Abstract Submitted
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Quasi-relaxed magnetohydrodynamics – phase-space action with EXB constraint[1] ROBERT DEWAR, Australian National University, JOSHUA BURBY, Los Alamos National Laboratory, ZHISONG QU, Australian National University, NAOKI SATO, Tokyo University, MATTHEW HOLE, Australian National University — A new formulation of time-dependent Relaxed Magnetohydrodynamics (RxMHD) has recently [R.L. Dewar, J.W. Burby, Z.S. Qu, N. Sato, and M.J. Hole, Phys. Plasmas **27**, 062504 (2020)] been derived variationally from Hamilton's Action Principle using a non-canonical phase-space version of the MHD Lagrangian with the phase space variables both being velocity fields, $\vec{u}$ and $\vec{v}$ (actual and reference flows, respectively). In the static case, this formalism gives Euler–Lagrange equations consistent with previous work on exact ideal and relaxed axisymmetric MHD equilibria with flow, but also generalizes the relaxation concept from statics to dynamics. The new dynamical formalism agrees with ideal-MHD equiilibrium theory in the case of flow purely parallel to the magnetic field, i.e. in the *fully relaxed* case when the perpendicular electrostatic field is zero. While, the ideal (zero resistivity, no turbulent dynamo) Ohm's Law is not built in, and can be shown to be violated in dynamical evolution, the phase space Lagrangian method is shown to be sufficiently flexible as to allow the electrostatic ideal Ohm's Law to be added as a constraint to produce a Quasi Relaxed MHD (QRxMHD).

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