PRELIMINARY RESULTS OF SIMULATION OF A SAWTOOTH CRASH IN CDXU

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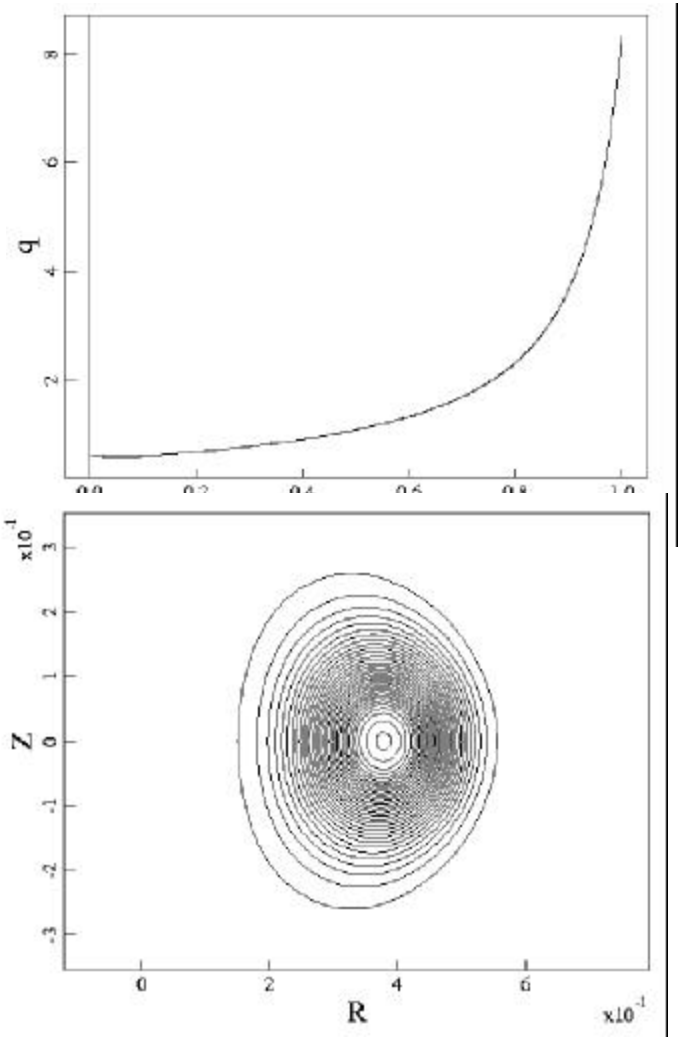
CDXU EQUILIBRIUM

- **Computed by TSC**
  - R/a = 1.39
  - B_0 = 0.127 T
  - I = 58.2 kA
  - I/aB = 1.888
  - q_0 = 0.605
  - q_{max} = 8.322
  - b = 7.8 X 10^{-3}
  - b_N = 0.412
  - t_A = 4.5 X 10^{-7} sec

