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Equation-free Modeling of Ion Acoustic Wave with Particle Trapping GEORGE STANTCHEV, MICHAEL SHAY, WILLIAM DORLAND, JAMES DRAKE, University of Maryland — Recently, Shay et al.[1] have successfully implemented equation-free projective integraion methods to simulate the propagation and steepening of a 1D ion acoustic wave. For the forward extrapolation step they have been using only a small number of lower moments of the probability density function (PDF) based on the assumption that the distribution would remain Maxwellian at all times. This however is no longer valid in many interesting situations, in particular for the case of particle trapping. To solve this problem we propose a generalization of Shay's algorithm to allow for tracking of an arbitrary PDF. We estimate the PDF at each micro-time step using statistical wavelet analysis. The resulting vectors of wavelet coefficents are used for forward extrapolation in time to obtain a multi-scale representation of the projected PDF after a coarse time step. An optimal wavelet basis is selected through adaptive refinement at the beginning of each microscopic simulation sequence. We discuss the application of this technique to the 1D acoustic wave problem with particle trapping.
[1] M. Shay, J. Drake, W. Dorland, Multiscale modeling of plasmas via equation-free projective integration, in preparation

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