Coarse-grained entropy decrease and novel phase-space focusing and cooling in Hamiltonian dynamics ARJENDU PATTANAYAK, DANIEL W.C. BROOKS, ANTON DE LA FUENTE, LAWRENCE URRICHIO, EDWARD HOLBY, DANIEL KRAWISZ, JORGE SILVA, Carleton College — We analyze the behavior of the coarse-grained entropy for classical probabilities in nonlinear Hamiltonians. We focus on the result that if the trajectory dynamics are integrable, the probability ensemble shows transient increases in the coherence, corresponding to an increase in localization of the ensemble and hence the phase-space density of the ensemble. We discuss the connection of these dynamics to the problem of cooling in atomic ensembles. We show how these dynamics can be understood in terms of the behavior of individual trajectories, allowing us to manipulate ensembles to create "cold" dense final ensembles. We illustrate these results with an analysis of the behavior of particular nonlinear integrable systems, including discussions of the spin-echo effect and the seeming violation of Liouville's theorem.

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