Hamiltonian reductions of the one-dimensional Vlasov equation using phase-space moments

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We consider Hamiltonian closures of the one-dimensional Vlasov equation using the phase-space moments of the Vlasov distribution function. We provide some conditions on the closures imposed by the Jacobi identity. We completely solve some families of examples. As a result, we show that imposing that the resulting reduced systems preserve the Hamiltonian property of the parent model shapes their phase space by creating a set of Casimir invariants as a direct consequence of the Jacobi identity. We exhibit three main families of reduced Hamiltonian models with two, three, and four degrees of freedom aiming at modeling the complexity of the bunch of particles in the Vlasov dynamics.

References

[1] C. Chandre, M. Perin, Hamiltonian reductions of the one-dimensional Vlasov equation using phase-space moments, J. Math. Phys. **57**, 032902 (2016)