TITLE: Reproducing Microtearing Mode Instabilities in the H-mode Tokamak Pedestal Using GPR Profile Fitting

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ABSTRACT: Within the pedestal region of H-mode tokamaks, microtearing mode[1] (MTM) instabilities continue to challenge plasma confinement by releasing particle and energy fluxes, causing the formation of topological magnetic islands. It has been observed that MTMs typically occur due to the electron temperature and density profile gradients. To better study MTMs, computational physicists attempt to reproduce their frequency bands, as well as the growth rate of their magnetic islands using gyrokinetic simulations[2]. While typically successful, occasionally the simulations do not accurately reproduce MTM frequencies in line with experimental results, which is an indication the profiles used in reproduction do not accurately reflect experimental conditions. A machine-learning tool called Gaussian process regression[3,4] (GPR) is thought to be an effective method that can be used to recreate an ensemble of profiles in a short period of time by sampling the plasma profiles within the experimental error bars. This research project focused on the development of a GPR tool that generates profiles using the electron temperature and density profiles from the DIII-D tokamak discharge #162490[2], and passing the mean GPR fit to these profiles through the CHEASE[5] code used to simulate tokamak equilibrium. The code explores the possibilities of finding destabilized MTMs using the means of the generated profiles from the GPR algorithm within agreement of experimental observations.

References:

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