$S = 10^4$

Pr = 1



NIMROD GRID

20 X 12

Bi-quartic finite elements

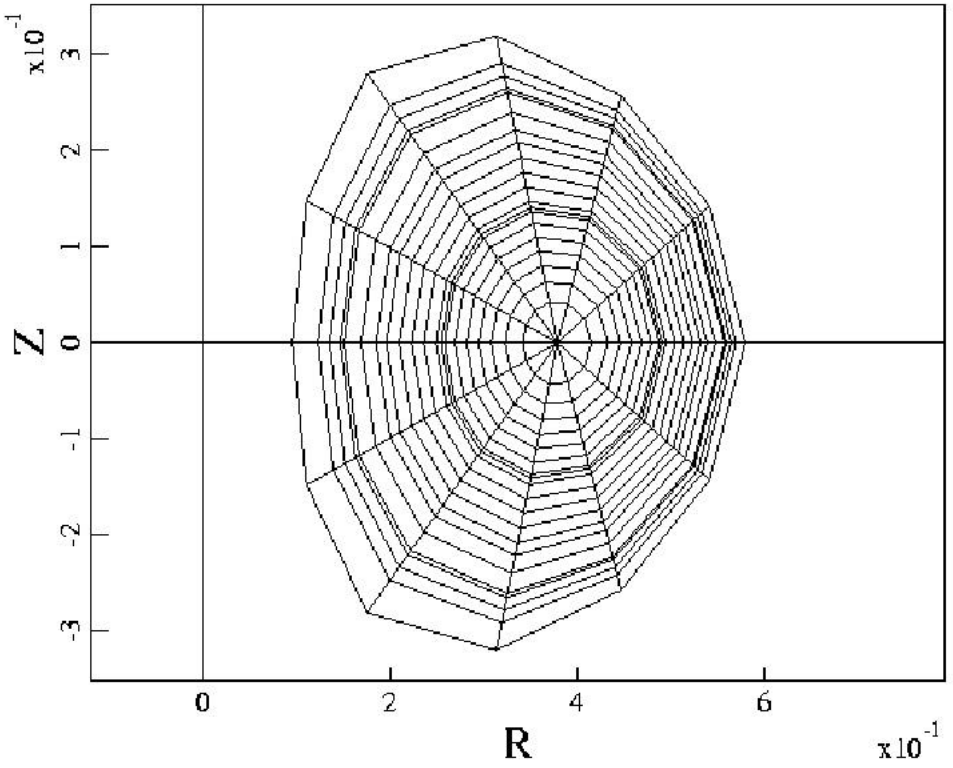
***n* = 0 - 5**

D*t* = 5 X 10^{-7} sec

~ t_A

