

Musings on the Logistic Map

Shane Celis and Yun Tao
PHY 256

Hypothesis

- Entropy rate measures randomness
- Lyapunov exponent measures randomness
- Is there a relationship between the two?
- Perhaps there's a functional form something like this:

$$\lambda = \lim_{p \rightarrow \infty} f(h_\mu)$$

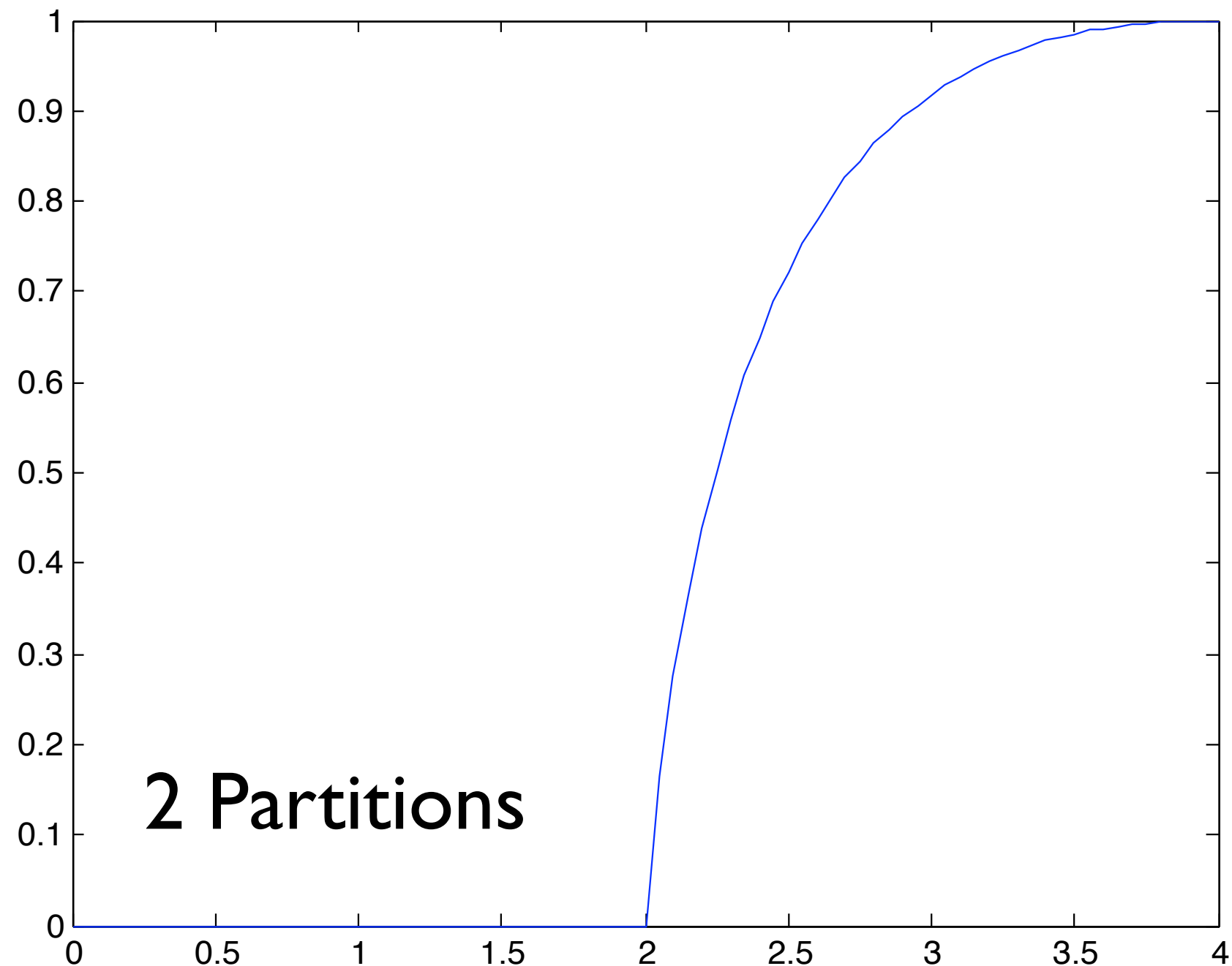
- And how does partition resolution affect the transient entropy rate?

