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The Hamiltonian structure and Euler-Poincaré formulation of the Vlasov-Maxwell and gyrokinetic systems JONATHAN SQUIRE, Princeton University, HONG QIN, Princeton Plasma Physics Laboratory; Dept. of Modern Physics, USTC, Hefei, WILLIAM TANG, Princeton Plasma Physics Laboratory, CRISTEL CHANDRE, Centre de Physique Theortique, CNRS — We present a new variational principle for the gyrokinetic system, similar to the Maxwell-Vlasov action presented in Ref 1. The variational principle is in the Eulerian frame and based on constrained variations of the phase space fluid velocity and particle distribution function. Using a Legendre transform, we explicitly derive the field theoretic Hamiltonian structure of the system. This is carried out with a modified Dirac theory of constraints, which is used to construct meaningful brackets from those obtained directly from Euler-Poincaré theory. Possible applications of these formulations include continuum geometric integration techniques, large-eddy simulation models and Casimir type stability methods.

[1] H. Cendra, D. D. Holm, M. J. W. Hoyle, and J. E. Marsden, Journal of Mathematical Physics 39, 3138 (1998).

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