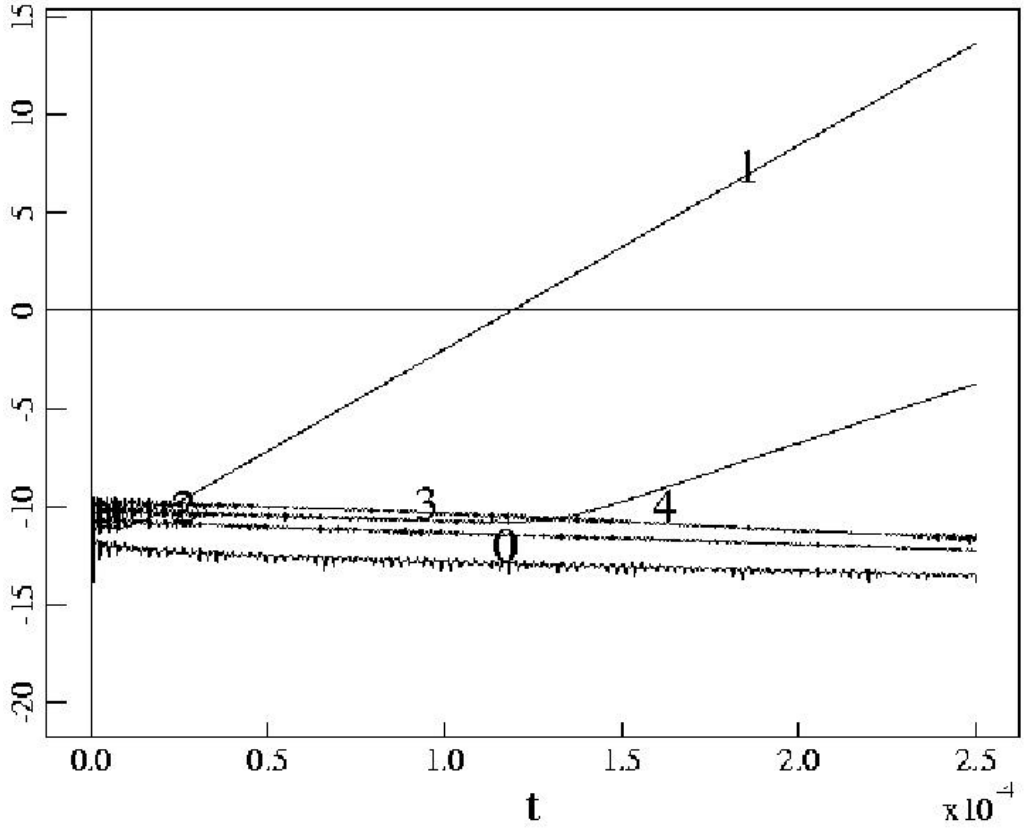
Adiabatic pressure

Density profile from equilibrium



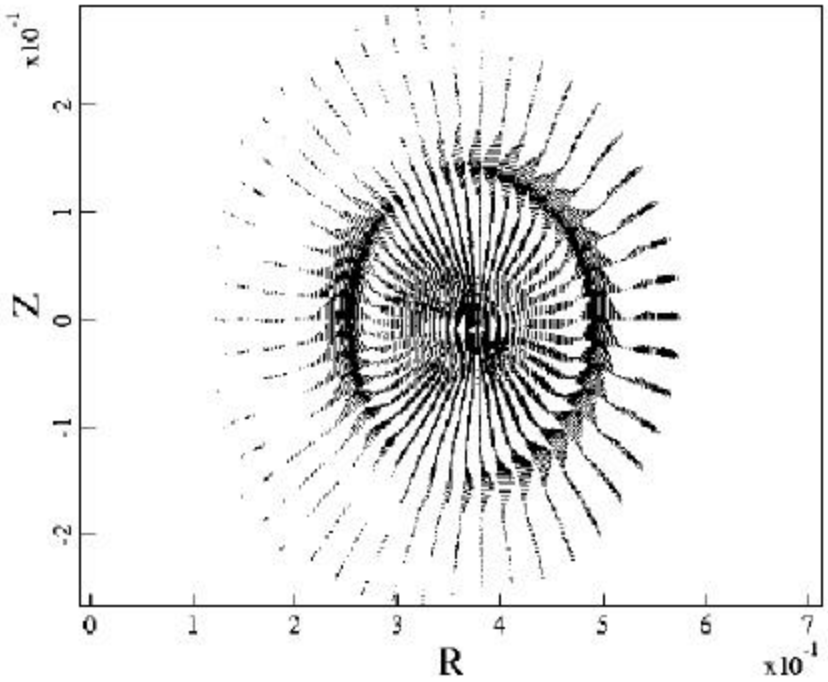
Run with single processor on 2 GHz Linux workstation

