
Martin*	NRC	Proposal to the Nuclear Regulatory Commission to Establish the...	F023382	\$119,711
Martin	NRC	Faculty Development Program at the University of Michigan	F024078	\$287
Martin*	NRC	Undergraduate Nuclear Engineering Scholarship	F025359	\$133,907

		Program at the U...		
Pozzi	DOD-DTRA – Subcontract	PHASE I – iFIND Mobile Detection System	F023299	(\$67,515)
Pozzi	DOD-DTRA – Subcontract	Sub of F028131-YR1 CLIN0001-Compat Source of Laser-Driven Monoenergetic Gamma-Rays	F027417	\$4,899
Pozzi	DOD-DTRA – Subcontract	Sub of F028595-Phase II- iFind Mobile Detection	F028596	\$110,000
Pozzi	DOD-DTRA – Subcontract	Sub of F028131-YR2- CLIN0002-Compact Source of Laser-Driven Mono...	F028700	\$69,156
Pozzi	DOD-DTRA – Subcontract	Sub of F028595-Phase III- iFind Mobile Detection System	F030148	\$89,642
Pozzi	DOD-DTRA – Subcontract	Sub of F028131-YR3- CLIN0003-Compat Source of Laser-Driven Monoenerg	F030828	\$4,415
Pozzi	DOE	Digital Waveform Sampling of Neutron and Gamma Ray Signals	F024818	\$196,988
Pozzi	DOE	FAB-New University of Michigan Laboratory for Research and Tea...	F026304	\$27,589
Pozzi	DOE	Energy-Angle Correlations in Spontaneous and Induced Fission	F028845	\$140,847
Pozzi	DOE	Epithermal and Fast Neutron Detection System for Active	F030241	\$21,437
Pozzi	DOE – Subcontract	A Multisensor Fusion Approach to the Solution of Inverse	F021885	\$6,963
Pozzi*	DOE – Subcontract	Development of a New Graduate Level Course in Nuclear...	F023805	(84,048)
Pozzi	DOE – Subcontract	Basic Physics Data: Improved Fission Neutron Data...	F023849	\$56,267
Pozzi	DOE – Subcontract	Sub of F023849-Basic Physics Data: Improved Fission Neutron Data...	F023979	\$130,340
Pozzi	DOE – Subcontract	Digital Fast Neutron Detection System for Simultaneous Time Cor....	F027394	\$170,394
Pozzi	DOE – Subcontract	Neutron Interrogation for Fuel Cycle Measurements	F027470	\$29,776
Pozzi	DOE – Subcontract	Basic Physics Data: Measurement of Neutron	F029588	\$41,165

		Multiplicity from Ind		
Pozzi	DOE – Subcontract	Liquid Scintillator Neutron Multiplicity Counter for Safeguards...	F029784	\$97,000
Pozzi	DHS	Sub of F026265-YR2 New Detectors, Electronics, and Algorithms for...	F026423	\$5,329
Pozzi	DHS	Subk of F026265-YR2-Brigham Young University	F026429	\$93,900
Pozzi	DHS	Sub of F026265-YR2-New Detectors, Electronics, and Algorithms for...	F026440	\$39,009
Pozzi	DHS	Sub of F026265-YR3-New Detectors, Electronics, and Algorithms for...	F028868	\$91,840
Pozzi	DHS	Sub of F026265-YR3-New Detectors, Electronics, and Algorithms for...	F029044	\$137,814
Pozzi	DHS	Sub of F026265-YR3-Brigham Young University	F029047	\$4,088
Pozzi	NSF	New Detectors, Electronics, and Algorithms for Fast Neutron	F023551	(\$1,153)
Pozzi	NRC	Sub of F020758-Department of Nuclear Engineering and Radiological Sciences-Faculty Development	F020989	\$9,068
Thomas	NSF	NSF CAREER Proposal: Bright femtosecond x and gamma-ray	F028881	\$81,042
Thomas	NRC	Sub of F024078-Department of Nuclear Engineering and Radiological Sciences-Faculty Development	F024156	\$99,129
Wang	DOE	Self-Organized 3-D Array of Nanostructures Under Irradiation	F007316	\$12,598
Wang	DOE	Sub of F018506-Consortium on Cladding & Structural Materials for Adv	F019437	(\$0)
Wang	DOE	Sub of F022352-Lumin Wang-Particle Induced Amorphization of	F012220	\$173
Wang	DOE – Subcontract	Evaluation of Materials for Interim Storage of Spent Fuel for...	F026317	\$174,171
Wang	DOE – Subcontract	Sub of F026766-Fission	F026933	\$107,960



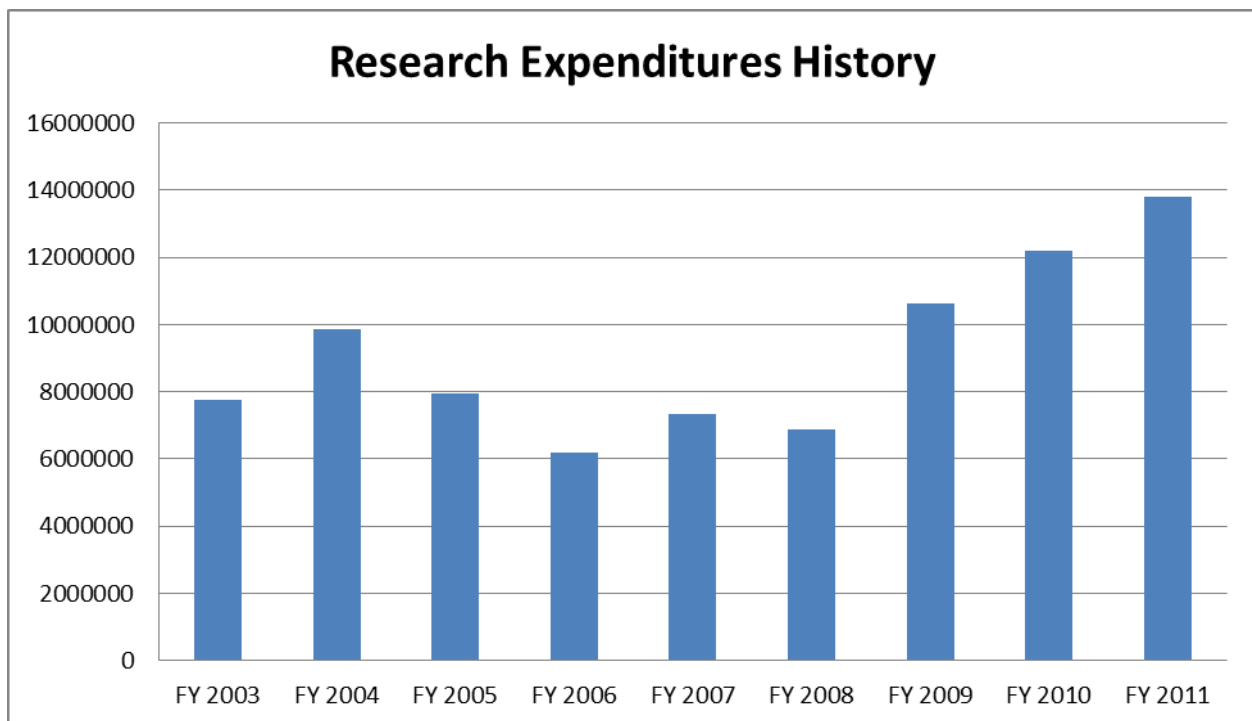
		Product Transport in Triso Particle Layers		
Was	Electric Power Research Institute	Identifying Mechanisms and Mitigation Strategies for Irradiation	N010827	\$236,188
Was	EPRI	Factor of Improvement in Resistance of Stress Corrosion Crack...	N012413	\$76,820
Was	EPRI	Establishing a Cause-and-Effect Relationship Between Localized	N012581	\$74,776
Was	Electricite De France (EDF)	Irradiation-Accelerated Corrosion of Reactor Core Materials	N013607	\$134,530
Was	EDF	Irradiation-Accelerated Corrosion of Reactor Core Materials	N013636	\$115
Was	DOE	Consortium on Cladding and Structural Materials for Advanced...	F018506	(\$12,821)
Was	DOE	Sub of F018506-UC Berkeley-Consortium of Cladding & Structural	F018705	(\$2,208)
Was	DOE	Sub of F018506-Penn St.-Consortium of Cladding & Structural	F018706	\$2,029
Was	DOE	Localized Deformation and Intergranular Fracture of Irradiated...	F021533	\$118,178
Was	DOE	Sub of F021533-Localized Deformation and Intergranular Fracture of...	F021747	\$33,673
Was	DOE	Sub of F021533-Localized Deformation and Intergranular Fracture of...	F021748	\$31,198
Was	DOE	Acquisition of a 3 MV Tandem Accelerator for Research and Teach...	F029265	\$54
Was	DOE – Subcontract	Sodium Compatibility of Advanced Fast Reactor Materials	F022060	\$18,441
Was	DOE – Subcontract	Identifying Mechanisms and Mitigation Strategies for Irradiation	F022700	\$251,270
Was	DOE – Subcontract	Corrosion and Creep of Candidate Alloys in High Temperature	F023807	\$139,122

