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**Formation of phase space structures by sculpted initial conditions in Vlasov simulations** P.J. MORRISON, Department of Physics and Institute for Fusion Studies, University of Texas, Austin, Texas 78712, F. VALENTINI, Dipartimento di Fisica, CNISM, Università della Calabria, 87036 Rende CS), Italy, F. PEGORARO, Dipartimento di Fisica, CNISM, Universitá di Pisa, 56127 Pisa, Italy, T.M. O'NEIL, Department of Physics, University of California at San Diego, La Jolla, California, 92093 — Usually Vlasov-Poisson (VP) simulations are initiated close to equilibria; alternatively, dynamically accessible initial conditions are generated by applying external drive fields. We study a variety of states in VP simulations with drive fields launched into a plasma with fixed ions. Time evolution of the response electric field strongly depends on the form of the drive. In particular, complex non-sinusoidal oscillations are obtained in the case of an abrupt turning off of the drive, and phase space can be sculpted by the drives of multiple sinusoidal oscillations that open 'resonances'. Examination of the phase space contours provides understanding of the resulting electric field behavior. For a single sinusoidal drive, a main BGK mode (hole) with a secondary structure of two counter-propagating smaller holes (period-2 resonance) is observed. Physical and mathematical arguments that explain this structure are given. For longitudinal propagation in a plasma with properties that change on a short time scale, pseudo-Fresnel relations between the incident, transmitted, and reflected wave amplitudes can be derived. Mathematically, the states that occur can be interpreted as periodic orbits in the VP system, akin to those that occur in finite-dimensional Hamiltonian systems.

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