

Abstract Submitted
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Physics-constrained, low-dimensional models for MHD: First-principles and data-driven approaches¹ ALAN KAPTANOGLU, KYLE MORGAN, CHRISTOPHER HANSEN, STEVEN BRUNTON, University of Washington — Modeling and control of plasmas is a notoriously challenging, yet vital topic in modern physics. This work focuses on the development of several novel reduced-order modeling frameworks for compressible plasmas, leveraging decades of progress in first-principles and data-driven modeling of fluids. These theoretical frameworks enable the development of sparse and interpretable nonlinear reduced-order models from data that are intrinsically connected to the underlying physics. We demonstrate the effectiveness of these approaches on data from high-fidelity numerical simulations. These techniques prove promising for the prediction, estimation, and control in industrial and laboratory plasmas.

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