Was	DOE – Subcontract	Intergranular Attack and Stress Corrosion Cracking in Nickel-Base	F024029	\$10,943
Was	DOE – Subcontract	Aging and Embrittlement of High Fluence Stainless Steel	F024274	\$41,356
Was	DOE – Subcontract	Sub of F024274-Aging and Embrittlement of High Fluence Stainless Steel	F024371	\$2,347
Was	DOE – Subcontract	Microstructure and Property Evolution in Advanced Cladding and...	F026313	\$150,447
Was	DOE – Subcontract	Irradiation-Accelerated Corrosion of Reactor Core Materials 10-068	F026314	\$48,037
Was	DOE - Subcontract	Proton Irradiation Induced Creep in Pyrocarbon	F026315	\$12,681
Was	DOE – Subcontract	SubK University of Notre Dame	F026379	\$81,101
Was	DOE – Subcontract	SubK of F026313-University of Wisconsin	F026380	\$150,755
Was	DOE – Subcontract	Fab of F026314-Irradiation-Accelerated Corrosion of Reactor Core Matter	F026825	\$41,518
Was	DOE – Subcontract	Sub of F026766-Fission Product Transport in Triso Particle Layers	F026932	\$97,917
Was	DOE – Subcontract	Sub of F026317-Fab-Evaluation of Materials for Interim Storage of Sp	F027105	\$1,174
Was	DOE – Subcontract	Sub of F029451-Consortium for Advanced Simulation of Light Water Reactors	F029618	\$81,952
Was	DOE – Subcontract	Sub of F029269-Characterization and Modeling of Grain Boundary Chemi	F030405	\$1,493
Was*	DOE – Subcontract	Recharge for MIBL-ATR	F026168	\$10,488
Was	Institute of Nuclear Safety System (INSS)	Ion Irradiation-Induced Degradation of Reactor Structural	N010334	(\$14,231)
Was	NASA – Subcontract	Production of Microspheres to Support Fuel Fabrication	F030608	\$3,541
Was	TerraPower	Heavy Ion Irradiation of HT9	N013825	\$111,951
Was*	Various Sponsors	Recharge for MIBL	N009040	\$64,228
Wehe*	DOD-DTRA – Subcontract	Support for Symposium on Radiation Measurements and Application	F025387	\$37,471

Wehe*	Elsevier Science B.V.	Editorial Services for Journal "Nuclear Instruments...	N007321	\$13,358
Wehe	DOE	Mobile Robotics and Sensing-Univ Research Prog in Robotics	F010788	\$245,836
Zhang	DOE – Subcontract	Growth of Semiconductors for Room Temperature Gamma-Ray Detection	F029720	\$41,100
Zhang	DHS – Subcontract	Sensor Pack CdZnTe detector evaluation with Polaris system	F029352	\$14,118
Sub Total:				\$13,076,483

\*Amounts in parentheses are accounting adjustments

Total Research Expenditures Attributed to an External Sponsor	\$13,076,483
Total Internal Research Expenditures	\$938,623
GSRA RIP3 Outstate Differential	\$451,658
Grand Total	\$14,466,764



# Publications

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(January 1, 2011 – December 31, 2011)

## FISSION SYSTEMS AND RADIATION TRANSPORT

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J. C. Lee and N. J. McCormick, *Risk and Safety Analysis of Nuclear Systems*, Wiley (July 2011).

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Z. Gao, Y. Xu, T. Downar, "The Treatment of Resonance Interference Effects in the Subgroup Method," *Annals of Nuclear Energy*, March, (2011).

A. Ward, B.S. Collins, M.R. Madariaga, Yunlin Xu, T.J. Downar, "Methods & Model Development for Coupled RELAP5 / PARCS Analysis of the Atucha-II Nuclear Power Plant," *STNI, CSNI Journal*, Jan. (2011).

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M. Hursin, T.J. Downar, B. Kochunas, "Analysis of the Core Power Response during a PWR Rod Ejection Transient using the PARCS Nodal Code and the DeCart MOC Code," *Nuclear Science and Engineering*, accepted for publication, October, 2011.

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S. Yusuf, M. Krahenbuhl, B. Haskins, and M.R. Hartman, "Improving Neutron Activation Analysis for the Measurement of Gold in the Characterization of Heterogeneous Catalysts Using a TRIGA Reactor," submitted for publication, *J. Radioanal. Nucl. Chem.*

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W.R. Marcum, T.S. Palmer, B.G. Woods, S.T. Keller, S.R. Reese, and M.R. Hartman, "A Comparison of Pulsing Characteristics of the Oregon State University TRIGA Reactor with FLIP and LEU Fuel," accepted for publication, *Nucl. Sci. Eng.*

A.B. Wollaber and E.W. Larsen, "A Linear Stability Analysis for Nonlinear, Gray, Thermal Radiative Transfer Problems," *J. Comp. Phys.* **230**, 1528 (2011).

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E. Olbrant, E.W. Larsen, M. Frank, and B. Seibold, "Asymptotic Derivation of Time-Dependent Simplified PN Equations," *J. Comp. Phys.*, submitted.

F. Abdul Rahman, A. Varuttamaseni, M. Kinter-Meyer, and J.C. Lee, "Application of Fault tree analysis for customer reliability assessment of a distribution power system," submitted for publication in *Reliability Engineering and System Safety*.

A. Hoffman, B. Kochunas, and J.C. Lee, "Parallelized Adaptive Time Stepping Using the Step Doubling Method in DeCart," *Trans. Am. Nucl.*, **101**, 350 (2011).

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J. Freixa, A. Manera, "Verification of a TRACE EPR<sup>TM</sup> model on the basis of a scaling calculation of an SBLOCA ROSA test," *Nuclear Engineering and Design* **241**(3), 888 (2011).

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M. Perez, F. Reventos, L. Batet, A. Guba, I. Tóth, T. Mieusset, P. Bazin, A. de Crécy, S. Borisov, T. Skorek, H. Glaeser, J. Joucla, P. Probst, A. Ui, B.D. Chung, D.Y. Oh, R. Pernica, M. Kyncl, J. Macek, A. Manera, et al, "Uncertainty and sensitivity analysis of a LBLOCA in a PWR Nuclear Power Plant: Results of the Phase V of the BEMUSE program," *Nuclear Engineering and Design* **241**(10), 4206 (2011).

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E.R. Wolters, E.W. Larsen, and W.R. Martin, "Generalized Hybrid Monte Carlo-CMFD Methods for Fission Source Convergence," *Proc. Int. Conf. on Mathematics and Computational Methods Applied to Nuclear Science and Engineering (M&C 2011)*, Rio de Janeiro, RJ, Brazil, May 8-12, 2011 on CD-ROM, American Nuclear Society (ANS), ISBN 978-85-63688-00-2 (2011).