Method

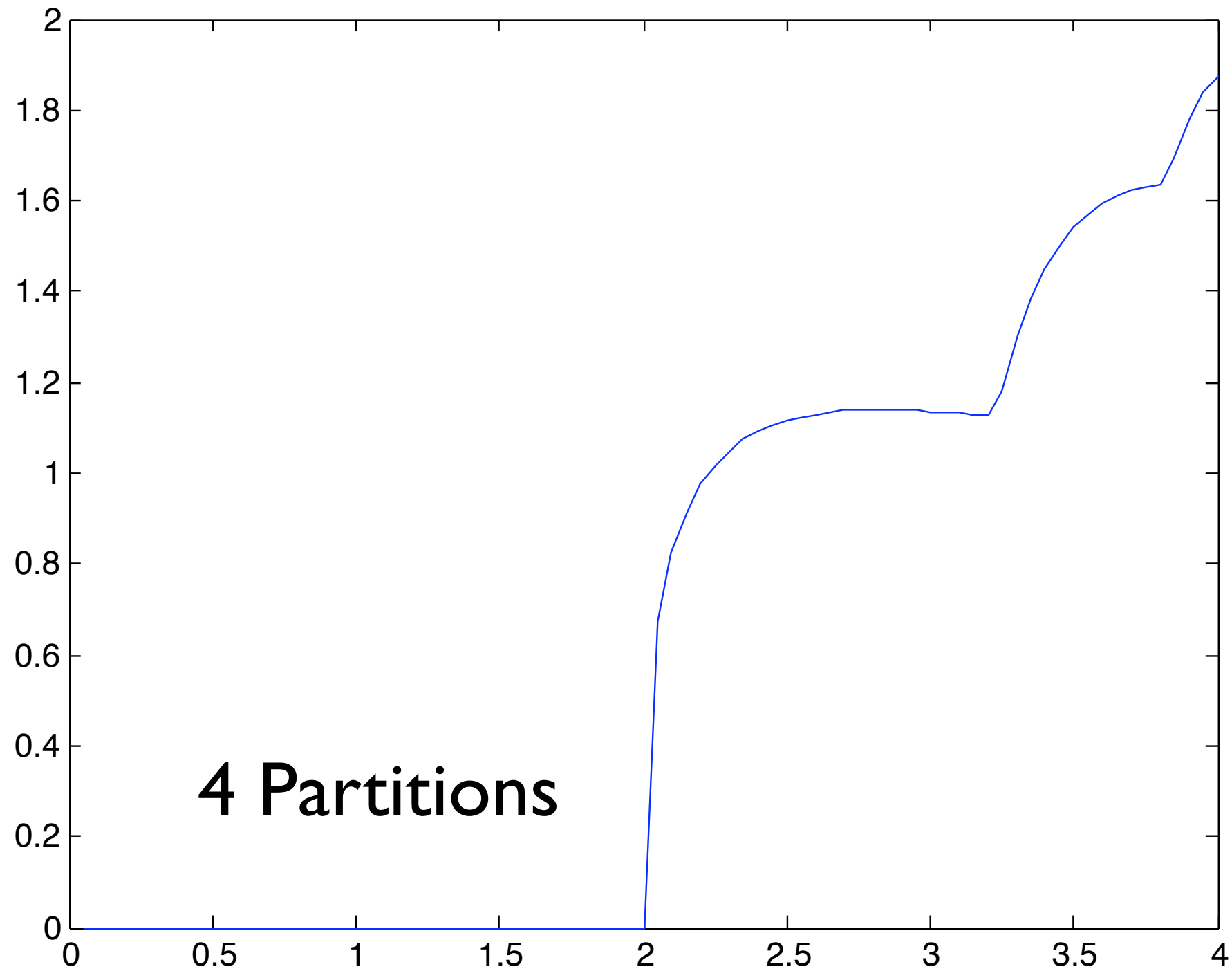
- Start simple. Use a 1D map, the beloved logistic map.

