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Single Particle Motion in Systems with Spatially Rapidly Varying Fields[1] HAROLD WEITZNER, Courant Institute-NYU — Earlier work, *Phys. Plasmas* **12**, 012106 (2005), showed that adiabatic invariants may exist even in certain systems with large gradients in the underlying electromagnetic fields. Those results were highly implicit and hard to employ for further theoretical developments. This work shows that extensions may allow gradient lengths of order $\sqrt{\rho L}$, where ρ is the larmor radius parameter and L a macroscopic distance. The underlying fields may vary with this parameter in one coordinate only, say a flux variable, while turbulent electromagnetic fields of amplitude $\sqrt{\rho L}$ and scale length $\sqrt{\rho L}$ may also be present and depend on all coordinates. Such turbulent fields would have $k_\perp \rho \sim \sqrt{\rho/L}$, that is not quite so large as 1, but easily of order .1 or .2. The model of single particle motion is fully nonlinear and explicit in the amplitude of the turbulent electromagnetic potentials. The associated turbulence models would be far more explicit than the earlier work or the conventional gyrokinetic theories.

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