

## Uri Shumlak

Professor, Department of Aeronautics and Astronautics  
University of Washington, Seattle, WA

### Degrees

**Ph.D.:** University of California, Berkeley, 1992  
**B.S.:** Texas A & M University, 1987

### Current Position

**Professor:** Sep. 2007 – present  
**Associate Professor:** Sep. 2002 – Sep. 2007  
**Assistant Professor:** Sep. 1999 – Sep. 2002  
**Research Assistant Professor:** Dec. 1994 – Sep. 1999  
**National Research Council Associate:** Dec. 1992 – Dec. 1994

### Research Interests

Plasma Science, Innovative Confinement Concepts, Fusion Energy, Advanced Space Propulsion, Computational Fluid Dynamics

### Honors and Awards

American Institute of Aeronautics and Astronautics Abe Zarem Award of Excellence 2003  
University of Washington Aeronautics & Astronautics Professor of the Year 2002  
American Institute of Aeronautics & Astronautics Senior Member 2001  
University of Washington Aeronautics & Astronautics Professor of the Year 1999  
National Research Council Associateship 1992

### Selected Publications

K.A. Munson, U. Shumlak, and B.A. Nelson, "Extreme Ultraviolet Light Production from a ZaP Flow Z-Pinch Xenon Plasma," *Journal of Micro/Nanolithography, Microfabrication, and Microsystems (JM3)* **7** (1), 013003-1-9 (2008).

W. Song and U. Shumlak, "Charged Nanoparticle Source for High Thrust Level Colloid Thrusters," *Journal of Propulsion and Power* **24** (1), 139 (2008).

U. Shumlak, B.A. Nelson, C.S. Adams, B.-J. Chan, R.P. Golingo, S.D. Knecht, K.A. Munson, and D.J. Den Hartog, "Stabilization in the ZaP Flow Z-Pinch," *Journal of Fusion Energy* **27** (1-2), 111 (2008).

A. Hakim and U. Shumlak, "Two-Fluid Physics and Field-Reversed Configurations," *Physics of Plasmas* **14** (5), 055911 (2007).

U. Shumlak, B.A. Nelson, and B. Balick, "Plasma Jet Studies via the Flow Z-Pinch," *Astrophysics and Space Science* **307** (1-3), 41 (2007).

U. Shumlak, B.A. Nelson, C.S. Adams, D.J. Den Hartog, R.P. Golingo, S.L. Jackson, S.D. Knecht, J.B. Pasko, and D.T. Schmuland, "Equilibrium Evolution in the ZaP Flow Z-Pinch," *Journal of Fusion Energy* **26** (1-2), 185 (2007).

S.L. Jackson and U. Shumlak, "Abel Inversion of a Holographic Interferogram for Determination of the Density Profile of a Sheared-Flow Z-Pinch," *Reviews of Scientific Instruments* **77**, 083502 (2006).

J. Loverich and U. Shumlak, "Nonlinear Full Two-Fluid Study of  $m=0$  Sausage Instabilities in an Axisymmetric Z-Pinch," *Physics of Plasmas* **13** (8), 082310 (2006).

A. Hakim, J. Loverich, and U. Shumlak, "A High Resolution Wave Propagation Scheme for Ideal Two-Fluid Plasma Equations," *Journal of Computational Physics* **219**, 418 (2006).

M. Selwa, S.K. Solanki, K. Murawski, T.J. Wang, and U. Shumlak, "Numerical Simulations of Impulsively Generated Vertical Oscillations in a Solar Coronal Arcade Loop," *Astronomy and Astrophysics* **454**, 653 (2006).

R.P. Golingo, U. Shumlak, and B.A. Nelson, "Formation of a Sheared Flow Z-Pinch," *Physics of Plasmas* **12** (6), 062505 (2005).

J. Loverich and U. Shumlak, "A Discontinuous Galerkin Method for the Full Two-Fluid Plasma Model," *Computer Physics Communications* **169** (3), 251 (2005).