$$x_{n+1} = r x_n (1 - x_n)$$

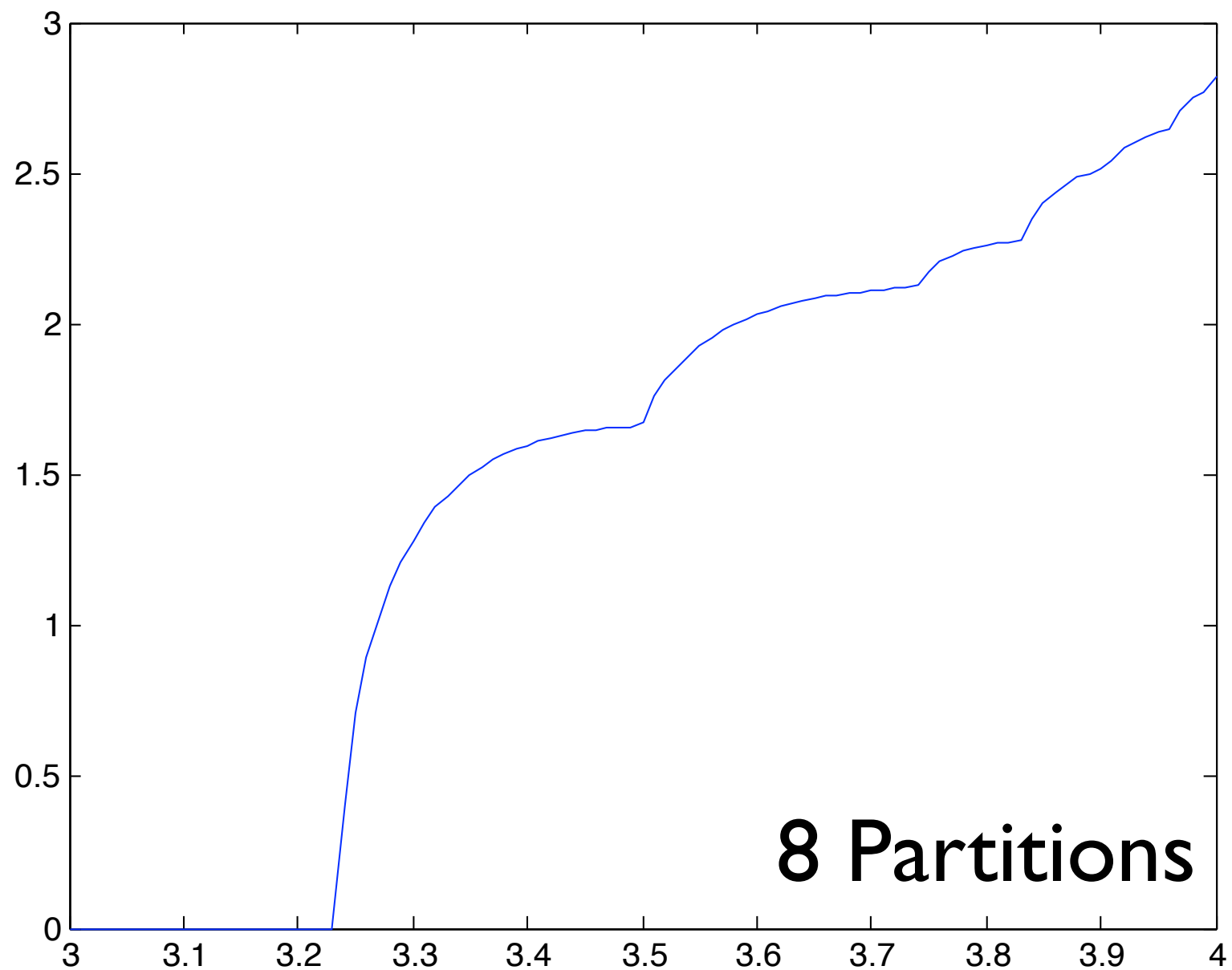
Transient Uncertainty of Length One