LINEAR STABILITY

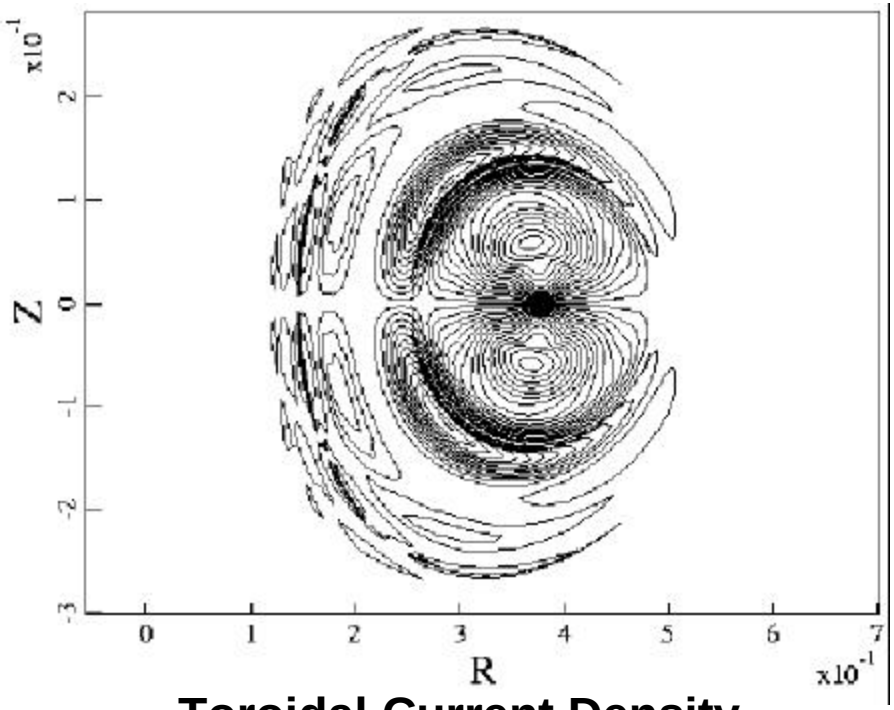


Both *n* = 1 (~ 1/1) and *n* = 3 (~ 2/3) linearly unstable

n = 1 EIGENFUNCTION



Poloidal Flow



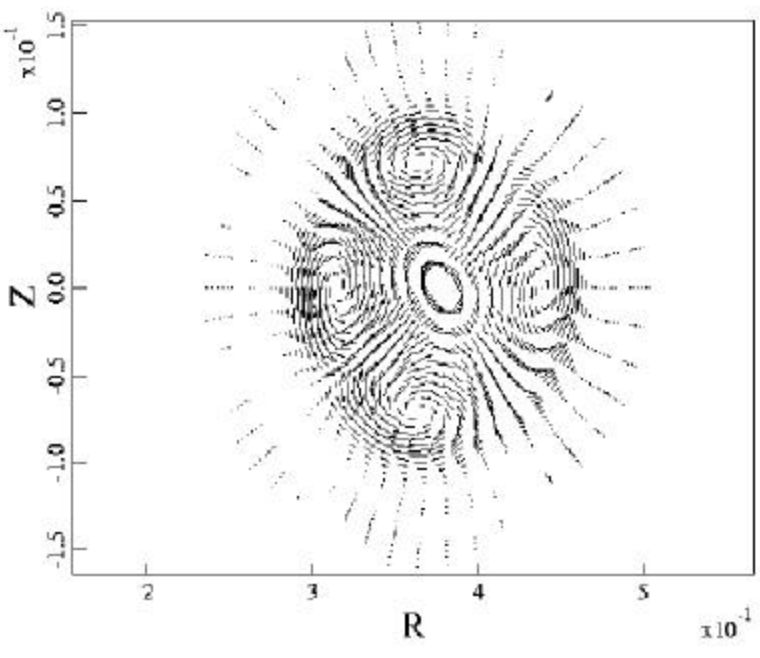
Toroidal Current Density

Dominant 1/1 structure ("sawtooth mode")