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B.R. Betzler, E.E. Sunny, J.C. Lee, and W.R. Martin, "Coupled Nuclear-Thermal-Hydraulic Calculations for Fort St. Vrain Reactor," *Proc. 14<sup>th</sup> International Topical Meeting on Nuclear Reactor Thermalhydraulics (NURETH-14)*, September 25-29, 2011.

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# MATERIALS

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### **Conference Papers and Presentations**

Z. He, W. Wang, C. Wahl, J.M. Jaworski, D. Lingenfelter, S. Joshi, J.A. Fessler, C. Scott, "Gamma-ray Imaging and Isotope Identification using 3D-Position-Sensitive Gamma-Ray Spectrometers," DNDO ARI Conference, April 2011.

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Z. He, F. Zhang, W. Kaye, Y.A. Boucher, W. Wang, C. Wahl, J. Jaworski, Y. Zhu, S. Joshi, J. Berry, "New Development on Polaris Gamma-Ray Imaging Spectrometer Systems," IEEE Nuclear Science Symposium, Medical Imaging Conference and Workshop on Room Temperature Semiconductor X & Gamma-Ray Detectors, Valencia, Spain, October 23-29, 2011.

F. Zhang and Z. He, "Performance Improvements in the Polaris Gamma-Ray Imaging Spectrometer," IEEE Nuclear Science Symposium, Medical Imaging Conference and Workshop on Room Temperature Semiconductor X & Gamma-Ray Detectors, Valencia, Spain, October 23-29, 2011.

J.C. Kim, W.R. Kaye, F. Zhang, H. Yang, C.R. Brown, Z. He, "Impact of Electric Field Non-Uniformity on Large CdZnTe Crystal," IEEE Nuclear Science Symposium, Medical Imaging Conference and Workshop on Room Temperature Semiconductor X & Gamma-Ray Detectors, Valencia, Spain, October 23-29, 2011.

J.C. Kim, W. Kaye, Z. He, "Impact of Electric Field Non-Uniformity on Large CdZnTe Crystals," IEEE Nuclear Science Symposium, Medical Imaging Conference and Workshop on Room Temperature Semiconductor X & Gamma-Ray Detectors, Valencia, Spain, October 23-29, 2011.

W. Wang and Z. He, "Including Pair-Production Events in the System Response Function for Energy-Imaging Integrated Deconvolution Algorithm," IEEE Nuclear Science Symposium, Medical Imaging Conference and Workshop on Room Temperature Semiconductor X & Gamma-Ray Detectors, Valencia, Spain, October 23-29, 2011.

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W. Kaye, F. Zhang, Y.A. Boucher, W. Wang, J.C. Kim, Z. He, "Event Classification in 3D Position Sensitive Pixelated CdZnTe Detectors," IEEE Nuclear Science Symposium, Medical Imaging Conference and Workshop on Room Temperature Semiconductor X & Gamma-Ray Detectors, Valencia, Spain, October 23-29, 2011.

S. Joshi Kaye, J.M. Jaworski, W.R. Kaye, Z. He, "Detector Motion Compensated Coded Aperture Imaging Using Thick 3D-Position-Sensitive Pixelated CdZnTe Detectors," IEEE Nuclear Science Symposium, Medical Imaging Conference and Workshop on Room Temperature Semiconductor X & Gamma-Ray Detectors, Valencia, Spain, October 23-29, 2011.

C. Thrall, Z. He, H. Kim, L. Cirignano, K. Shah, W. Kaye, F. Zhang, "Demonstration of the 3D-position-sensitive capability of the TlBr detectors," IEEE Nuclear Science Symposium, Medical Imaging Conference and Workshop on Room Temperature Semiconductor X & Gamma-Ray Detectors, Valencia, Spain, October 23-29, 2011.

D.J. Lingenfelter, J.A. Fessler, C.D. Scott, Z. He, "Detection Performance Prediction for CdZnTe Array," IEEE Nuclear Science Symposium, Medical Imaging Conference and Workshop on Room Temperature Semiconductor X & Gamma-Ray Detectors, Valencia, Spain, October 23-29, 2011.

M.L. Rodrigues and Z. He, "High-Flux Experiments and Simulations of Pulse-Mode 3D-Position-Sensitive CdZnTe Pixelated Detectors," IEEE Nuclear Science Symposium, Medical Imaging Conference and Workshop on Room Temperature Semiconductor X & Gamma-Ray Detectors, Valencia, Spain, October 23-29, 2011.

Y.A. Boucher, J.M. Jaworski, Z. He, "Spectroscopy and Imaging Results from 20x20x15 mm<sup>3</sup> Pixelated Cadmium Zinc Telluride Semiconductor Detectors," IEEE Nuclear Science Symposium, Medical Imaging Conference and Workshop on Room Temperature Semiconductor X & Gamma-Ray Detectors, Valencia, Spain, October 23-29, 2011.

Y.A. Boucher, F. Zhang, W.R. Kaye, Z. He, "Measurements of Gamma Rays above 3 MeV using 3D-Position-Sensitive 20x20x15 mm<sup>3</sup> CdZnTe Detectors," IEEE Nuclear Science Symposium, Medical Imaging Conference and Workshop on Room Temperature Semiconductor X & Gamma-Ray Detectors, Valencia, Spain, October 23-29, 2011.

J.M. Jaworski and Z. He, "3D Compton Image Reconstruction Using a Moving 3D-Position-Sensitive Room-Temperature CdZnTe Detector Array," IEEE Nuclear Science Symposium, Medical Imaging Conference and Workshop on Room Temperature Semiconductor X & Gamma-Ray Detectors, Valencia, Spain, October 23-29, 2011.

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D. Howard, K.J. Kearfott, S.J. Wilderman, K.F. Koral, Y.K. Dewaraja, "Comparison of Radioimmunotherapy (RIT) Tumor Dosimetry: Unit-density Sphere Model versus Monte Carlo Calculation," *J. Nucl. Med.* **52**(S1), 128 (2011).

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S.D. Clarke, M. Flaska, S.A. Pozzi, R.B. Oberer, and L.G. Chiang, "Monte Carlo Analysis of Nondestructive Assay Techniques for Highly Enriched Uranium Oxide," IEEE Nuclear Science Symposium Conference Record on CD-ROM, Valencia, Spain, October 23-29, 2011.

J.K. Polack, A. Poitrasson-Rivière, M.C. Hamel, K.L. McMillan, K. Ide, S.D. Clarke, M. Flaska, and S.A. Pozzi, "Dual Particle Imager for Standoff Detection of Special Nuclear Material," IEEE Nuclear Science Symposium Conference Record on CD-ROM, Valencia, Spain, October 23-29, 2011.

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M.A. Norsworthy, S.D. Clarke, S.A. Pozzi, T.A. Antaya, "Active Interrogation Source based on Deuteron Reactions," IEEE Nuclear Science Symposium Conference Record on CD-ROM, Valencia, Spain, October 23-29, 2011.

C.C. Lawrence, A. Enqvist, M. Ojaruega, M. Flaska, S.D. Clarke, S.A. Pozzi, F.D. Becchetti, "Neutron Energy Spectrum Unfolding with Deuterium- and Hydrogen-based Liquid Scintillators," IEEE Nuclear Science Symposium Conference Record on CD-ROM, Valencia, Spain, October 23-29, 2011.

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E.C. Miller, J.L. Dolan, S.D. Clarke, M. Flaska, S.A. Pozzi, E. Padovani, P. Peerani, P. Schillebeeckx, "Experiments and Simulation of Cross-Correlations on MOX fuel," Transactions of the Institute of Nuclear Materials Management 52<sup>nd</sup> Annual Meeting on CD-ROM, Palm Desert, California, July 17-22, 2011.

S. Prasad, A. Enqvist, S.D. Clarke, S.A. Pozzi, E.W. Larsen, "Response Function Study for Energy to Light Conversion in Organic Liquid Scintillators," Transactions of the Institute of Nuclear Materials Management 52<sup>nd</sup> Annual Meeting on CD-ROM, Palm Desert, California, July 17-22, 2011.