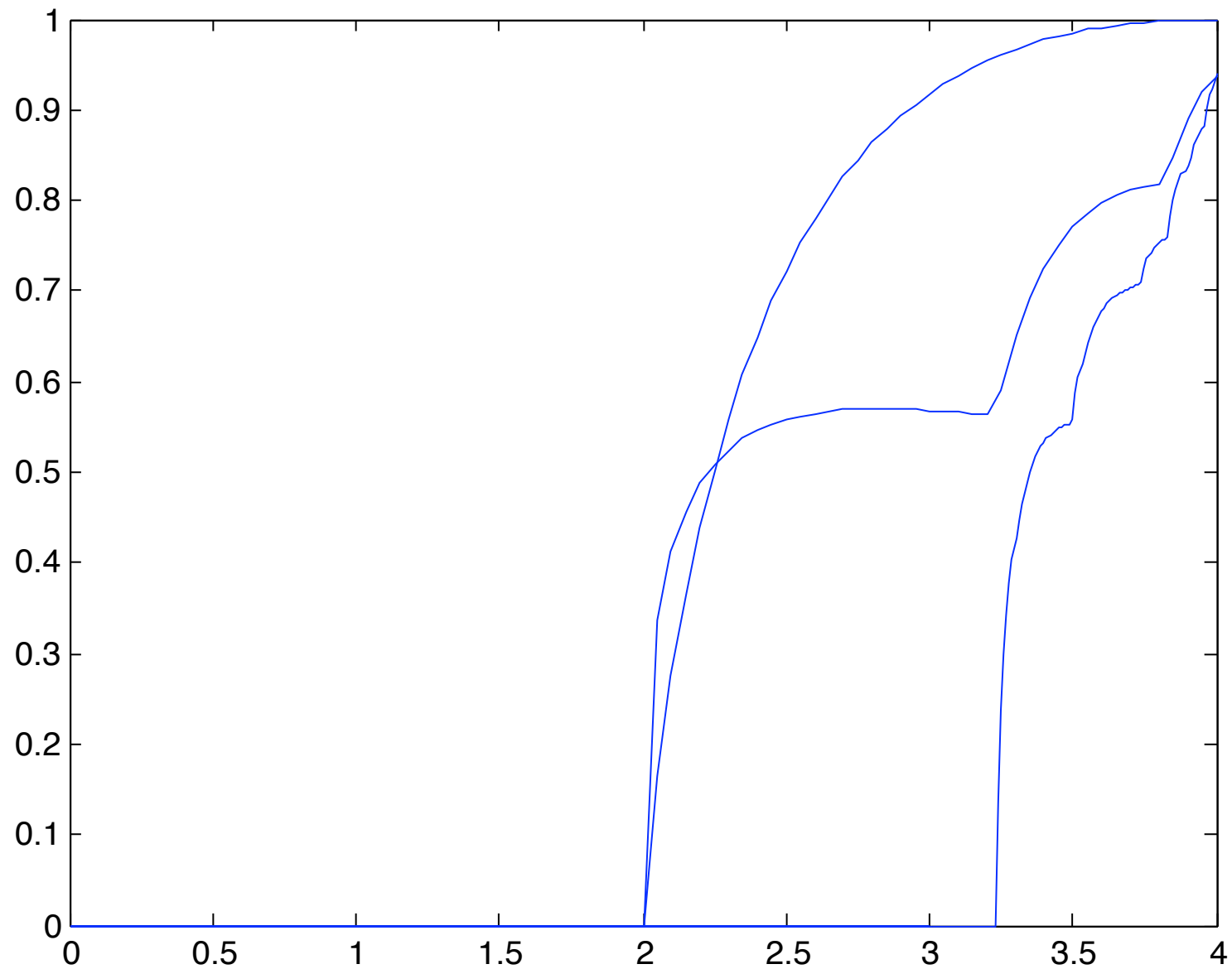
Transient Uncertainty of Length One



