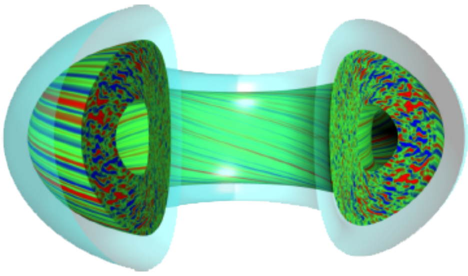

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Bayesian Inference of Experimental Particle Transport in Tokamak Plasmas

Tuesday, 30 November 2021 14:05 (25 minutes)

Impurity and neutral particles play a critical role in tokamak core-edge integration. This motivates close examination of state-of-the-art transport models and comparison of their predictions with experiments using modern computational statistics tools. Here we present a High Performance Computing (HPC) framework for fully-Bayesian inferences of particle diffusion and convection profiles and its application to both Alcator C-Mod and DIII-D plasmas without ELMs. Our inferences make use of the new Aurora package (https://aurora-fusion.readthedocs.io/en/latest/), developed to permit 1.5D forward modeling of impurity transport using new high-fidelity open-source code. Aurora simulations of Laser Blow-Off (LBO) injections of Ca, Al, and F are used to illustrate discrepancies between experimental inferences and theoretical modeling with neoclassical (NEO) and turbulent (TGLF, CGYRO) codes in cases where flat or hollow impurity profiles are observed in experiments. These C-Mod and DIII-D inferences leverage a number of new spectroscopic analysis and statistical techniques, including forward-modeling of the entire Ca K-alpha spectrum, simulation of multiple atomic species, and use of non-separable priors. Extensive modeling capabilities have been made public via the OMFIT framework (https://omfit.io/index.html).

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