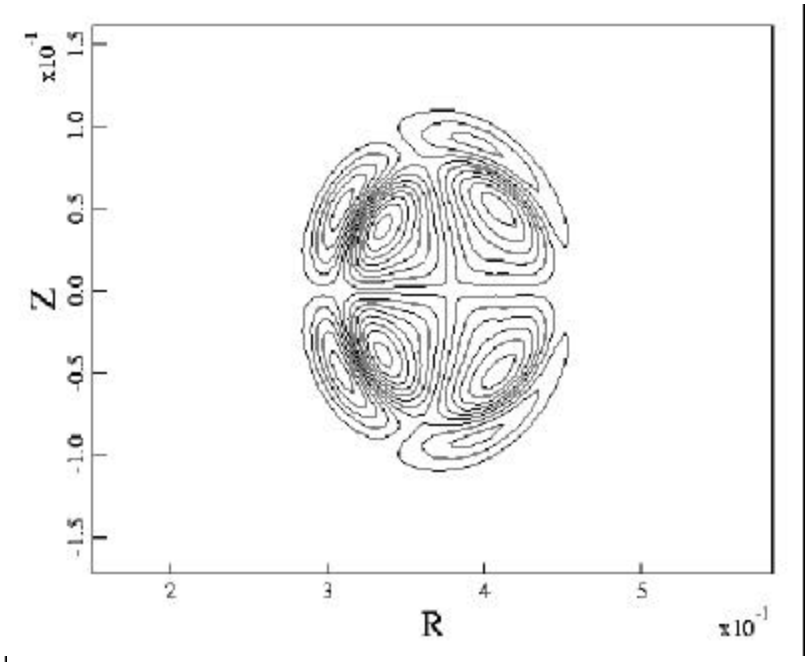
Higher *m* harmonics

g **= 2.39 X 10^5 sec^{-1}** $\quad$ gt_A **= 0.11**

n = 3 EIGENFUNCTION



Poloidal Flow



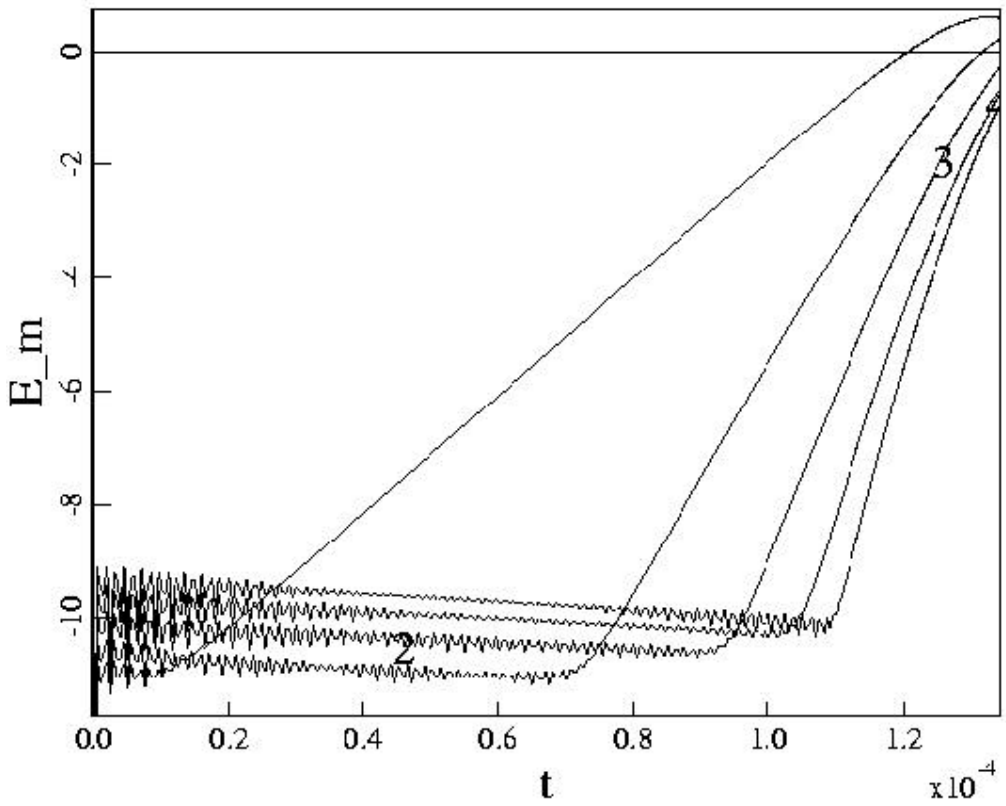
Toroidal Current Density

Dominant 2/3 mode

Resonant because q_0 = 0.6 < 2/3