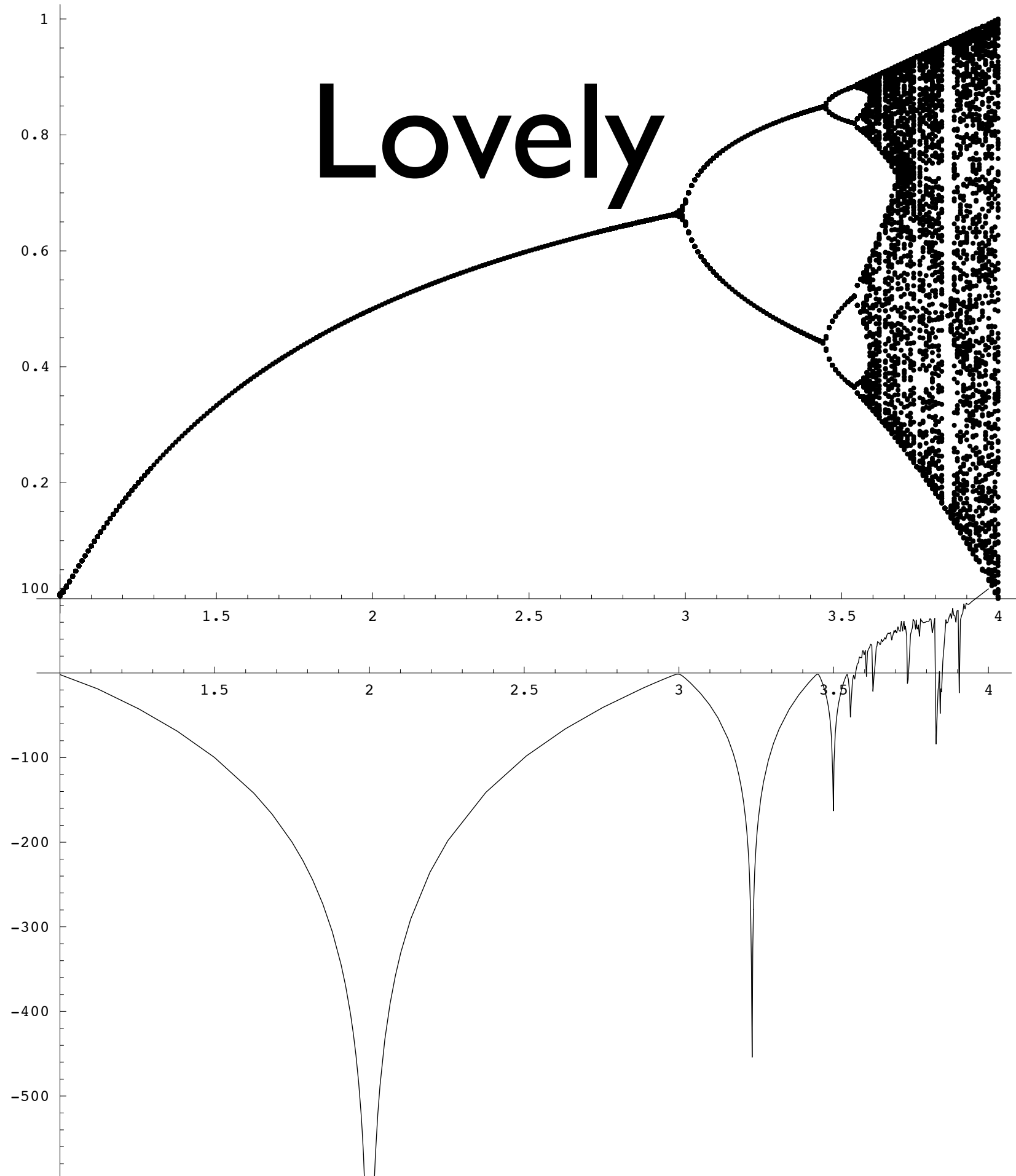
Transient Uncertainty of Length One



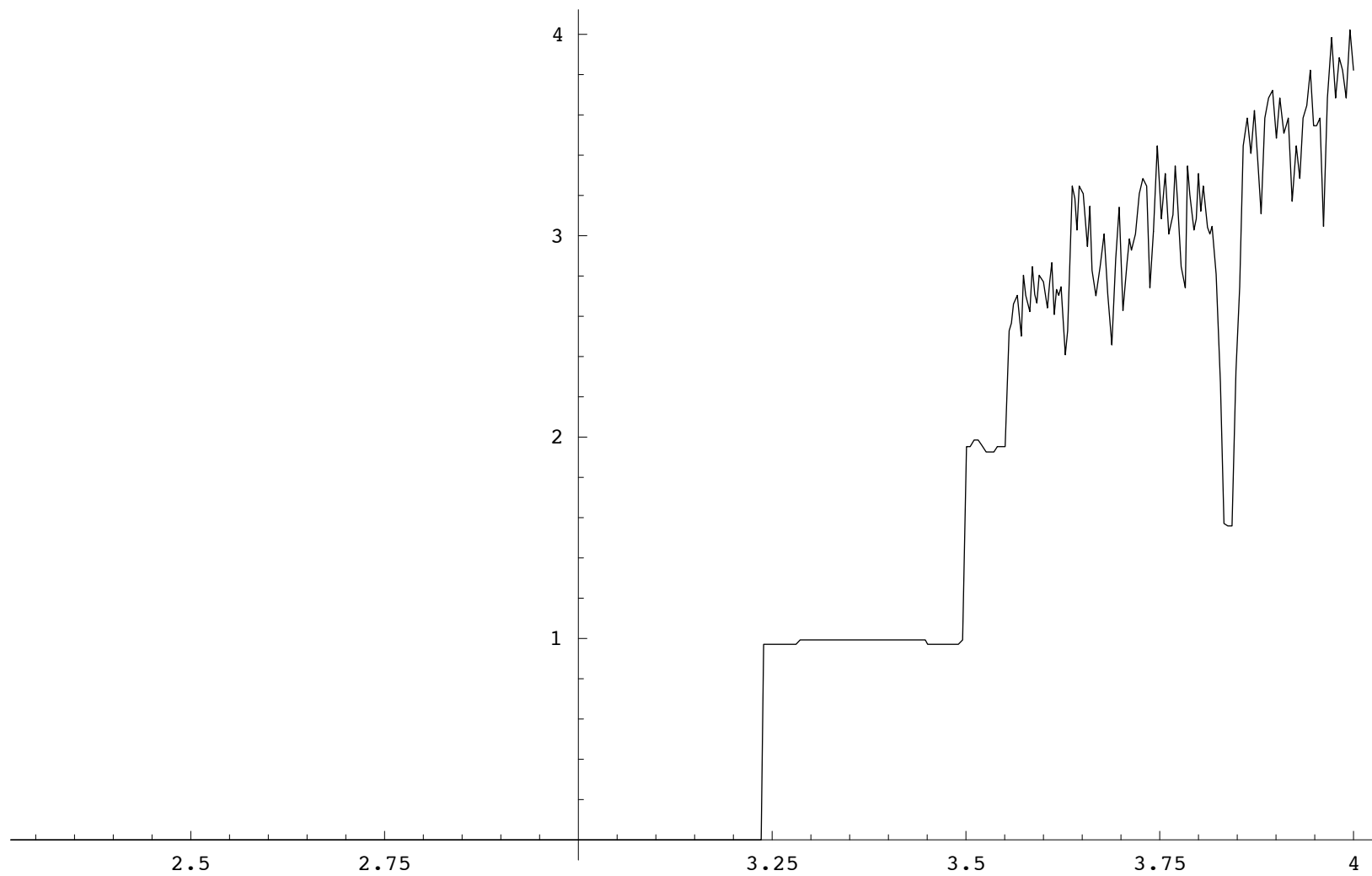
