

PiAI Seminar Series: Physics informed AI in Plasma Science
8:00-9:00, 23 January 2023 (EST)
14:00-15:00, 23 January 2023 (CET)
22:00-23:00, 23 January 2022 (JST)
Web Seminar

Reinforcement Learning for Nuclear Fusion in Tokamaks

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Reinforcement Learning (RL) has had many recent successes in games and other applications where accurate, cheap simulations are available or a large amount of learning trials are possible. In doing so, it has demonstrated its ability to learn control and decision making policies for large-scale, nonlinear, hidden state systems that are too challenging for scientists to manually design policies. The problem of designing control policies for nuclear fusion in tokamaks contains all these features of a difficult dynamic system and the challenge of not having good simulators or the ability to run many experiments.

In this talk, I will describe our recent efforts at overcoming these challenges on the DIII-D tokamak. I will first present our algorithms for learning dynamic models with uncertainty quantification and then the corresponding RL and Bayesian optimization algorithms that build on those models to produce control policies. Finally, I will summarize the results of testing these policies on the DIII-D tokamak over the past 6 months.