

University Leadership

*Vice President, Research and Economic Development, and Professor, Physics and Astronomy
University of Wyoming, 2017-present*

- Responsible for campus-wide research strategic planning, stimulus, and research program administration. Oversee research support services, budget operations, and research compliance functions. Responsible for stimulating economic development through IP transfer and stewardship of economic development units funded by the state of Wyoming. Responsible for relations with UW Foundation regarding research
- Key Accomplishments:
 - Leading campus-wide research strategic planning on transdisciplinary Grand Challenges, working with a Research Planning Council comprised of faculty from STEM fields, humanities, and social sciences, and UW Foundation representation
 - Established new Office of Research and Economic Development organization with expanded or strengthened services in proposal development, budget operations, compliance, and core facility management
 - Established planning activity for first-of-a-kind multidisciplinary biodiversity research center
 - With legislators past and present, faculty, and architects, led final design of \$100M multidisciplinary life sciences building, contributing to the release of construction funds from the Wyoming state legislature
 - Helped establish UW's Institute for Innovation and Entrepreneurship
 - Negotiated new contract with Wyoming Business Council for managing state-sponsored economic development units, giving UW flexibility to adjust resources between them

At DOE: Federal Research Program Leader and Administrator

*Associate Director of Science, U.S. Department of Energy (DOE), for Fusion Energy Sciences (FES),
2009-2017. Recipient of the Secretary's Meritorious Service Award, 2017*

- Responsible for national program strategic planning, budget formulation and execution, federal oversight of projects including U.S. ITER, and program integration with other agencies and offices. Budget in 2016 of over \$400,000,000
- FES directly supports programs at eight national and two federal laboratories, about 40 universities, and eight private industries, not including subcontractors
- Duties include: oversight of construction projects including U.S. ITER, proposal solicitations and reviews, funding awards; establishing national lab program metrics, and reviewing national lab performance of 10 Office of Science national labs
- Key Accomplishments:
 - Led development of U.S. ten-year strategic plan for fusion and plasma sciences
 - National lab program expansion: Led formation of intra-agency DOE research venture yielding a new class of plasma research centered at a national lab (SLAC), now regarded as world- leading
 - Grew overseas partnerships with new university and national lab teams

- Stakeholder engagement included program briefings and issues discussions with:
 - National lab and industry leaders and scientists, Congressional staff, university research leaders, faculty, and students, National Academies panels and committees, local, national, and international press
 - Administration stakeholders including OMB, Office of Science and Technology Policy, Presidential Science Advisor, and the Secretary and Deputy Secretaries of Energy
 - Congressional testimony, House Committee on Science and Technology, 2009, cf. <http://archives.democrats.science.house.gov/publications/Testimony.aspx?TID=15260>
- Oversight responsibilities included PPPL (M&O Contractor), ITER Project Office (Oak Ridge National Laboratory), FES construction projects

In the Field: Research Program Leader

Lawrence Livermore National Laboratory (LLNL; 2006-2009); Princeton Plasma Physics Laboratory, Princeton University (PPPL), 2000-2006

LLNL: Fusion Energy Program Leader (FEP), 2006-2009; Deputy Leader, Physics Division, Physical and Life Sciences Directorate, 2009

- Responsible for FEP strategic planning, execution, and business management. Multiple funding sources. Annual budget \$25-30M
- Elements included partnerships with private industry (General Atomics), other national labs, and university researchers
- Key Accomplishments:
 - Strategic realignment of the LLNL FEP research program with lab and national interests, through negotiation with DOE and LLNL leadership

PPPL: Head of Research, National Spherical Torus Experiment (NSTX), a national collaborative research facility, 2004-2006; Deputy Program Director, 2000-2004

- Key Accomplishments:
 - Led development and defense of NSTX Five Year Plan, 2004-2008 (2003)
 - NSTX is the leading fusion experiment at the lab and one of the two largest fusion experiments in the country
 - Successfully defended the NSTX research program in competitive DOE review (2005)

In the Laboratory: Research Physicist at a University-based National Laboratory

Princeton University's Princeton Plasma Physics Laboratory: All levels 1988-2000

Research: Both individual PI and team lead on the largest fusion research facility in the U.S.