Transient Entropy Convergence Rate



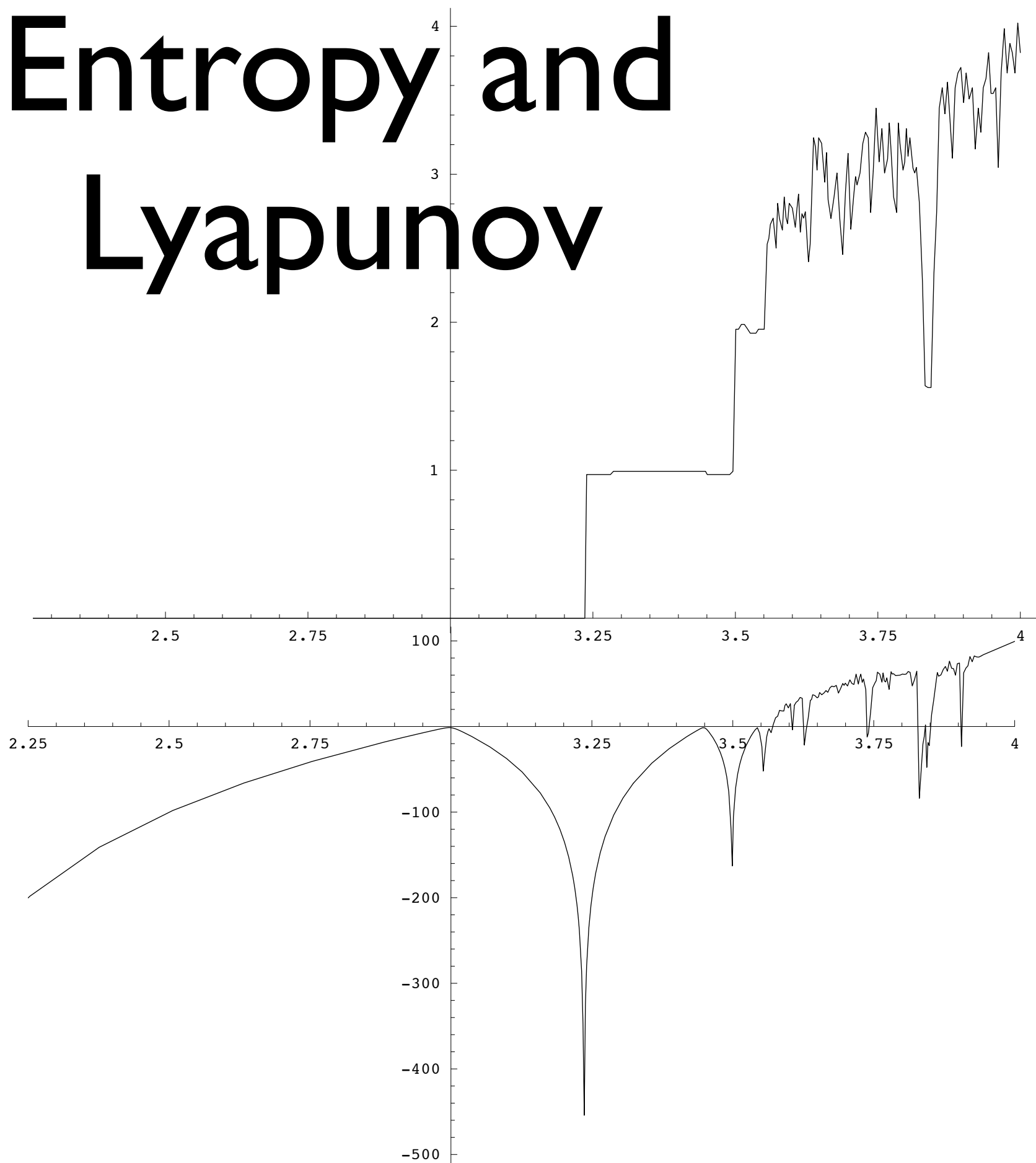
Lovely



