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Reducing Undersampling Noise in PIC Codes Using Advanced Multiresolution Analysis Techniques[1] KIRK WON, BEDROS AFEYAN, Polymath Research Inc., JEAN LUC STARCK, CEA, France — We show results from the implemention of a number of new ideas stemming from the multiscale, multiresolution analysis arena where Poisson noise, or under-sampling noise, is adequately treated via a series of more and more geometrically sophisticated objects going from elementary 2D Haar wavelets, to isotropic undecimated wavelet transforms (in 2D), to biorthogonal Haar bases with multiscale nonlinear transforms that convert Poisson distributions to Gaussian ones where noise estimation (thresholding) is much easier, to curvelets, where orientation information (resolving coherent structures in phase space, detecting and respecting anisotropy) is vitally important. This suite of new techniques allows the accurate extraction of phase space densities with fidelity impossible to achieve with naive or trivial interpolation or smoothing techniques. We will demonstrate the relative strengths and detection capabilities of these techniques. The examples we treat are the Beam-Plasma Instability (BPI) and ponderomotively driven KEEN waves. These allow intricate phase space structures to coexist with chaos and turbulence. The former has a simple single mode linear limit which is unstable, but the latter gives rise to pure multimode nonlinear phenomena.

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