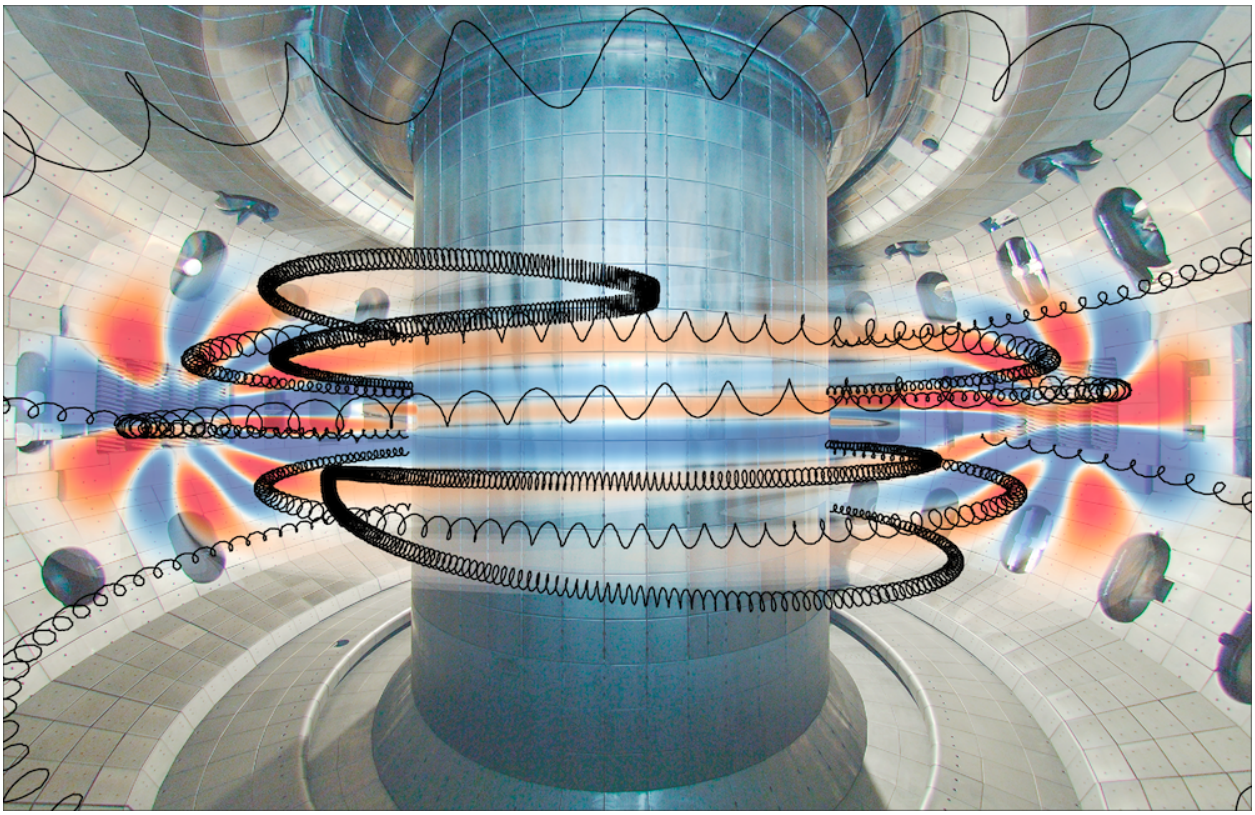
DIII-D Graphic for BPO Newsletter

Corresponding Author: D.C. Pace



A fusion reactor is designed to maintain the necessarily high plasma temperatures through the confinement of fusion-produced ions. Ongoing research aims to develop a predictive understanding of the ways in which these energetic ions both drive coherent waves and, through further interaction with those same waves, experience transport through velocity and real space. The graphic demonstrates energetic ion transport in the DIII-D tokamak (the center post diameter is 2 m). A single, trapped, energetic ion orbit resulting from neutral beam injection is shown as the black trace. The red and blue contours represent a synthetic image of a plasma wave (e.g., the normalized density or temperature perturbation caused by an Alfvén eigenmode) that perturbs the ion orbit and causes it to impact the outer wall on the right. The ending location of the orbit corresponds to the location of the energetic ion loss detector diagnostic system. Various resonant interactions between energetic ions and coherent waves result in fluctuations of the measured lost ion flux that occur at the frequencies of the waves. Measurements of the energetic ion transport and the waves are compared with results from simulation codes that are rapidly evolving to develop increasingly realistic descriptions of the physics, including non-linear effects and impacts on the background plasma. This work was supported by the DOE Office of Science (Office of Fusion Energy Sciences).

Graphic by M.A. Van Zeeland (photo courtesy Steve Allen)

For More Information

Review on Alfvén Eigenmodes: W.W. Heidbrink, *Phys. Plasmas* **15**, 055501 (2008)
Energetic Ion Loss Detector System: X. Chen, et al., *Rev. Sci. Instrum.* **83**, 10D707 (2012)
Simulation of Experiments: Y. Todo, et al., *Nucl. Fusion* **54**, 104012 (2014)