S.A. Pozzi, J.L. Dolan, E.C. Miller, M. Flaska, S.D. Clarke, A. Enqvist, P. Peerani, M.A. Smith-Nelson, E. Padovani, J.B. Czirr, L.B. Rees, "Evaluation of New and Existing Organic Scintillators for Fast Neutron Detection," Transactions of the Institute of Nuclear Materials Management 52<sup>nd</sup> Annual Meeting on CD-ROM, Palm Desert, California, July 17-22, 2011.

M. Flaska, E.C. Miller, C.C. Lawrence, S.A. Pozzi, A. Borella, P. Schillebeeckx, F.D. Becchetti, "Characterization of a C<sub>6</sub>D<sub>6</sub> Liquid Scintillation Detector with Monoenergetic Neutrons," Transactions of the Institute of Nuclear Materials Management 52<sup>nd</sup> Annual Meeting on CD-ROM, Palm Desert, California, July 17-22, 2011.

A. Enqvist, B.M. Wiegner, K. Weinfurther, L. Huang, M. Flaska, S.A. Pozzi, R.C. Haight, "Measurements of Fission Spectrum at LANSCE for the Evaluation of Safeguards Data," Proceedings of the Institute of Nuclear Materials Management 52<sup>nd</sup> Annual Meeting, Palm Desert, California, July 17-21, 2011.

M. Flaska, S.A. Pozzi, J.B. Czirr, L.B. Rees, "Response of the Cadmium-Sheets/Plastic-Scintillator-Slabs Capture-Gated Detector to Various Neutron Sources," Proceedings of the Institute of Nuclear Materials Management 52<sup>nd</sup> Annual Meeting, Palm Desert, California, July 17-21, 2011.

J.L. Dolan, E.C. Miller, A. Enqvist, M. Flaska, S.D. Clarke, S.A. Pozzi, P. Peerani, "Neutron Measurement and Spectroscopy with Capture-Gated Scintillation Detectors for Nuclear Safeguards Applications,"



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K.J. Weinfurther, A. Enqvist, M. Flaska, S.A. Pozzi, "Energy Correlation of Neutrons from Fission Sources," Proceedings of the Institute of Nuclear Materials Management 52<sup>nd</sup> Annual Meeting, Palm Desert, California, July 17-21, 2011.

A. Poitrasson-Rivière, M.C. Hamel, J.K. Polack, K.L. McMillan, K. Ide, S.D. Clarke, M. Flaska, S.A. Pozzi, "Design Considerations of a Dual-Particle Imager for Nonproliferation Applications," Transactions of the Institute of Nuclear Materials Management 52<sup>nd</sup> Annual Meeting on CD-ROM, Palm Desert, California, July 17-22, 2011.

W.J. Walsh, S.D. Clarke, S.A. Pozzi, "Nuclear Resonance Fluorescence Simulation Techniques Using MCNP," Transactions of the Institute of Nuclear Materials Management 52<sup>nd</sup> Annual Meeting on CD-ROM, Palm Desert, California, July 17-22, 2011.

D.K. Wehe, "Trends in Radiation Measurements Technology," invited presentations at the APPLICATIONS OF NUCLEAR TECHNIQUES: Eleventh International Conference, 12-18 June 2011, Crete, Greece, AIP Conference Proceedings, ISBN: 978-0-7354-0986-6

W. Mayer, P. Roumayah, M. Denman, W. Fisher, S. Rand, D. Wehe, B. Roe, "Laser induced fluorescence for proportional detection of ionizing radiation," No. WP243 in Int. Conf. on Luminescence (ICL '11), Ann Arbor, MI, June 2011.

# Service

(January 1, 2011 – December 31, 2011)

<b>SERVICE TO THE DEPARTMENT, COLLEGE, AND UNIVERSITY</b>	
Chair, Promotion Committee for Assistant Research Scientist Zhijie Jiao	Atzmon
Member, NERS Curriculum Committee	Atzmon
Member, MSE Graduate Committee	Atzmon
Member, NERS Graduate Committee	Atzmon
Advisor, Engineering Physics	Atzmon
Coordinator, Materials Option for NERS	Atzmon
Director, NERS Undergraduate Program	Bielajew
Coordinator, ABET for NERS	Bielajew
Chair, Undergraduate Program Committee	Bielajew
Member, SACUA Library Committee	Bielajew
Member, Engineering Faculty Library Advisory Committee	Bielajew
Member, ENG 101 Steering Committee	Bielajew
Advisor, NERS Undergraduate	Bielajew
Chair, NERS Graduate Committee	Downar
Member, NERS Executive Committee	Foster
Member, Applied Physics Executive Committee	Foster
Member, Center for Research on Learning and Teaching Advisory Board	Foster
Member, Rackham-NSF Bridges Advisory Board	Foster
Member, Rackham AGEP	Foster
Member, Center for Engineering Diversity and Outreach Faculty Advisory Council	Foster
Member, Imes-Moore Bridge Committee	Foster
Member, COE Faculty Panel (Masters) – New Graduate Student Welcome	Foster
Member, Panel on Graduate School Life-SHPE-Grad (Sept. 2011)	Foster
Advisor, Faculty-NSBE	Foster
Member, COE Task Force on Master's Program	Foster
Reviewer, Rackham Merit Fellowship	Foster
Judge, MIPSE Symposium	Foster
Participant, Bridges Mentoring Workshop	Foster
Reviewer, CLRT GSI Award	Foster
Reviewer, CLRT Grants	Foster
Host, DACEP with "Wolverine Plasma Academy" Lecture and Tour	Foster
Member, NERS Executive Committee	Hartman
Member, NERS Undergraduate Program Committee	Hartman
Member, COE Safety Committee	Hartman
Advisor, Engineering Advising Center (EAC)	Hartman
Director, Neutron Science Laboratory (NSL)	Hartman
Vice-Chair, UM Senate Advisory Committee on University Affairs (SACUA)	Kearfott
Member, NERS Curriculum Committee	Kearfott
Member, NERS Committee for Preparation of Doctoral Exams in Measurements	Kearfott

Member, UM Radiation Policy Committee	Kearfott
Member, UM Ford Nuclear Reactor Decommissioning Review Committee	Kearfott
Member, UM Goldwater Scholarship Committee	Kearfott
Member, UM Senate Assembly	Kearfott
Member, Senate Advisory Committee on University Affairs (SACUA)	Kearfott
Member, UM Civil Liberties Board	Kearfott
Member, SACUA Liaison, Senate Assembly Committee for a Multicultural University	Kearfott
Member, SACUA Liaison, Academic Affairs Advisory Committee	Kearfott
Member, UM Faculty Hearing Committee	Kearfott
Member, UM Faculty Grievance Monitor	Kearfott
Advisor, Faculty-oSTEM	Kearfott
Advisor, Faculty-UM NERS Health Physics Society Student Branch	Kearfott
Participant, UM NERS Meeting with SNTU	Kearfott
Co-Organizer, GIEU Visit to Cook Nuclear Power Plant	Kearfott
Participant, GIEU Visit to China	Kearfott
Director, Center for Ultrafast Optical Science	Krushelnick
Member, Center for Ultrafast Optical Science (CUOS) Executive Committee	Krushelnick
Member, NSF PFC-FOCUS Council Member	Krushelnick
Member, Scholastic Standing Committee	Krushelnick
Member, Promotion Committee for Assistant Professor John Foster	Krushelnick
Member, Responsible Conduct of Research Committee	Krushelnick
Member, NERS Graduate Committee	Krushelnick
Member, COE Honors and Awards Committee	Krushelnick
Member, Rackham Outstanding GSI Awards Committee	Krushelnick
Director, High Field Science at CUOS	Krushelnick
Chair, NERS Colloquium Committee	Larsen
Chair, NERS Curriculum Committee	Larsen
Member, COE Curriculum Committee	Larsen
Advisor, NERS Undergraduate	Larsen
Chair, NERS Plasma Option	Lau
Chair, Reappointment Committee for Professor Alec Thomas	Lau
Member, Reappointment Committee for Professor John Foster	Lau
Member, NERS Curriculum Committee	Lau
Member, NERS Colloquium Committee	Lau
Member, COE Scholastic Standing Committee	Lau
Member, NERS Executive Committee	Lee
Member, COE Research Advisory Committee	Lee
Member, NERS NRC Fellowship Committee	Lee
Member, NERS Graduate Committee	Martin
Member, COE Entrepreneurship Task Force	Pozzi
Member, Dean's Advisory Committee on Diversity	Pozzi
Member, COE Faculty Committee on Discipline	Pozzi
Member, COE International Programs Committee	Pozzi
Member, NERS Evaluation of the Candidacy Exam Committee	Pozzi
Member, Rackham Faculty Allies for Diversity in Graduate Education	Pozzi
Member, NERS Executive Committee	Thomas

