



POST-DOCTORAL RESEARCH ASSOCIATE

Long Pulse ITER Scenarios and Control – KSTAR

Lehigh University (LU), in collaboration with General Atomics, Princeton Plasma Physics Laboratory, and Oak Ridge National Laboratory, is seeking to fill a Post-Doctoral Research Associate position in the area of Long Pulse ITER Scenarios and Control. The main goals of this research team are to improve, demonstrate and predict key ITER $Q=10$ scenarios on KSTAR, while qualifying ITER control solutions for disruption-free operation consistent with long pulse requirements. KSTAR (Daejeon, South Korea) enables study and optimization of ITER scenarios and controls in a long-pulse device with reactor-relevant constraints of distant superconducting coils and a tungsten divertor.

The postdoctoral researcher will be permanently located either at Lehigh University in Bethlehem, PA or at General Atomics in San Diego, CA. This position may require to travel to South Korea to carry out collaborative work and conduct experiments at KSTAR. This is a two-year postdoctoral appointment with the possibility of subsequent renewals. The position is funded by the Office of Fusion Science at the US Department of Energy.

Major Duties

The Post-doctoral Research Associate will participate in the development of control-oriented models and model-based controls by carrying out different tasks associated with the problem such as:

- Develop Machine-Learning-based surrogate models for heating & current-drive sources and transport as well as MHD equilibrium solvers to enhance fast-simulation and high-accuracy capabilities of LU's Control Oriented Transport SIMulator (COTSIM) for KSTAR.
- Carry out full-discharge model-based kinetic+magnetic scenario optimization for $Q=10$.
- Develop dynamic density model in response to gas puffing and pellet injection and synthesize subsequent model-based active estimation and control approaches.
- Design fusion-gain control algorithms based on beta, safety-factor and confinement regulation.
- Develop possible feedback schemes for tungsten accumulation control.
- Develop active estimation and control algorithms for effective regulation of plasma volume-averaged properties in order to robustly sustain reactor-level advanced modes of operation by active regulation of the proximity to stability and disruption boundaries.
- Supervise students' work on the design of disruption-prevention algorithms to ensure ITER-like scenario operation in KSTAR.

Required Qualifications

- PhD in engineering, physics or a related field.
- Knowledge and/or previous work on basic plasma control.
- Experience conducting original research and publishing in peer-reviewed scientific journals.
- Excellent oral and written communication skills to deliver presentations at scientific venues, write technical reports/proceedings/journals, effectively interact with group members & collaborators.
- Ability to work independently and supervise PhD students, as well as to collaborate with colleagues in a multidisciplinary team to accomplish research goals in a timely fashion.
- Coding/programming experience.

Desired Qualifications

- Experience modeling the plasma response in tokamaks, including equilibrium, stability, transport, and heating and current drive.
- Experience coding in Matlab.
- Experience running transport codes like TRANSP.

Compensation and Benefits

Lehigh University offers competitive compensation and benefits, which include health care, life and disability insurance, tax-advantaged accounts, retirement plan with university contribution and match, tuition assistance, vacations/holidays, and flexible schedule (<https://hr.lehigh.edu/benefits>).

Application Materials Required

Please send 1) letter of interest (describing applicants' research experience and interests), 2) CV with a list of publications, 3) contact info of three references (name and email) to schuster@lehigh.edu. The position will remain open until filled.

About Lehigh University

For 150 years, Lehigh University has combined outstanding academic and learning opportunities with leadership in fostering innovative research. The institution is among the nation's most selective, highly ranked private research universities. Lehigh's four colleges provide graduate and undergraduate education to approximately 7,000 students. Located in Bethlehem, Pennsylvania, Lehigh is 80 miles west of New York City and 50 miles north of Philadelphia, providing an accessible and convenient location that offers an appealing mix of urban and rural lifestyles. The Lehigh Valley International Airport is just six miles from campus. Lehigh Valley cities and towns are regularly listed as among the best places to live in the country. Lehigh's MEM Department is consistently ranked among the best in the country.

About Lehigh University Plasma Control Group

The LU Plasma Control Group, directed by Prof. Eugenio Schuster and co-directed by Dr. Tariq Rafiq, conducts research at the boundary of theory-based modeling, predictive simulation, and plasma control. Group members combine backgrounds in plasma physics, applied mathematics, computational methods, machine learning, and controls. They work closely with colleagues at experimental facilities to integrate the fields of nuclear fusion, physics-based modeling, and model-based control. Present collaborations include the DIII-D tokamak (San Diego, CA, USA), the NSTX-U tokamak (Princeton, NJ, USA), the KSTAR tokamak (Daejeon, South Korea), the EAST tokamak (Hefei, China), and the ITER tokamak (St. Paul-lez-Durance, France).

Equal Employment Opportunity

Lehigh University is an Equal Opportunity/Affirmative Action Employer, and women and members of minority groups are strongly encouraged to apply. Lehigh provides a wide range of networking, mentoring and development opportunities for early-career scientist, and promotes a healthy work-life balance (see <http://www.lehigh.edu/~inprv/faculty/worklifebalance.html>). Lehigh is a recipient of the 2006 Alfred P. Sloan Award for Faculty Career Flexibility and a 2010 National Science Foundation ADVANCE Institutional Transformation Award to increase the advancement of women faculty in science, engineering, and math (see <http://advance.cc.lehigh.edu>). Lehigh offers excellent benefits, including domestic-partner benefits, and Lehigh is a founding member of the Lehigh Valley Inter-Regional Networking & Connecting Consortium to assist highly qualified couples who face the dual career challenge.