

Faculty Name:

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Lab:

Columbia Plasma Physics Laboratory

Project Title:

Machine Learning for Tokamak Three-Dimensional Field Thresholds

Description:

The tokamak, a leading device design for magnetic confinement fusion energy reactors, performs well due to the capture of charged plasma particles on its toroidal flux surfaces. However, it is possible for the nice concentric flux surfaces to “tear” and open up “magnetics islands” that cause radial transport of particles and heat [YouTube Lecture on Islands, Poli IPP Thesis 2012 (Ch 1-2.1)]. Asymmetries as small as $\delta B/B_0 \sim 1e-4$ (i.e. a perturbation “error field” 10,000 times smaller than the primary tokamak magnetic field) can drive a plasma instability.

This project will look at a database of experiments that did this intentionally, and use that data to determine what level of asymmetry would cause tearing in a future reactor so operators might avoid it or force it as they please. Specifically, this project will concentrate on Machine Learning (ML) approaches for predicting the RMP thresholds. A second objective of the work will be to identify the most impactful new experimental observations that could be obtained within the available operating space. The ML based approach will require an investigation of the relative importance of different plasma parameters in determining this threshold, which will in turn guide what new experiments should be performed to improve our understanding.

Students will also generally assist with other Columbia Plasma Physics Lab initiatives. More information can be found at <https://plasma.apam.columbia.edu>

** This position and others in Prof Paz-Soldan’s group have a common application **

** Please apply using the form <https://forms.gle/viSUdEneLy66vFaZ6>. Do NOT email the PI **

** Flexibility in project choice is welcome **

Location of Research:

On Site

of hrs/week:

40

Department/Program:

Applied Physics and Applied Mathematics

Eligibility:

BS, First Year, BS, Second Year, BS, Third Year, MS

To apply, please contact:

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