- Developed and led award-winning energy and particle transport studies in prototype fusion systems
- Forged award-winning research partnership with private industry (General Atomics, La Jolla, CA)
- Received American Physical Society and Princeton University awards for excellence in research

Education

Ph.D., Physics, The University of Texas at Austin, 1988

B.A., Physics, The Johns Hopkins University, 1982

Graduated with Departmental Honors

Donald Kerr Medal for Excellence in Physics

Phi Beta Kappa

Professional Society Membership and Honors

- American Physical Society prize for Excellence in Plasma Physics Research (2001)
- Princeton University's Kaul Foundation Prize for Excellence in Plasma Physics Research and Technology Development (2000)
- American Physical Society prize for Excellence in Plasma Physics Research (2001)
- Fellow, American Physical Society
- Fellow, Institute of Physics (UK)

Publications

Over 160 peer-reviewed journal articles. Some details follow; a complete list is available separately

Select Research Achievements

- First experimental causality tests of the role of sheared plasma flows in reducing turbulence and losses of fuel and energy in a hot fusion plasma core. Also, the first demonstration of control by varying flows of energy containment and turbulence in a fusion plasma core

Publications include:

- Synakowski, E. J., *"Formation and structure of internal and edge transport barriers,"* Plasma Physics and Controlled Fusion **40** (5) 581-596 (invited international review)
- Synakowski, E. J., S. H. Batha, M. A. Beer, M. G. Bell, R. E. Bell, R. V. Budny, C. E. Bush, P. C. Efthimion, G. W. Hammett, T. S. Hahm, B. LeBlanc, F. Levinton, E. Mazzucato, H. Park, A. T. Ramsey, G. Rewoldt, S. D. Scott, G. Schmidt, W. M. Tang, G. Taylor and M. C. Zarnstorff (1997). *"Roles of electric field shear and Shafranov shift in sustaining high confinement in enhanced reversed shear plasmas on the TFTR Tokamak,"* Physical Review Letters **78** (15) 2972-2975
- Synakowski, E. J., S. H. Batha, M. A. Beer, M. G. Bell, R. E. Bell, R. V. Budny, C. E. Bush, P. C. Efthimion, T. S. Hahm, G. W. Hammett, B. LeBlanc, F. Levinton, E. Mazzucato, H. Park, A. T. Ramsey, G. Schmidt, G. Rewoldt, S. D. Scott, G. Taylor and M. C. Zarnstorff (1997). *"Local transport barrier formation and relaxation in reverse-shear plasmas on the Tokamak Fusion Test Reactor "* Physics of Plasmas **4**(5): 1736-1744 (national invited paper)
- First comparative study between major fusion research facilities (national lab and private industry) of plasma regimes with reduced cross-field transport in the fusion plasma core

Publications include:

- Synakowski, E. J., M. A. Beer, R. E. Bell, K. H. Burrell, B. A. Carreras, P. H. Diamond, E. J. Doyle, D. Ernst, R. J. Fonck, P. Gohil, C. M. Greenfield, T. S. Hahm, G. W. Hammett, F. M. Levinton, E. Mazzucato, G. McKee, D. E. Newman, H. K. Park, C. L. Rettig, G. Rewoldt, T. L. Rhodes, B. W. Rice, G. Taylor and M. C. Zarnstorff (1999). *"Comparative studies of core and edge transport barrier dynamics of DIII-D and TFTR tokamak plasmas,"* Nuclear Fusion **39** (11Y) 1733-1741 (international invited paper)

- First measurements of helium born in fusion reactions in the laboratory, leading to an assessment of favorable implications for a future fusion reactor

Publications include:

- Synakowski, E. J., R. E. Bell, R. V. Budny, C. E. Bush, P. C. Efthimion, B. Grek, D. W. Johnson, L. C. Johnson, B. Leblanc, H. Park, A. T. Ramsey and G. Taylor (1995) "*Measurements of the Production and Transport of Helium Ash in the TFTR Tokamak,*" Physical Review Letters **75** (20) 3689-3692

- First experimentally determined fluxes of heat and multiple species of ions compared with state-of-the-art instability theory and computation. This indicated that electrostatic turbulence is the dominant driver of heat and fuel across a confining magnetic field in a fusion system. and has favorable implications for a fusion reactor

Publications include:

- Synakowski, E. J., P. C. Efthimion, G. Rewoldt, B. C. Stratton, W. M. Tang, B. Grek, K. W. Hill, R. A. Hulse, D. W. Johnson, M. W. Kissick, D. K. Mansfield, D. McCune, D. R. Mikkelsen, H. K. Park, A. T. Ramsey, M. H. Redi, S. D. Scott, G. Taylor, J. Timberlake and M. C. Zarnstorff (1993). "*Helium, Iron, and Electron Particle-Transport and Energy-Transport Studies on the Tokamak Fusion Test Reactor.*" Physics of Fluids B-Plasma Physics **5** (7) 2215-2228 (national invited paper)