Member, NERS Undergraduate Committee	Thomas
Member, Center for Ultrafast Optical Science Executive Committee	Thomas
Member, MIPSE Executive Committee	Thomas
Mentor, NERS Undergraduates	Thomas
Judge, MIPSE Graduate Student Symposium	Thomas
Marshall, Spring Commencement	Thomas
Co-Author, NERS Strategic Plan-Sustainable Energy	Thomas
Panelist, College of Engineering Junior Dinner	Thomas
Lecturer, ENG 110 Class (2 lectures on NERS)	Thomas
Advisor, UROP	Thomas
Member, NERS Graduate Committee	Wang
Member, EMAL Executive Committee	Wang
Member, COE International Program Committee	Wang
Member, COE Executive Committee	Was
Member, NERS Graduate Committee	Was
Chair, NERS Measurements Option	Wehe
Member, NERS Curriculum Committee	Wehe
Member, Ivor K. McIvor Award Committee	Wehe
Member, NERS Graduate Committee	Wehe
Member, COE Faculty Committee on Discipline	Wehe

<b>SERVICE TO THE NATION</b>	
Reviewer, NSF Proposals	Atzmon
Co-Session Chair, NASA-HBCU Aerospace Conference (Cleveland State-Summer 2011)	Foster
Member, National Academies Plasma Committee	Foster
Reviewer, Proposals-DOE for STTRs	Foster
Reviewer, DOE NEUP Proposals	Hartman
Member, DOE NA-22 Office Review Panel at NCSU, December 15, 2011	He
Member, National Council on Radiation Protection (NCRP) Scientific Committee	Kearfott
Reviewer, DOE Office of Nuclear Energy University Programs (NEUP) Grant Program	Kearfott
Member, Brookhaven National Laboratory External Advisory Panel, Accelerator Science	Krushelnick
Member, Omega Laser Facility, DOE Lab for Laser Energetics Scheduling Committee	Krushelnick
Reviewer, Proposals-National Science Foundation	Krushelnick
Reviewer, Proposals-Department of Energy	Krushelnick
Reviewer, Proposals-Department of Energy	Lau
Reviewer, Proposals-AFOSR	Lau
Member, DOE Office of Nuclear Energy Advanced Reactor Concepts Technical Review Panel	Lee
Reviewer, Proposals-NEUP	Lee
Member, Technical Review Panel for NE-KAMS	Manera
Member, Technical Review Panel for INCITE	Manera
Chair, Department of Energy INCITE Nuclear Physics Review Panel	Martin
Reviewer, Proposals-NEUP	Pozzi
Reviewer, Proposals-DOE Office of Nuclear Energy	Pozzi
Reviewer, Department of Energy, NNSA NA-22 Projects	Pozzi
Reviewer, Department of Energy SBIR Program	Pozzi

Reviewer, NSF Early Career Award Applications	Thomas
Reviewer, Proposals-DOE Nuclear Engineering University Program	Wang
Reviewer, Proposals-DOE Basic Energy Sciences	Wang
Reviewer, NSF Proposals	Wang
Reviewer, Proposals-DOE Basic Energy Sciences SCGF Program	Was
Reviewer, NEUP Proposals	Was
Reviewer, Proposals-DOE NA-22, DNDO, and DTRA Radiation Detection Projects	Wehe
Member, DOE Interagency Forensics Panel for Nonproliferation and Arms Control	Wehe

<b>SERVICE TO THE PROFESSION</b>	
Member, Steering Committee, International Symposium on Metastable, Mechanically Alloyed and Nanocrystalline Materials	Atzmon
Member, Chemistry and Physics of Materials Committee, TMS	Atzmon
Member, Awards Committee, Materials Research Society	Atzmon
Member, National Academies Plasma Science Committee	Foster
Member, IEEE Plasma Science and Applications Technical Committee	Foster
Judge, Best Paper at AIAA Joint Propulsion Conference	Foster
President, American Nuclear Society, Michigan Section	Hartman
Member, Spallation Neutron Source Scientific Review Committee	Hartman
Member, Oregon State TRIGA Reactor (OSTR) Operations Committee	Hartman
Member, DOE NA-22 Office Review Panel on Project at NC State University	He
Member, Program Committee of SPIE International Symposium on Optical Science, Engineering, and Instrumentation	He
Member, Great Lakes Health Physics Society Chapter Executive Council	Kearfott
Member, Health Physics Society Decommissioning Section Executive Board	Kearfott
Member, American Nuclear Society Planning Committee	Kearfott
Member, Planning Committee, International Radiation Protection Association Planning Committee for IRPA 13 International Congress	Kearfott
Secretary/Treasurer, American Physical Society, Division of Plasma Physics	Krushelnick
Member, Laser Acceleration Workshop (Shanghai, 2011) Program Committee	Krushelnick
Member, SPIE Conference on High Power Lasers (Prague, 2011) Program Committee	Krushelnick
Member, APS Division of Plasma Physics Conference (Salt Lake City, 2011) Committee	Krushelnick
Member, Technical Review Committee-Mathematics & Computation Division of ANS	Larsen
Chair, Program Subcommittee, APS Plasma Physics Division Annual Meeting	Lau
Member, International Advisory Committee, Department of Nuclear and Quantum Engineering, Korea Advanced Institute of Science and Technology	Lee
Visiting Professor, Pohang University of Science and Technology	Lee
Member, Technical Committee of NURETH-14	Manera
Track Leader, "Multi-scale multi-physics couplings," NURETH-14	Manera
Track Leader, "Development, Assessment, and Applications of TRACE," NURETH-14	Manera
Member, ANS Honors and Awards Committee	Martin
Member, ANS M&C Topical Meeting, Program Committee	Martin
Member, MIT Department of Nuclear Science and Engineering Visiting Committee	Martin
Member, University of Tennessee Department of Nuclear Engineering Board of Visitors	Martin
Member, Review Committee, EESA Directorate at ANL, University of Chicago	Martin

