Derek Sutherland, Ph.D.

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Research Interests

Plasma Physics, Fusion Energy Science, Nuclear Engineering, Experimental Physics, Computational Physics, High Performance Computing.

Education

Doctor of Philosophy
University of Washington, Seattle, WA, 98195, December 2019
Area: Plasma Physics and Fusion Energy
GPA: 3.86/4.0
Adviser: Professor Thomas Jarboe, jarboe@uw.edu

Bachelor of Science
Massachusetts Institute of Technology, Cambridge, MA, June 2012
Majors: Nuclear Science and Engineering and Physics
GPA: 4.7/5.0
Adviser: Professor Dennis Whyte, whyte@psfc.mit.edu

Experience

Co-Founder and CEO August 2015 - Present
CTFusion, Inc., Seattle, WA, 98145, U.S.A.

Research Associate September 2012 - June 2019
HIT-SI Group, University of Washington, Seattle, WA, 98195, U.S.A.

Graduate Instructor Autumn 2015 Quarter
University of Washington, Seattle, WA, 98195, U.S.A.
- Graduate Course AA523: Nuclear Reactor Physics and Technology

Graduate Instructor Spring 2015 Quarter
University of Washington, Seattle, WA, 98195, U.S.A.
- Graduate Course AA523: Tokamak Fusion Physics and Technology

Student Internship Summer 2012
General Fusion Inc., Burnaby, BC, Canada

National Undergraduate Fellowship Program Summer 2011
General Atomics, DIII-D National Fusion Facility, San Diego, CA, U.S.A.

Student Internship Summer 2010
General Fusion Inc., Burnaby, BC, Canada

Student Internship Summer 2009
Los Alamos National Laboratory, Los Alamos, NM, U.S.A.

Presentations and Articles

Invited Talks

The Dynomak: A Sustained Spheromak Pathway to Economical Fusion Energy, *2018 American Nuclear Society - Technology of Fusion Energy Conference (TOFE)*, Orlando, FL, November 12-16, 2018.

Compact, spheromak-based pilot plants for the demonstration of net-gain fusion power, *2018 Exploratory Plasma Research Conference*, Vancouver, Canada, August 1-4, 2017.

Spheromak-based Fusion Reactors for the Expedited Pursuit of Economical Fusion Energy, *U.S. Magnetic Fusion Research Strategic Directions Workshop*, Madison, WI, July 24-28, 2017.

An overview of the HIT-SI3 research program and its implications for magnetic fusion energy, *36th Annual Fusion Power Associates Meeting*, Washington, D.C., December 16-17, 2015.

An overview of the HIT-SI3 research program and its implications for magnetic fusion energy, *18th International Spherical Tokamak Workshop*, Princeton, NJ, November 3-6, 2015.

The Dynomak Reactor System, *Exploratory Plasma Research Conference*, Madison, Wisconsin, August 5 - 8, 2014.

An Imposed-dynamo spheromak roadmap, *34th Annual Fusion Power Associates Meeting*, Washington, D.C., December 10-11, 2013.

The Dynomak: An advanced spheromak reactor system with imposed-dynamo current drive and next-generation nuclear power technologies, *2013 US-Japan Workshop on "Advanced Control and Confinement Improvement of Innovative Compact Toroidal Configurations"*, September 24-26, 2013, Kobe, Japan.

Production of Biodiesel and Biogasoline via Coupling a LBE-cooled Reactor to Hydrogen and Biofuel Plants, *ANS Winter Conference*, San Diego, CA, November 2012.

Posters

Project scaling of sustained spheromak configurations for economical fusion power, *61st Annual American Physical Society, Division of Plasma Physics Conference*, Poster UP10.00115, Ft. Lauderdale, Florida, October 21-25, 2019.

Two-fluid (plasma-neutral) Extended-MHD simulations of spheromak configurations in the HIT-SI3 experiment with PSI-Tet, *60th Annual American Physical Society, Division of Plasma Physics Conference*, Poster PP11.00076, Portland, Oregon, November 5-9, 2018.

Two-fluid (plasma-neutral) Extended-MHD simulations of spheromak configurations in the HIT-SI experiment with PSI-Tet, *59th Annual American Physical Society, Division of Plasma Physics Conference*, Poster NP11.00112, Milwaukee, Wisconsin, October 23-27, 2017.

An Overview of Research and Design Activities at CTFusion, *58th Annual American Physical Society, Division of Plasma Physics Conference*, Poster CP10.00098, San Jose, California, October 31-November 4, 2016.

