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Self-consistent diffusion in coupled symplectic maps

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The study of diffusion in symplectic maps has been a problem of interest in plasma physics for a number of years. Since the introduction of the standard map as a simple model of magnetic field lines stochasticity, different maps have been proposed to model various aspects of plasmas transport. Maps are highly simplified models and there are many directions one can take to make them more physically meaningful. Here we explore the issue of self-consistency, which despite of its critical importance, is usually overlooked in the description of plasmas with maps and, in general, with low degrees of freedom models. We propose a class of self-consistent models consisting of an ensemble of standard maps globally coupled through a mean field [1]. The nontrivial effects of self-consistency on transport, including subcritical diffusion and suppression of diffusion, are studied analytically and numerically. [2]

[1] D. del-Castillo-Negrete, Chaos, 10, 75 (2000).
[2] G. Boffetta, D. del-Castillo-Negrete, C. Lopez, G. Pucacco, A. Vulpiani, Phys. Rev. E, 67, 026224 (2003).