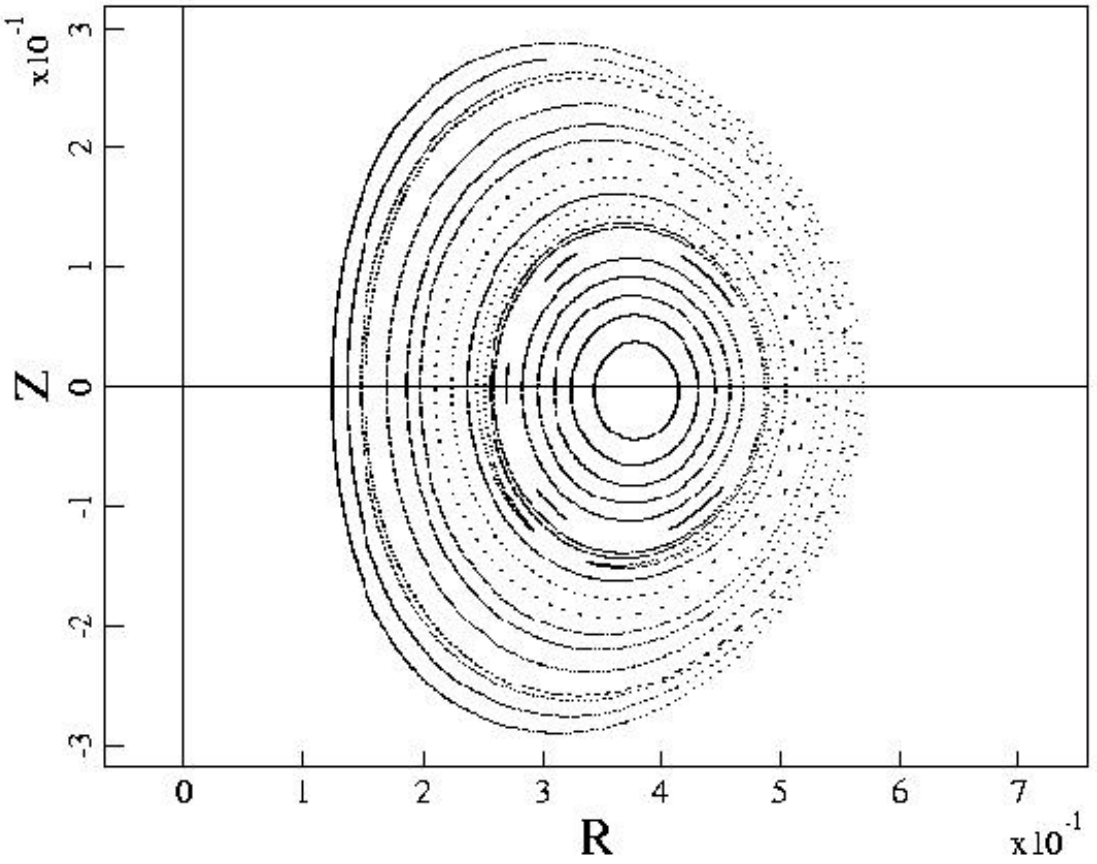
g = 1.39 X 10^5 sec^{-1} gt_A = 0.062

NONLINEAR CALCULATION



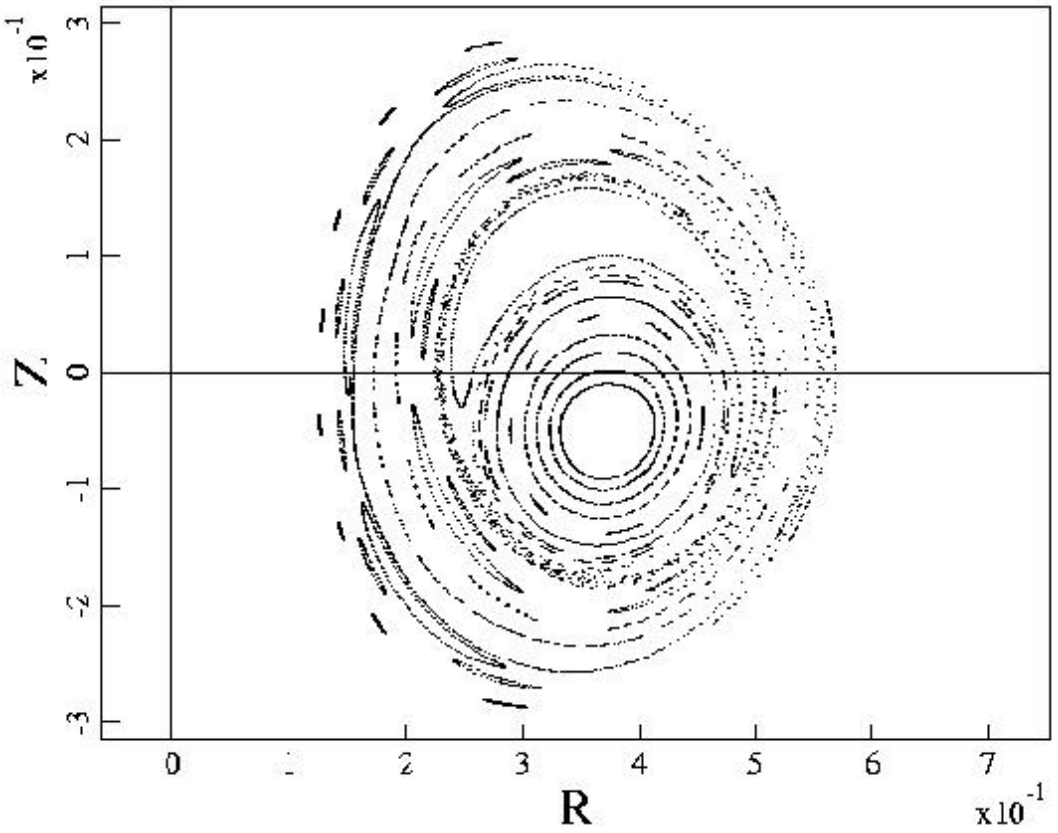
Modal magnetic energy vs. time

FIELD LINES



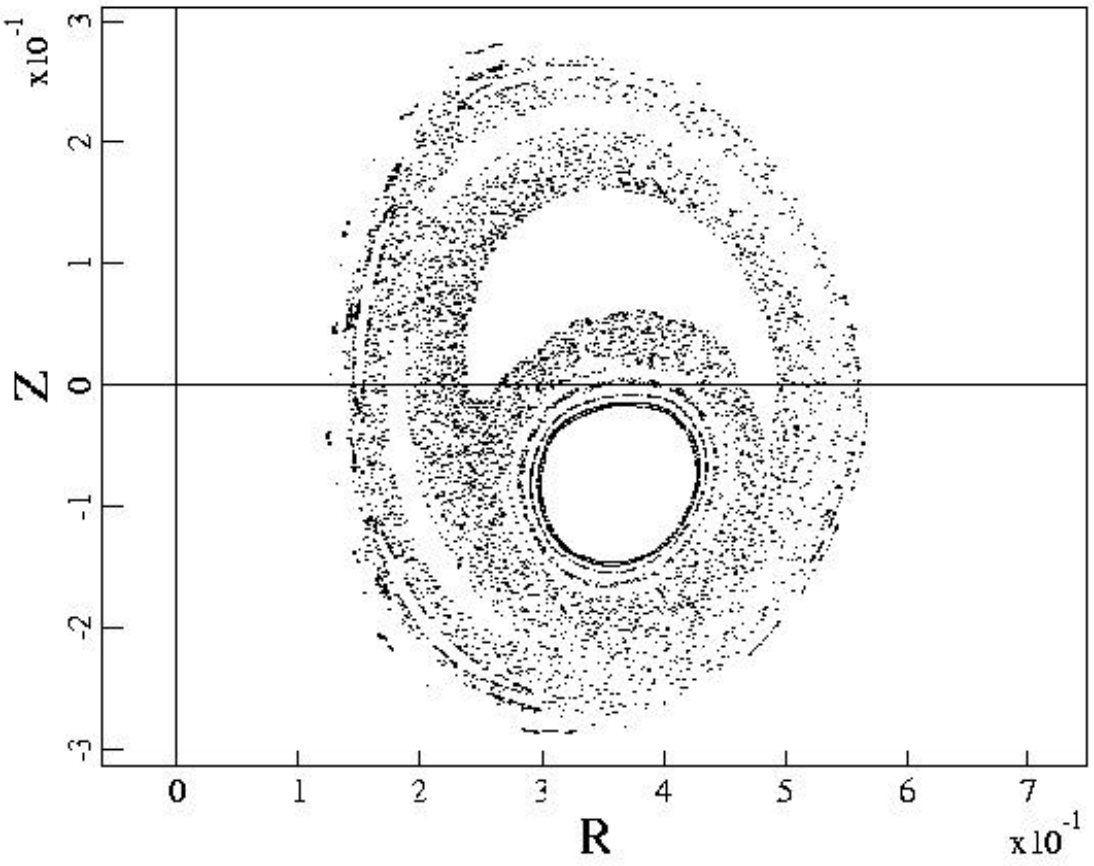
$t = 10^{-4}$ sec

FIELD LINES