Two-photon absorption laser induced fluorescence (TALIF) neutral density measurements and two-fluid (plasma-neutral) 3D Extended-MHD simulations with PSI-TET on the HIT-SI3 experiment, *57th Annual American Physical Society, Division of Plasma Physics Conference*. Poster BP12.00048, Savannah, GA, November 16-20, 2015.

Overview of the HIT-SI3 experiment, *56th Annual American Physical Society, Division of Plasma Physics Conference*. Poster UP8.00062, New Orleans, LA, October 27-31, 2014.

The Dynomak: An advanced spheromak reactor system with imposed-dynamo current drive and next-generation nuclear power technologies, *55th Annual American Physical Society, Division of Plasma Physics Conference*. Poster GP8.00063, Denver, CO, November 11-15, 2013.

The Dynomak: An advanced fusion reactor concept with imposed-dynamo current drive and next-generation nuclear power technologies, *25th International Atomic Energy Agency Fusion Energy Conference*, St. Petersburg, Russia, October 13-18, 2014, FIP/P8-25, pg. 580.

Studies of prompt losses from neutral beam injection into DIII-D, *53rd Annual American Physical Society, Division of Plasma Physics Conference*. Poster JP9.00078, Salt Lake City, UT, November 14-18, 2011.

Neutron Activation Diagnostics for FRCHX at AFRL, *51st American Physical Society, Division of Plasma Physics Conference*, Poster JP8.00033, Atlanta,

GA , November 2-6, 2009.

Publications

A.C. Hossack, D.A. Sutherland, and T.R. Jarboe, Derivation of dynamo current drive in a closed-current volume and stable current sustainment in the HIT-SI experiment, *Phys. Plasmas* **24**(020702), 2017.

A.C. Hossack, T.R. Jarboe, R.N. Chandra, K.D. Morgan, D.A. Sutherland, J.M. Penna, C.J. Everson, B.A. Nelson, Plasma response to sustainment with imposed-dynamo current drive in HIT-SI and HIT-SI3, *Nucl. Fusion* **57** (076026), 2017.

D.B. Elliott, D.A. Sutherland, et al., Two-photon LIF on the HIT-SI3 experiment: Absolute density and temperature measurements of deuterium neutrals, *Rev. Sci. Instru.* **87**(11), 2016.

B.N. Sorbom, et al., ARC: A compact, high-field, fusion nuclear science facility and demonstration power plant with demountable magnets, *Fusion Eng. and Design* **100**, 378-405, 2015.

T.R. Jarboe, B.A. Nelson, D.A. Sutherland, A mechanism for the dynamo terms to sustain closed-flux current, including helicity balance, by driving current which crosses the magnetic field, *Phys. Plasmas* **22**(072503), 2015.

C. Hansen, et al., Numerical studies and metric development for validation of magnetohydrodynamic models in the HIT-SI experiment, *Phys. Plasmas* **22**(056105), 2015.

T.R. Jarboe, et al., A Proof of Principle of Imposed Dynamo Current Drive: Demonstration of Sufficient Confinement, *Fus. Sci. and Tech.* **66**(3), 2014.

D.A. Sutherland, et al., The dynomak: An advanced spheromak reactor concept with imposed-dynamo current drive and next-generation nuclear power technologies, *Fusion Eng. Des*, **89**(4), 412-425, 2014.

Patents

U.S. Patent US9754686B2, Plasma confinement system and methods for use, September 05, 2017 (https://patents.google.com/patent/US9754686B2/en).

Awards and Recognition

CoMotion $50k Innovation Fund Award, University of Washington, June 2015.

CoMotion Graduate Innovators Award, University of Washington, May 2015.

Forbes' 30 Under 30 in Energy, Forbes Magazine, January 2015.

William E. Boeing Endowed Graduate Fellowship, University of Washington, November 2012.

ANS Student Design Competition Finalist: Production of Biodiesel and Biogasoline via Coupling an LBE-Cooled Reactor to Hydrogen and Biofuel Plants, ANS Winter Conference, San Diego, CA, November 2012.

Irving Kaplan Award for academic achievement by a junior in the MIT Department of Nuclear Science and Engineering, May 2011.

ANS Alpha Nu Sigma Honor Society Inductee, May 2011.

Computer Skills *Languages & Software:* Python, Fortran, C/C++, Mathematica, MATLAB, MCNP5/6
Operating Systems: macOS, iOS, UNIX, Linux, Windows