# Unified Theory of Ghost and Quadratic-**Flux-Minimizing Surfaces**

#### R.L. Dewar, S.R. Hudson, A.M. Gibson

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A generalized Hamiltonian definition of ghost surfaces (surfaces defined by an action-gradient flow) is given and specialized to the usual Lagrangian definition. Numerical calculations show uncorrected quadratic-flux-minimizing (QFMin) and Lagrangian ghost surfaces give verv similar results for a chaotic magnetic field weakly perturbed from an integrable case in action-angle coordinates, described by  $L = L_0 +$ \epsilon L\_1\$, where \$L\_0(\dot{\theta})\$ (with \$\dot{\theta}\$ denoting \$d\theta/d\zeta\$) is an integrable field-line Lagrangian and \$\epsilon\$ is a perturbation parameter. This is explained using a perturbative construction of the auxiliary poloidal angle \$\Theta\$ that corrects QFMin surfaces so they are also ghost surfaces. The difference between the corrected and uncorrected surfaces is \$O(\epsilon^2)\$, explaining the observed smallness of this difference. An alternative definition of ghost surfaces is also introduced, based on an actiongradient flow in \$\Theta\$, which appears to have superior properties when unified with QFMin surfaces.

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