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From plasma equilibrium to Hamiltonian chaos and the "destruction" of the magnetic moment

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Starting from a given passive particle equilibrium particle cylindrical profiles [1], we built self-consistent stationary conditions of the Maxwell-Vlasov equation at thermodynamic equilibrium with non-flat density profiles[2,5]. In this setting the possible presence of a bifurcation leading to a better plasma confinement is discussed. Further more the full motion of charged particles in an ideal though realistic magnetic configuration giving rise to the passive particle equilibrium is analyzed. The destruction of a separatrix and the emergence of Hamiltonian chaos, is displayed[3,4]. In these regions the magnetic moment, shows large fluctuations and is not a conserved adiabatic quantity.[4,5] This leads to questions the validity of the hypothesis behind gyrokinetics, as the change of variables used in these appears to be not valid over the whole phase space, implying that we results from gyrokinetics should not be considered as stemming from first principles.

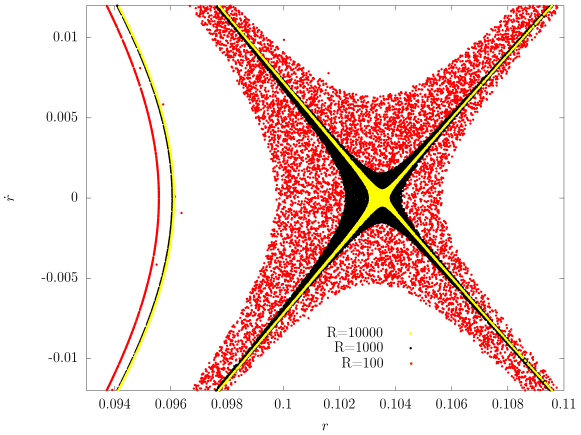

Fig 1. :Emergence of chaos as aspect ratio is decreased

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Note: Abstract should be in (full) double-columned one page.