Abstract Submitted
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Small perturbations in magnetically confined plasmas[1] LINDA SUGIYAMA, MIT — Two types of small perturbation theories exist for plasmas confined in strong toroidal magnetic fields. Both are well developed and provide useful insights into plasma behavior. The MHD plasma equations can be linearized to predict exponential growth rates for small disturbances.[2] The toroidal magnetic field can be described as a Hamiltonian system with two degrees of freedeom, as long as the toroidal field component is nonzero. Small perturbations produce magnetic island chains at low order rational surfaces and characteristic stochasticity around magnetic X-points (homoclinic or heteroclinic tangles around hyperbolic saddle points in Hamiltonian dynamics), The X-points can be induced by the perturbations or exist in the equilibrium configuration). The two descriptions appear to predict different behavior for small plasma perturbations. The explanation of this apparent paradox has important implications for linear and nonlinear small plasma perturbations and for plasma models, that extend beyond MHD. The cases of magnetic tearing modes on interior flux surfaces and edge instabilities in plasmas with X-poinhts on the plasma separatrix are discussed.

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[2]I.B. Bernstein et al., *Proc. Roy. Soc. London, Ser. A* **244** 1765 (1958).

Linda Sugiyama
MIT

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