

Physics Colloquium

Physics Faculty Search Committee Candidate

Tariq Rafiq

Thursday, February 2nd at 4:10 pm in LL 316.

Refreshments available at 3:45.

Role of Plasma Science in Making a Sun on Earth

Fusion is the process which powers the sun and the stars. In a controlled thermonuclear fusion reactor, light nuclei in a fully ionized gas (a plasma) undergo a reaction, forming heavier elements and liberating large amounts of energy. Fusion offers an environmentally acceptable, secure, and long term source of energy. In view of world's growing energy requirements and the rapid exhaustion of existing energy resources, the development of fusion energy is of fundamental importance. Results will be presented describing application of plasma science that contributes to understanding the behavior of fusion plasmas by advancing the comprehension of the mechanisms that impact the confinement of fusion plasmas. Whole device integrated modeling simulations, carried out utilizing an improved description of turbulent transport, are employed in predicting the evolution of plasma profiles. The predicted profiles are compared with corresponding experimental data in order to validate the components used in the whole device modeling. Simulations are then carried out to predict the performance of ITER, the international fusion device that is currently under construction. It is expected that ITER will produce ten times as much fusion power as input heating power. Predictive whole device modeling, using reliable theory based modules, helps to avoid costly design mistakes and facilitates the optimization of experimental scenarios in order to make the most effective use of expensive experiments.

Tariq Rafiq is a Principal Research Scientist in the Lehigh University Physics Department.

Dr. Rafiq received his undergraduate education in Pakistan and his Ph.D. from Chalmers University of Technology, Sweden where he studied the influence of geometry on drift waves in tokamaks and stellarators. Following his doctoral work, he joined the University of Wisconsin as a post-doctoral researcher. At Wisconsin, Dr. Rafiq developed theoretical models related to energy and particle transport and applied these models in 3-D geometry. His current focus is on development of verified and validated theoretically derived models that can be used in whole device modeling and that can contribute to fusion becoming a practical energy source.