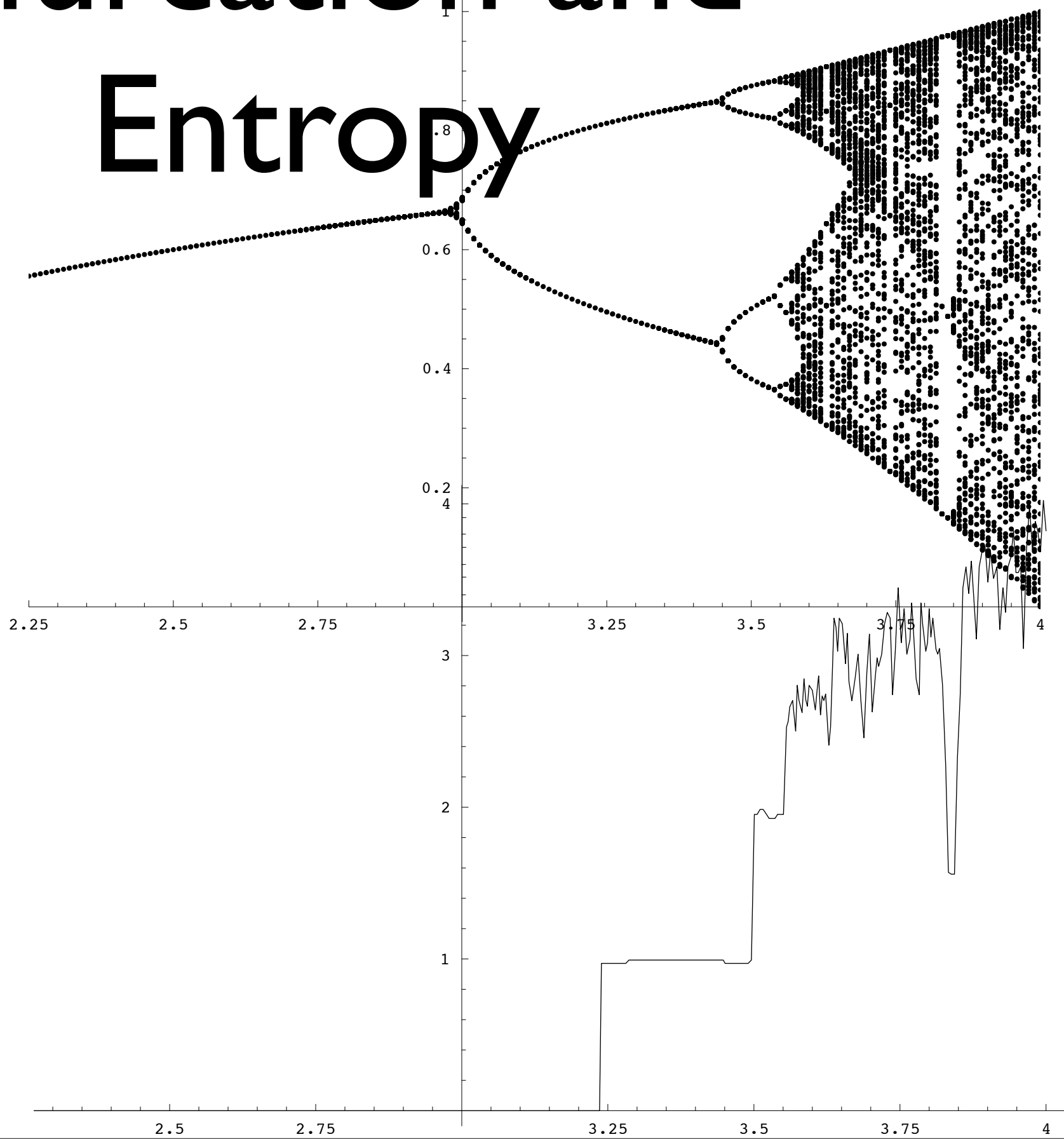
Entropy



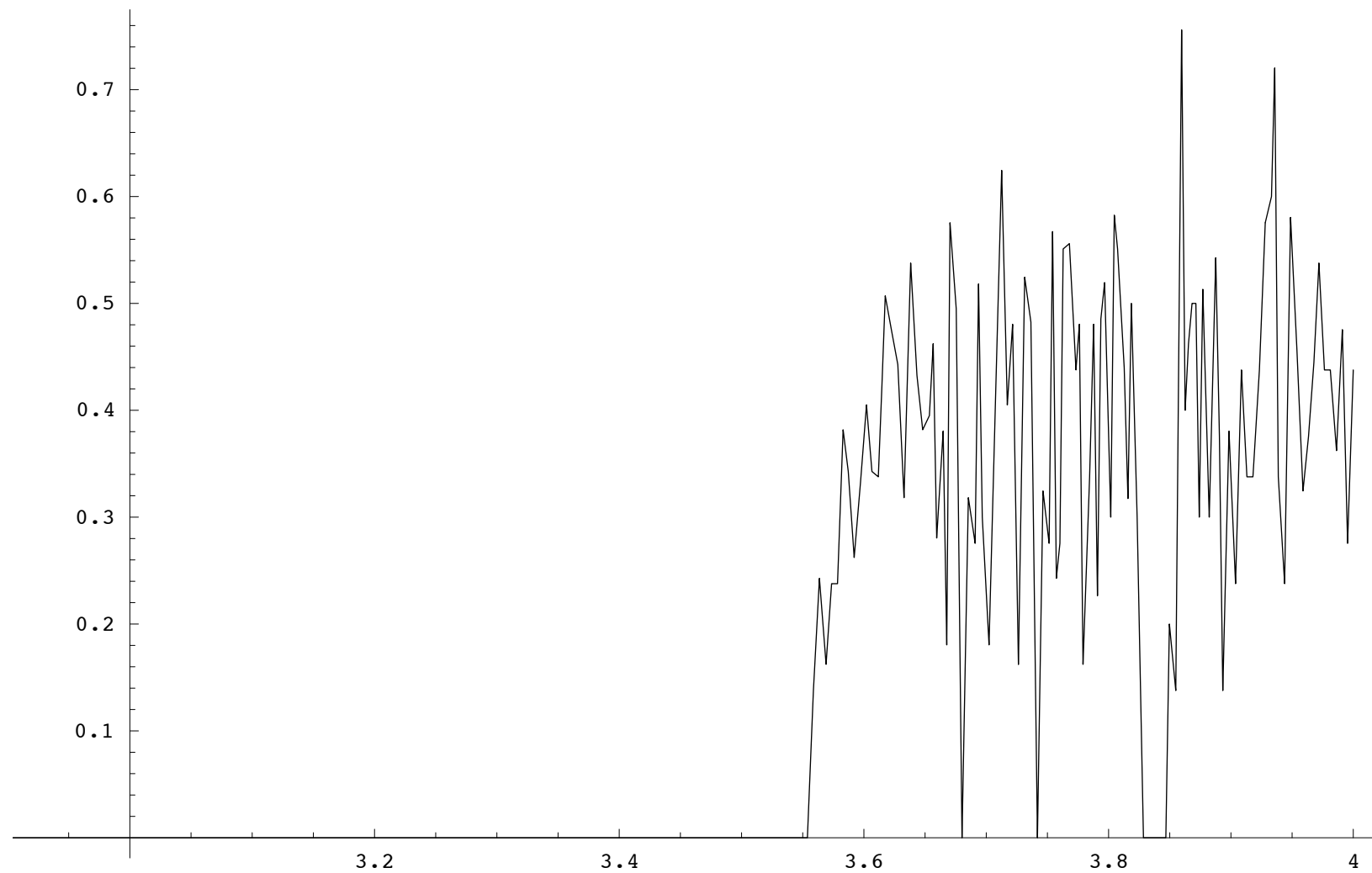