R.P. Golingo and U. Shumlak, "Spatial Deconvolution Technique to Obtain Velocity Profiles from Chord Integrated Spectra," *Reviews of Scientific Instruments* **74** (4), 2332 (2003).

- U. Shumlak, B.A. Nelson, R.P. Golingo, S.L. Jackson, E.A. Crawford, and D.J. Den Hartog, "Sheared Flow Stabilization Experiments on the ZaP Flow Z-Pinch," *Physics of Plasmas* **10** (4), 1683 (2003).
- U. Shumlak and J. Loverich, "Approximate Riemann Solver for the Two-Fluid Plasma Model," *Journal of Computational Physics* **187** (2), 620 (2003).
- U. Shumlak, R.P. Golingo, B.A. Nelson, and D.J. Den Hartog, "Evidence of Stabilization in the Z-Pinch," *Physical Review Letters* **87** (20), 205005 (2001).
- U. Shumlak and T.R. Jarboe, "Stable High Beta Spheromak Equilibria Using Concave Flux Conservers," *Physics of Plasmas* **7** (7), 2959 (2000).
- U. Shumlak and T.R. Jarboe, "Higher Mode Stability in Spheromak Equilibria," *Physics of Plasmas* **6** (11), 4382 (1999).
- U. Shumlak and N.F. Roderick, "Mitigation of the Rayleigh-Taylor Instability by Sheared Axial Flows," *Physics of Plasmas* **5** (6), 2384 (1998).
- O.S. Jones, U. Shumlak, D.S. Eberhardt, "An Implicit Scheme for Non-Ideal Magnetohydrodynamics," *Journal of Computational Physics* **130**, 231 (1997).
- C.W. Hartman, J.L. Eddleman, A.A. Newton, L.J. Perkins, and U. Shumlak, "Magnetic Confinement Fusion and the Continuous-Flow Pinch," *Plasma Physics and Controlled Fusion* **17** (5), 267 (1996).
- U. Shumlak and C.W. Hartman, "Sheared Flow Stabilization of the m=1 Kink Mode in Z-Pinches," *Physical Review Letters* **75** (18), 3285 (1995).
- U. Shumlak, T.W. Hussey, and R.E. Peterkin, "Three-Dimensional Magnetic Field Enhancement in a Liner Implosion System," *IEEE Transactions on Plasma Science* **23** (1), 83 (1995).
- T.W. Hussey, N.F. Roderick, U. Shumlak, R.B. Spielman, and C. Deeney, "A Heuristic Model for the Non-Linear Rayleigh-Taylor Instability in Fast Z-Pinches," *Physics of Plasmas* **2** (6), 2055 (1995).

#### Patents

- "Plasma-Based EUV Light Source," U. Shumlak, R.P. Golingo, and B.A. Nelson, Utility Patent US 7,372,059 B2, May 13, 2008.
- "Plasma-Based EUV Light Source for Next Generation Lithography," U. Shumlak, B.A. Nelson, and R.P. Golingo, Foreign Patent Application through the Patent Cooperation Treaty filed April 2008 for Europe and Taiwan.

#### Grants & Contracts

PI since 1994 on numerous grants and contracts from AFOSR, DOE, NASA, Boeing, etc. Total research funding to date: approximately \$8,000,000.

#### Professional Memberships

American Physical Society  
American Institute of Aeronautics and Astronautics

#### Selected Professional Service

AIAA Plasmadynamics Conference, Session Organizer  
APS Division of Computational Physics, Conference Program Committee  
APS John Dawson Award for Excellence in Plasma Physics Selection Committee, Chair  
ASME Propulsion Technical Committee  
DOD High Performance Computing Modernization Program Technical Evaluation Panel  
IEEE International Conference on Plasma Science, Session Organizer  
NASA High Energy Space Systems Review Panel  
University Fusion Association, Executive Committee Member

#### Selected Consulting & Expert Witness

Advanced Energy & Aerospace Programs, MSE Technology Applications, Butte, MT  
Andrews Space & Technology, Seattle, WA  
Boeing Company, Everett, WA  
OMAX Abrasive Waterjet Systems, Kent, WA  
Tethers Unlimited, Bothell, WA

