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Plasma Density Increases in a Low Power ECR Thruster Using Pulsed Power and Frequency Mixing Techniques[1] BENJAMIN WACHS, BRENDAN STASSEL, BENJAMIN JORNS, University of Michigan — The work presented here explores increases in plasma density at the exit plane of a low power Electron Cyclotron Resonance (ECR) magnetic nozzle thruster achieved using custom input power waveforms. The waveforms used in this experiment are generated by a solid-state power amplifier thus allowing for a variety of modulation techniques to be tested. We employ Bayesian optimization to maximize plasma density while keeping total input power constant. Here, multiple frequencies and modulation schemes are combined in different weights to produce new waveforms. We then measure density in real time using a microwave interferometer setup, which gives rapid feedback and thus allows for the exploration of a wide design space. While pulsed power is common in plasma processing and multifrequency heating is often used in high power ion sources, these techniques have not been combined in this manner for real time optimization of plasma parameters. While this experiment is conducted using a prototype thruster, and plasma density serves as a corollary for thrust generation, the techniques developed in this work can easily be applied to plasma processing and other types of plasmas.

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