Member, Idaho National Lab, Nuclear Science and Technology Peer Review Committee	Martin
Chair, Rensselaer Polytechnic University External Advisory Board	Martin
Chair, Los Alamos National Laboratory, Computational Physics and Applied Mathematics Capability Review Committee	Martin
Member, Nuclear Science & Technology Peer Review Committee, INL	Martin
Member, Nuclear Engineering and Technology Capability Review Committee, LLNL	Martin
Member, External Review Committee for Computation, LLNL	Martin
Member, External Advisory Council, Department of Nuclear Engineering, NC State	Martin
Member, Institute of Nuclear Materials Management (INMM)-Elected	Pozzi
Member, Student Activities Committee, INMM	Pozzi
Member, Institute of Nuclear Materials Management Central Chapter-Elected	Pozzi
Advisor, UM Institute of Nuclear Materials Management Student Chapter	Pozzi
Chair, Honors & Awards Committee, Radiation Instrumentation Steering Committee of the IEEE Nuclear and Plasma Sciences Society	Pozzi
Chair/Organizer, First MCNP-PoliMi Workshop, Ann Arbor, 2011	Pozzi
Member, Technical Program Committee (ANIMMA 2011)	Pozzi
Member, Expert Advisory Group, European Union FP7 project SCINTILLA	Pozzi
Member, European Safeguards Association, Nondestructive Assay Working Group	Pozzi
Member, European Safeguards Association, Novel Approaches/Novel Technologies Working Group	Pozzi
Vice Chair, High Energy Density Science Association (elected)	Thomas
Reviewer, General Secretariat for Research and Technology of Greece ARISTEIA Program	Thomas
Co-Chair, Organizing Committee/Working Group 1, Laser and Plasma Accelerator Workshop (Shanghai, 2011)	Thomas
Member, ANS International Program Committee	Wang
Member, IAEA Group on Very Long Term Storage of Used Nuclear Fuels	Wang
Vice-Chair, International Cooperative Group on Environmentally Assisted Cracking	Was
Member, TMS Nuclear Materials Committee	Was
Member, TMS Corrosion and Env. Effects Committee	Was
Member, MRS, Special Programs Committee	Was
Member, AFCI/GenIV Materials Working Group, LLNL	Was
Member, International Conference on Environmental Degradation of Materials in Light Water Reactors Organizing Committee	Was
Organizer, TMS Symposium on Microstructural Processes in Irradiated Materials	Was
Chair, Materials Review Capability Team, LLNL	Was
Member, Expert Panel on Primary & Secondary NPP Structural Metals Systems	Was
Member, EPRI Roadmap for Development of Radiation Resistant Materials	Was
Member, International Conference on Fusion Reactor Materials	Was
Conference Chair, 2010 Symposium on Radiation Measurements and Applications	Wehe

<b>EDITORIAL SERVICES</b>	
Associate Editor, Physics of Plasmas	Gilgenbach
Associate Editor, Health Physics	Kearfott
International Advisory Board, Plasma Physics and Controlled Fusion	Krushelnick
Editorial Board, Transport Theory and Statistical Physics	Larsen

Editorial Board, International Journal for Science and Technology of Nuclear Installations	Manera
Lead Editor, "Selected papers from the OECD-NEA PSBT Benchmark" issue in IJSTNI	Manera
Guest Editor, Special Issue on "Advances in Reactor Thermal-hydraulic System Analysis" in International Journal for Science and Technology of Nuclear Installations	Manera
Associate Editor, Journal of Computational Physics	Martin
Advisory Editor, Nuclear Science and Engineering	Martin
Editorial Board, Transport Theory and Statistical Physics	Martin
Guest Editor, Nuclear Instruments and Methods A	Pozzi
Editorial Board, Journal of Nuclear Materials	Was
Editorial Board, Metallurgical Transactions A	Was
Editor, Nuclear Instruments in Physics Research	Wehe
Editor, Nuclear Energy and Technology	Wehe

<b>JOURNAL REVIEW</b>	
Reviewer, Applied Physics letters	Atzmon
Reviewer, Acta Materialia	Atzmon
Reviewer, Chemical Physics	Atzmon
Reviewer, Intermetallics	Atzmon
Reviewer, International Journal of Materials Research	Atzmon
Reviewer, Journal of Alloys and Compounds	Atzmon
Reviewer, Journal of Applied Physics	Atzmon
Reviewer, Journal of Hydrogen Energy	Atzmon
Reviewer, Journal of Materials Research	Atzmon
Reviewer, Journal of Materials Science	Atzmon
Reviewer, Non-Crystalline Solids	Atzmon
Reviewer, Mater. Science and Engineering A	Atzmon
Reviewer, Physical Review Letters	Atzmon
Reviewer, Physics (Amer. Phys. Soc. Publication)	Atzmon
Reviewer, Scripta Materialia	Atzmon
Reviewer, Physics in Medicine and Biology	Bielajew
Reviewer, NSE/NucTech/ANE	Downar
Reviewer, Journal of Propulsion and Power	Foster
Reviewer, IEEE Transactions on Plasma Science	Foster
Reviewer, The Physics of Plasmas	Foster
Reviewer, Plasma Sources Science and Technology	Foster
Reviewer, Journal of Physics D	Foster
Reviewer, Plasma Physics and Controlled Fusion	Foster
Reviewer, Plasma Chemistry and Plasma Processing	Foster
Reviewer, Review of Scientific Instruments	Foster
Reviewer, IEEE Electron Devices Letters	Foster
Reviewer, Physics of Plasmas	Gilgenbach
Reviewer, IEEE Transactions on Plasma Science	Gilgenbach
Reviewer, Physical Review Letters	Hartman
Reviewer, Physical Review B	Hartman
Reviewer, Chemistry of Materials	Hartman
Reviewer, Nuclear Instruments and Methods In Physics Research Section A	Hartman

Reviewer, Nuclear Instruments and Methods in Physics Research	He
Reviewer, IEEE Transactions on Nuclear Sciences	He
Reviewer, Journal of Nuclear Medicine	Kearfott
Reviewer, Health Physics	Kearfott
Reviewer, Medical Physics	Kearfott
Reviewer, Nuclear Instrumentation and Methods Phys Rev A	Kearfott
Reviewer, Radiation Measurement	Kearfott
Reviewer, Physical Review Letters	Krushelnick
Reviewer, Physical Review E	Krushelnick
Reviewer, Physics of Plasmas	Krushelnick
Reviewer, Plasma Physics and Controlled Fusion	Krushelnick
Reviewer, New Journal of Physics	Krushelnick
Reviewer, Applied Physics Letters	Krushelnick
Reviewer, Review of Modern Physics	Krushelnick
Reviewer, Annals of Nuclear Energy	Larsen
Reviewer, Journal of Computational Physics	Larsen
Reviewer, Nuclear Science and Engineering	Larsen
Reviewer, Transport Theory and Statistical Physics	Larsen
Reviewer, Nuclear Instruments and Measurements, Section B (NIMB)	Larsen
Reviewer, Communications in Numerical Methods in Engineering	Larsen
Reviewer, Journal of Physics A	Larsen
Reviewer, Appl. Phys. Lett.	Lau
Reviewer, J. Appl. Phys.	Lau
Reviewer, IEEE Trans. Plasma Sci.	Lau
Reviewer, IEEE Trans. Electron Devices	Lau
Reviewer, Phys. Plasmas	Lau
Reviewer, Nuclear Science and Engineering	Lee
Reviewer, Nuclear Technology	Lee
Reviewer, Nuclear Engineering and Design	Lee
Reviewer, IEEE Transactions on Nuclear Science	Lee
Reviewer, Annals of Nuclear Energy	Lee
Reviewer, NED	Manera
Reviewer, CES	Manera
Reviewer, Journal of Nuclear Installations	Manera
Reviewer, Journal of Computational Physics	Martin
Reviewer, Nuclear Engineering and Design	Martin
Reviewer, Transport Theory and Statistical Physics	Martin
Reviewer, IEEE Transactions on Nuclear Science	Pozzi
Reviewer, Nuclear Science and Engineering	Pozzi
Reviewer, Transport Theory and Statistical Analysis	Pozzi
Reviewer, Nuclear Instruments and Methods in Physics Research A and B	Pozzi
Reviewer, Radiation Measurements	Pozzi
Reviewer, IEEE Transactions on Plasma Science	Thomas
Reviewer, Plasma Physics and Controlled Fusion	Thomas
Reviewer, New Journal of Physics	Thomas
Reviewer, Physical Review Special Topics – Accelerators and Beams	Thomas



Reviewer, APL, JAP, NIMB, JNM	Wang
Reviewer, Metallurgical Transactions A	Was
Reviewer, Journal of Nuclear Materials	Was
Reviewer, Journal of Chemistry and Physics	Was
Reviewer, Journal of Materials Science	Was
Reviewer, Materials Characterization	Was
Reviewer, ASTM	Was
Reviewer, Nuclear Instruments and Measurements in Physics B	Was
Reviewer, Journal of Plasticity	Was
Reviewer, Acta Materialia	Was
Reviewer, Radiation Physics and Chemistry	Was
Reviewer, Corrosion	Was
Reviewer, IEEE Trans. Nucl. Sci.	Wehe
Reviewer, IEEE Trans. Med. Imaging	Wehe