- First-ever measurements of the spatially localized helium diffusive and convective fluxes in a fusion plasma and comparison to heat and momentum fluxes. This suggested electrostatic drift-wave turbulence is the dominant transport mechanism for ions

Publications include:

- Synakowski, E. J., B. C. Stratton, P. C. Efthimion, R. J. Fonck, R. A. Hulse, D. W. Johnson, D. K. Mansfield, H. Park, S. D. Scott and G. Taylor (1990). "*Measurements of Radial Profiles of He²⁺ Transport-Coefficients on the TFTR Tokamak,*" Physical Review Letters **65** (18) 2255-2258

- First-ever comparisons of main ion (tritium) and impurity ion transport in a fusion plasma. _

Publications include:

- Efthimion, P. C., S. von Goeler, E. J. Synakowski, M. Bitter, S. H. Batha, R. E. Bell, C. E. Bush, W. A. Houlberg, F. M. Levinton, E. Mazzucato, D. McCune, D. Mueller, H. Park, A. T. Ramsey, A. L. Roquemore, G. Taylor and M. C. Zarnstorff (1998) "*Observation of tritium and helium core transport barriers in reversed shear plasmas on TFTR,*" Plasma Physics and Controlled Fusion **40** (5) 621-625

- Increased by an order of magnitude spectroscopic analyses of fusion plasma temperatures and flows, in service to the national research group at PPPL. This enabled spatial and temporal analyses of nearly every experiment on TFTR _

Examples of Talks, Forums, and Publications as Federal Research Program Leader

U.S. Department of Energy Report to Congress - The Office of Science's Fusion Energy Sciences Program: A Ten Year Perspective – Submitted to Congress, December 2015. Led the Administration's development of this plan, including obtaining community input. Available at http://science.energy.gov/~media/fes/pdf/program-documents/FES_A_Ten-Year_Perspective_2015-2025.pdf.

Congressional testimony, Subcommittee on Energy and Environment Committee on Science and Technology U.S. House of Representatives October 29, 2009; available at

<https://www.fas.org/sgp/congress/2009/102909synakowski.pdf>

Briefings to staffs of various Congressional committees, including:

- House and Senate Energy and Water Development Appropriations (at least annually)
- Senate Energy and Natural Resources
- House Science, Space, and Technology

University presentations. For example, *Leading Challenges and the Role of Transformation in the Fusion Energy Sciences*, 2015, at Columbia University, UCLA, and University of Michigan. These presentations accompany visits where I meet with graduate students, faculty, and university administration research leader

University Fusion Associates Town Hall, annually, American Physical Society Division of Plasma Physics national meeting

2nd Monaco-ITER International Fusion Energy Days, Principality of Monaco, December 2013, *Directing Transformation: The Science of Energy and Fusion*

Federal advisory committee meetings: for fusion and other Office of Science programs. Approximately biannually

Annually to the National Academies Board on Physics and Astronomy

Examples of Talks, Forums, and Publications as Federal Research Program Leader

Videos Online

Plasmas in Our Lives series interview, October 7, 2015, Michigan Institute for Plasma Science and Engineering:

- http://mipse.umich.edu/life/index.htm#miplasma_19

Reimagining the Possible: Scientific Transformations Shaping the Path Towards Fusion Energy, Public lecture video, March 5, 2015, "Science on Saturday," PPPL:

- <https://www.pppl.gov/events/science-saturday-reimagining-possible-scientific-transformations-shaping-path-towards-fusion>

Professional Community Service

- Chair, five-year review of major national fusion research and technology program. Advisory committee member of two leading US fusion experimental programs (university and industry)
- American Physical Society Division of Plasma Physics (APS-DPP) Executive Committee, APS-DPP Program Committee, and APS-DPP Distinguished Lecturer
- Vice-Chair, Energy Policy Act (EPAct of 2005) Task Group for development of US Research Plan for the international fusion project ITER, developed in response to Congressional request
- Vice Chair, Chair, and Steering Committee Chair, US Transport TaskForce

Interests and Activities

- Musical performance (trombone). Jazz; traditional jazz; dixieland in and around Washington D.C. and the East SF Bay area, in a quartet and other small groups. Also wind symphony, jazz orchestra, orchestra, British brass band, musical theater
- Literary interests include biography; history and philosophy of science; history of invention
- Amateur radio, bicycle touring, recreational speed skating