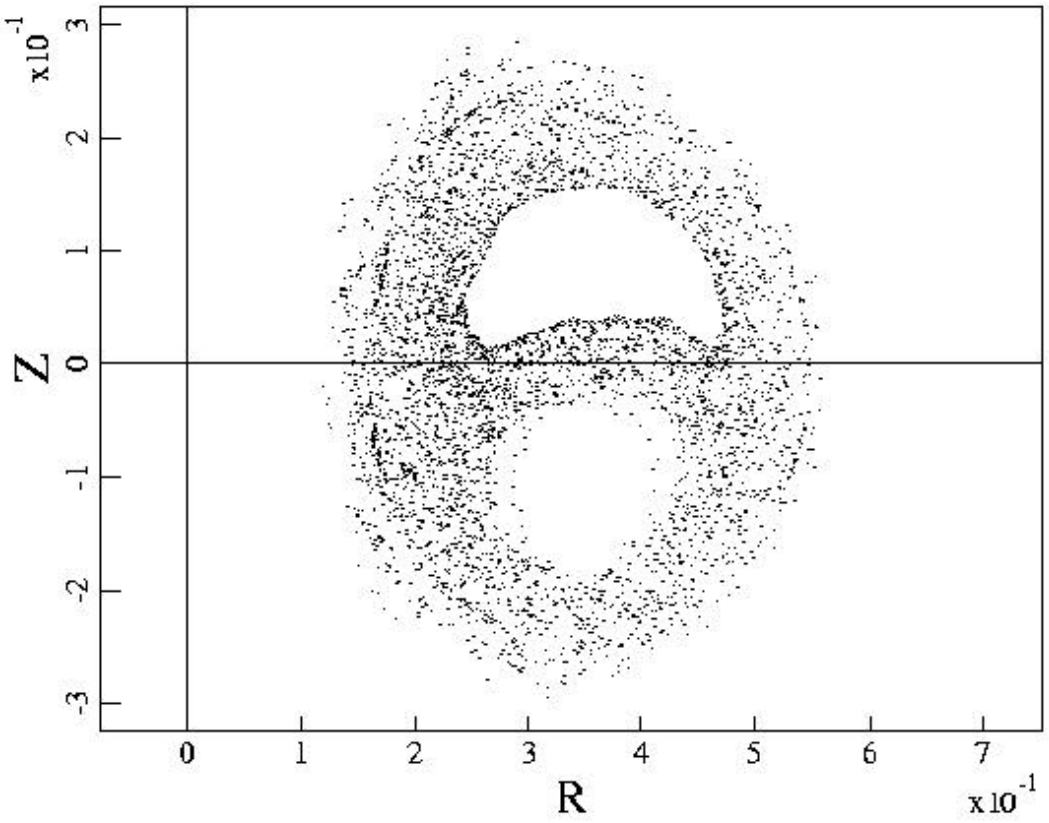
t = 1.26 X 10^{-4} sec

FIELD LINES



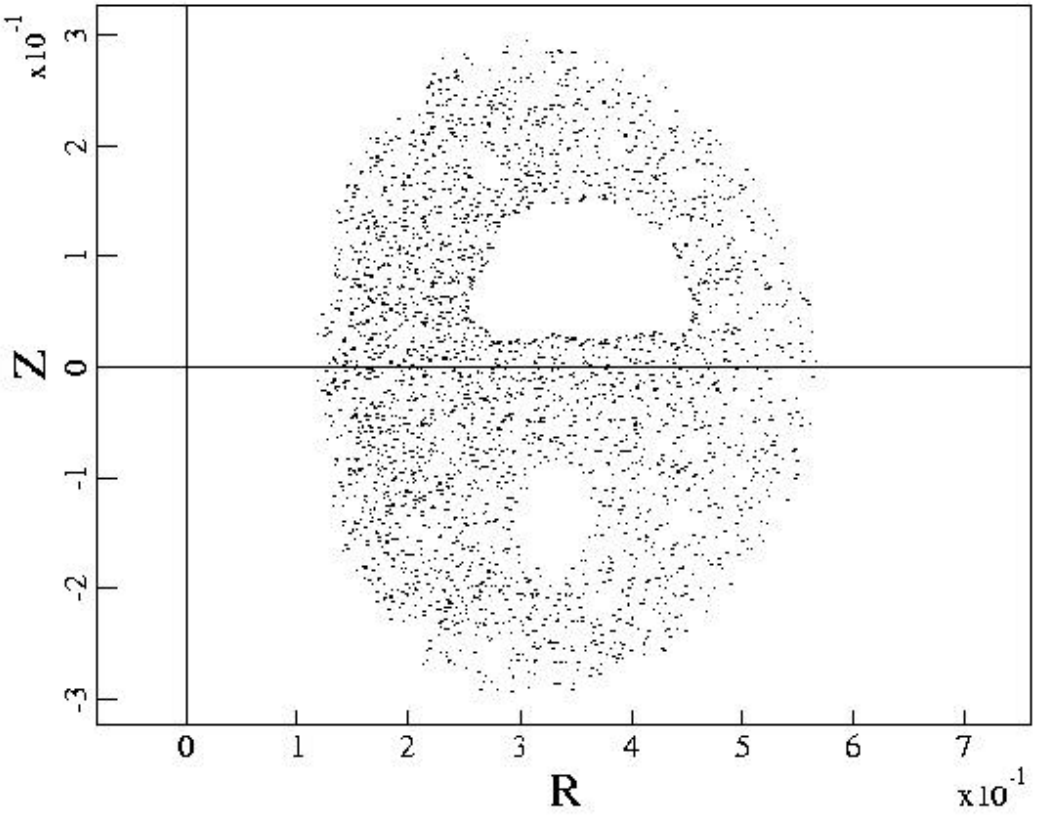
t = 1.32 X 10^{-4} sec

FIELD LINES



$t = 1.35 \times 10^{-4}$ sec

FIELD LINES



t = 1.36 X 10^{-4} sec

COMMENTS

- **All results are preliminary**
- **Linear results converged in Δt, not tested in Δx**
- **Large resistivity and viscosity allow runs to be completed on Linux work station**
- **Detailed comparisons with M3D required**
  - **Linear stability**
  - **Nonlinear time scales**
  - **Saturation amplitude?**
  - **Stochasticity**