# Personnel

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(September 1, 2010 – August 31, 2011)

## FACULTY

### **Yugo Ashida**

#### **Assistant Research Scientist**

PhD, Machine Intelligence and Systems Engineering, Tohoku University, 1999

Irradiation assisted stress corrosion cracking in neutron-irradiated stainless steels in light water reactor systems

### **Michael Atzmon**

#### **Professor**

*Also Professor, Materials Science and Engineering*

PhD, Applied Physics, California Institute of Technology, 1985

Thermodynamics of materials, diffusion of solids, amorphous metal alloys, ion beam modification of materials

### **Alex F. Bielajew**

#### **Professor**

PhD, Theoretical Physics, Stanford University, 1982

Theory of electron and photon transport, Monte Carlo theory and development, radiation dosimetry theory, radiotherapy treatment planning algorithms

### **David Chalenski**

#### **Assistant Research Scientist**

PhD, Electrical and Computer Engineering, Cornell University, 2010

Wide array and gas puff z-pinch physics, applications of pulsed power, q-switched laser design, optical diagnostics, high-speed digital circuits

### **Shaun Clarke**

#### **Assistant Research Scientist**

PhD, Nuclear Engineering, Purdue University, 2007

Simulation techniques for active-interrogation systems using high-energy photons. Methods under investigation include photoneutron energy spectra and multiplicity analysis

### **Thomas Downar**

#### **Professor**

PhD, Nuclear Engineering, Massachusetts Institute of Technology, 1984  
Computational nuclear reactor physics, nuclear reactor dynamics, and the development of coupled neutronics and thermal-hydraulics methods for power reactor safety analysis.

**James J. Duderstadt**

**Professor**

**President Emeritus, University of Michigan**

**University Professor of Science and Engineering**

PhD, Engineering Science and Physics, California Institute of Technology, 1967

Nuclear systems, computer simulation, science policy, higher education

**Rodney C. Ewing**

**Professor**

*Also Professor, Materials Science and Engineering*

*And Professor, Geological Sciences*

PhD, Mineralogy/Geology, Stanford University 1974

Nuclear waste management, radiation effects in complex ceramics and glasses.

**Marek Flaska**

**Assistant Research Scientist**

**PhD, Nuclear Engineering, Delft University of Technology, Delft, the Netherlands, 2006**

The development of new methods for accurate identification and characterization of special nuclear material and radioactive sources for applications in nuclear nonproliferation, nuclear safeguards, and homeland security; Monte Carlo simulations and experiments and analyses with organic scintillators and capture-gated detectors

**Ronald F. Fleming**

**Professor**

PhD, Nuclear Engineering, University of Michigan, 1975

Neutron activation analysis, materials analysis using nuclear techniques, radiation measurements

**John E. Foster**

**Associate Professor**

PhD, Applied Physics, University of Michigan, 1996

Low-temperature plasma physics including applications in the areas of space propulsion plasmas, environmental plasmas, space and atmospheric plasma phenomena, energy conversion plasmas, and processing plasmas

**Ronald M. Gilgenbach**

**Chair and Chihiro Kikuchi Collegiate Professor**

**Director, Plasma, Pulsed Power, and Microwave Laboratory**

PhD, Electrical Engineering, Columbia University, 1978

Plasmas, fusion, electron beams, high power microwave generation, z-pinches, interaction of intense laser and particle beams with plasmas and materials.

**Mark Hammig**

**Assistant Research Scientist**

PhD, Radiation Measurements, University of Michigan, 2004

Development of miniature sensors that use mechanical rather than electrical signals to detect ionizing radiation

**Michael Hartman**

**Assistant Professor**

PhD, Nuclear Engineering, University of Michigan 2005

Application of neutron scattering techniques to study the underlying physical properties of matter; development of high-capacity, reversible, hydrogen storage materials

**Zhong He**

**Professor**

PhD, Physics, University of Southampton, United Kingdom, 1993

Room-temperature semiconductor, gamma-ray detectors, and gamma-ray imaging devices

**James P. Holloway**

**Professor**

**Associate Dean for Undergraduate Education**

PhD, Engineering Physics, University of Virginia, 1989

Neutron and photon transport theory, nuclear reactor physics and control, nonlinear dynamics, inverse problems, plasma kinetic theory, mathematical analysis of engineering problems, computational physics and engineering, primary energy production.

**Zhijie Jiao**

**Assistant Research Scientist**

PhD (Materials Science) Polytechnic University, New York, 2004

Irradiation effects and environmental degradation of cladding and structural materials for reactor systems

**Kimberlee J. Kearfott**

**Professor**

*Also Professor, Biomedical Engineering*

*Adjunct Professor, Radiology*

ScD (Nuclear Engineering), Massachusetts Institute of Technology, 1980

Radiation safety regulation, detection, dosimetry, and dose assessment; environmental radioactivity, explosives detection, medical and radiological imaging

**Karl M. Krushelnick****Professor**

Associate Director of the Center for Ultrafast Optical Sciences

PhD (Plasma Physics), Princeton University, 1994

Plasma physics, ultra-high intensity laser plasma interactions, inertial confinement fusion, compact laser-based particle accelerators and applications

**Mark Kushner****Professor**

*Also Professor, Electrical Engineering and Computer Science*

PhD (Applied Physics), California Institute of Technology, 1979

Applied electromagnetics, optics and phototonics, quantum science and engineering, plasma science and engineering, energy and power

**Edward W. Larsen****Professor**

PhD (Mathematics), Rensselaer Polytechnic Institute, 1971

Analytic and numerical methods for nuclear reactor theory, neutron transport, non-linear radiative transfer, electron and photon transport.

**Y.Y. Lau****Professor**

PhD (Electrical Engineering), Massachusetts Institute of Technology, 1973

Theory of plasmas: high power microwaves, noise, intermodulation, ultra-intense laser plasma interaction, wire Z-pinch physics, heating phenomenology, nano-diodes

**John C. Lee****Professor**

PhD (Nuclear Engineering), University of California-Berkeley, 1969

Nuclear reactor theory, reactor core physics and design analysis, reactor kinetics, fuel cycle analysis, reactor safety analysis, power plant simulation and control

**Annalisa Manera****Associate Professor**

PhD (Nuclear Engineering), Delft University of Technology, the Netherlands, 2003

Experimental single and two-phase flow, computational fluid dynamics, and multiphysics methods for power reactor safety analysis

**William R. Martin****Professor**

PhD (Nuclear Engineering), University of Michigan, 1976

Computational methods for the solution of problems in neutron transport, reactor core analysis, reactor thermal hydraulics, and nonlinear radiation transport, including algorithms for advanced computer architectures

**Sara A. Pozzi**

**Associate Professor**

PhD (Nuclear Engineering) Polytechnic of Milan, Italy, 2001

Nuclear materials measurements for nuclear nonproliferation, nuclear material control accountability, and national security; Monte Carlo code development for neutron and photon transport

**Volkan Seker**

**Assistant Research Scientist**

PhD (Nuclear Engineering), Purdue University, 2007

High temperature gas cooled reactor physics and thermo-fluids, computer code development in nuclear reactor analysis, parallel and high performance computing.

