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Equation Free Projective Integration Enabled by Dynamic Mode Decomposition[1] SEBASTIAN DE PASCUALE, DAVID GREEN, Oak Ridge National Laboratory — We demonstrate the application of dynamic mode decomposition (DMD) on a classic multiscale problem in plasma physics: the ponderomotive modification of electron density by an oscillating electric field. DMD functions as a data-driven method that separates spatiotemporal scales simultaneously, an advantageous feature over limited Fourier and wavelet techniques. We leverage DMD in an automated procedure to identify and extract the slow secular drift of the ponderomotive force from 1x-1v Vlasov simulations of the fast system response to an applied electric field. We reconstruct the time averaged effect on the fluid density moment from analysis of the fast kinetic distribution function. This reconstruction enables an equation free projective integration (PI) of the quantity, where the form of the ponderomotive force is treated as unknown but its resultant effect is approximated by decomposition of simulation data into dynamic modes. Each spatial mode has a corresponding temporal variation that can projected outside of the sampling set. We devise a parameterization of the DMD method into a mapping between slow and fast scales in the equation free paradigm. We show improved accuracy over naive explicit Euler PI and discuss progress on a Picard iteration based PI.

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