**Alexander Thomas**

**Assistant Professor**

PhD (Physics), Imperial College of London, UK, 2006

Plasma physics, ultra-high intensity laser-plasma interactions, compact laser-based particle accelerators, particle-in-cell simulation, radiation generation and back-reaction, laser propagation in plasma at high intensity, inertial confinement fusion, Vlasov-Fokker-Planck modeling, non-local transport, magnetized plasmas, electromagnetic and electrothermal instabilities

**Lu-Min Wang**

**Professor**

PhD (Materials Science), University of Wisconsin-Madison, 1988

Ion beam modification of materials, transmission electron microscopy, nanocrystalline materials, and nuclear materials

**Gary S. Was**

**Professor**

*Also Professor, Materials Science and Engineering*

*Walter J. Weber, Jr. Professor of Sustainable Energy, Environmental, and Earth Systems Engineering*

Director, Michigan Ion Beam Laboratory

ScD (Nuclear Materials Engineering), Massachusetts Institute of Technology, 1980

Radiation materials science, materials degradation and design for advanced reactor systems, materials processing with radiation, ion beam modification and analysis of materials, corrosion, stress corrosion cracking, hydrogen embrittlement, materials degradation modes, nuclear fuels and fuel materials

**David K. Wehe**

**Professor**

PhD (Nuclear Engineering), University of Michigan, 1984  
Gamma ray imaging, neutron physics, radiation spectroscopy, artificial intelligence and robotics applications, power plant reliability

**Louise Willingale**

**Assistant Research Scientist**

PhD (Plasma Physics), Imperial College London, UK, 2007  
Ultra-high intensity laser-plasma interactions, particle acceleration, particle-in-cell simulation

**Feng Zhang**

**Assistant Research Scientist**

PhD (Nuclear Engineering and Radiological Sciences), University of Michigan, 2004  
Room-temperature semiconductor detectors, ASIC readout systems and reconstruction of radiation interactions, next generation 3-D position sensitive CdZnTe detector array systems

## EMERITUS FACULTY

**A. Ziya Akcasu**

**Professor Emeritus**

PhD (Nuclear Engineering), University of Michigan, 1963  
Dynamics

**Terry Kammash**

**Stephen S. Attwood Professor Emeritus of Nuclear Engineering and Radiological Sciences**

PhD (Nuclear Engineering), University of Michigan, 1958  
Fusion hybrid reactors for terrestrial and space power and propulsion applications

**Glenn F. Knoll**

**Professor Emeritus**

PhD (Nuclear Engineering), University of Michigan, 1963  
Detection and spectroscopy of ionizing radiation, gamma ray imaging for medical and other applications, 3-D position sensing in gamma ray spectroscopy, nuclear detection and imaging.

**Dietrich H. Vincent**

**Professor Emeritus**

Dr. Rer. Nat. (Physics), Universitaet Goettinen, 1956  
Radiation effects in materials, hydrogen (and helium) in metals, ion beam analysis, Mossbauer spectroscopy, positron lifetime spectroscopy

# ADJUNCT FACULTY

## **Forrest Brown**

### **Adjunct Professor**

PhD (Nuclear Engineering), University of Michigan, 1981  
Research and Development Scientist, Los Alamos National Laboratory  
Research Professor, University of New Mexico  
International reputation in Monte Carlo simulation and advanced computing

## **Frederick W. Buckman**

### **Adjunct Associate Professor**

PhD (Nuclear Engineering), Massachusetts Institute of Technology, 1970  
President, Power Group, the Shaw Group, Inc.

## **Jeremy Busby**

### **Adjunct Assistant Professor**

PhD (Nuclear Engineering), University of Michigan, 2000  
Research Scientist, Oak Ridge National Laboratory  
Irradiation effects in metals for high temperature reactors, fusion reactors, and spacecraft reactors

## **Jack Davis**

### **Adjunct Professor**

PhD (Physics), Imperial College of Science, London, England, 1967  
Science & Technology Chair, Naval Research Laboratory  
Atomic physics, plasma spectroscopy, radiation transport, and non-LTE physics

## **Michael J. Flynn**

### **Adjunct Professor**

PhD (Nuclear Science), University of Michigan, 1975  
Radiation imaging with emphasis on medical applications

## **Mitchell M. Goodsitt**

### **Adjunct Professor**

*Also Professor, Radiological Sciences, Department of Radiology*  
PhD (Medical Physics), University of Wisconsin-Madison, 1982  
Diagnostic x-ray and ultrasound imaging and quality control, such as development of a 3-D x-ray and 3-D ultrasound breast imaging system

## **Ruth F. Weiner**

### **Adjunct Professor**

PhD (Chemistry), Johns Hopkins University, 1962



Sandia National Laboratories  
Radiation risk analysis, radioactive waste management

## **VISITING FACULTY**

### **Senada Avdic**

#### **Visiting Associate Research Scientist**

University of Tuzla, Department of Physics, Bosnia & Herzegovina  
Invited by Professor Sara Pozzi

### **Han Gyu Joo**

#### **Visiting Professor**

Seoul National University, Korea  
Invited by Professor Thomas Downar

### **Guang Ran**

#### **Visiting Assistant Research Scientist**

Xiamen University, China  
Invited by Professor Lu-Min Wang

### **Yunlin Xu**

#### **Visiting Associate Research Scientist**

Argonne National Laboratory  
Invited by Professor Thomas Downar

### **Gang Yu**

#### **Visiting Associate Research Scientist**

China Electric Power University, Beijing, China  
Invited by Professor Lu-Min Wang

## **POST DOCTORAL RESEARCH FELLOWS**

Shaily Bhola (Professor Gary Was)  
Ben Collins (Professor Thomas Downar)  
Andreas Enqvist (Professor Sara Pozzi)  
Mathieu Hursin (Professor Thomas Downar)  
Jae Cheon Kim (Professor Zhong He)  
Jinan Yang (Professor William Martin)

# **STAFF**

## **Technical Support**

James Berry, Mechanical Engineer  
Edward A. Birdsall, Facilities Infrastructure Manager  
Rodney Capps, Web Applications Developer  
Alex Flick, Research Project Engineer  
Dan Jabaay, Engineer in Research Intermediate  
Fabian Naab, Research Lab Specialist Associate  
Mark Perreault, Senior Electronics Technician, Plasma Experimental Bay  
Ovidiu Toader, Research Area Specialist Lead, Michigan Ion Beam Laboratory  
Scott Wilderman, Research Computer Specialist

## **Administrative Support**

Sheena Banghart, Administrative Assistant Associate  
Donna Constant, Secretary Senior  
Cherilyn Davis, Administrative Assistant Associate  
Pam Derry, Academic Advisor/Counselor  
Amber French, Accountant Associate  
Peggy Jo Gramer, Senior Graduate Program Coordinator  
Caroline Joaquin, Department Administrator  
Pat Moore, Office and Editorial Assistant  
Shannon Thomas, Research Process Coordinator  
Lois Vazquez, Accounting Clerk Associate  
Steven Winters, Administrative Assistant Senior

# Advisory Board

(September 1, 2010 – August 31, 2011)

Wesley E. Bolch	Professor, Nuclear and Radiological Engineering University of Florida Gainesville, FL
Forrest Brown	Diagnostics Applications Group Los Alamos National Laboratory Los Alamos, NM
Frederick W. Buckman	President, Power Group The Shaw Power Group Portland, OR
Jack Davis	Senior Scientist Naval Research Laboratory Washington D.C.
Jonathan E. Grindlay	Professor, Department of Astronomy Harvard University Boston, MA
Simon E. Labov	Associate Program Leader Lawrence Livermore National Laboratory Livermore, CA
Richard C. Lanza	Senior Scientist, Dept. of Nucl. Sci. and Engineering Massachusetts Institute of Technology Cambridge, MA
Thomas A. Mehlhorn	Superintendent, Plasma Physics Division Naval Research Laboratory Washington D.C.
Arthur T. Motta	Chair and Professor, Nuclear Engineering Program Penn State University University Park, PA
G. Robert Odette	Professor, Mechanical Engineering & Materials University of California-Santa Barbara Santa Barbara, CA
Charles A. Schrock	President and CEO Integrays Energy Group Chicago, IL
Joseph Schumer	Head, Pulsed Power Physics Branch Naval Research Laboratory Washington D.C.
Jasmina Vujic	Professor, Department of Nuclear Engineering University of California-Berkeley Berkeley, CA
Steven J. Zinkle	Director, Materials Science and Technology Division Oak Ridge National Laboratory Oak Ridge, TN