Entropy and Lyapunov



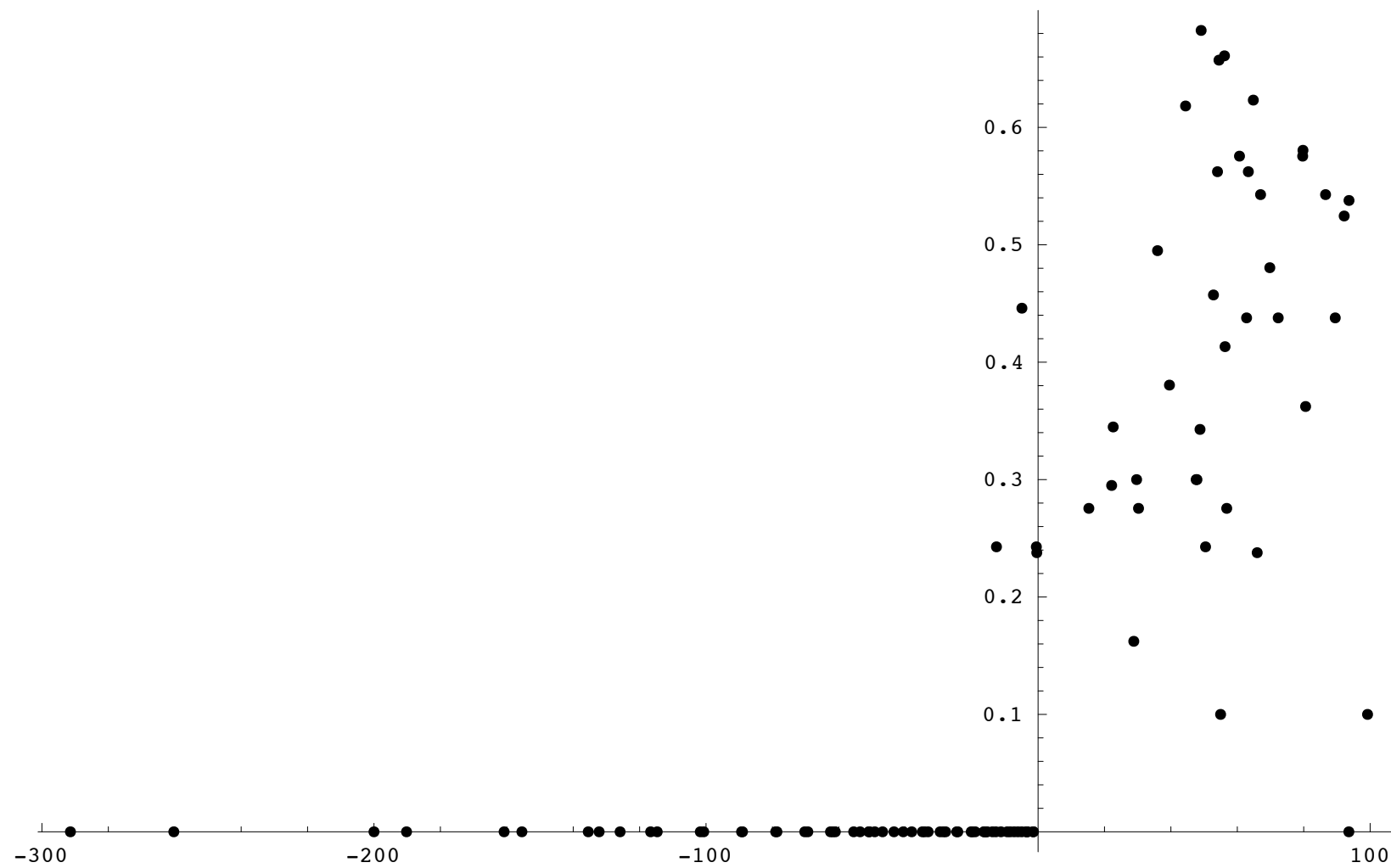
Bifurcation and Entropy



Entropy Rate

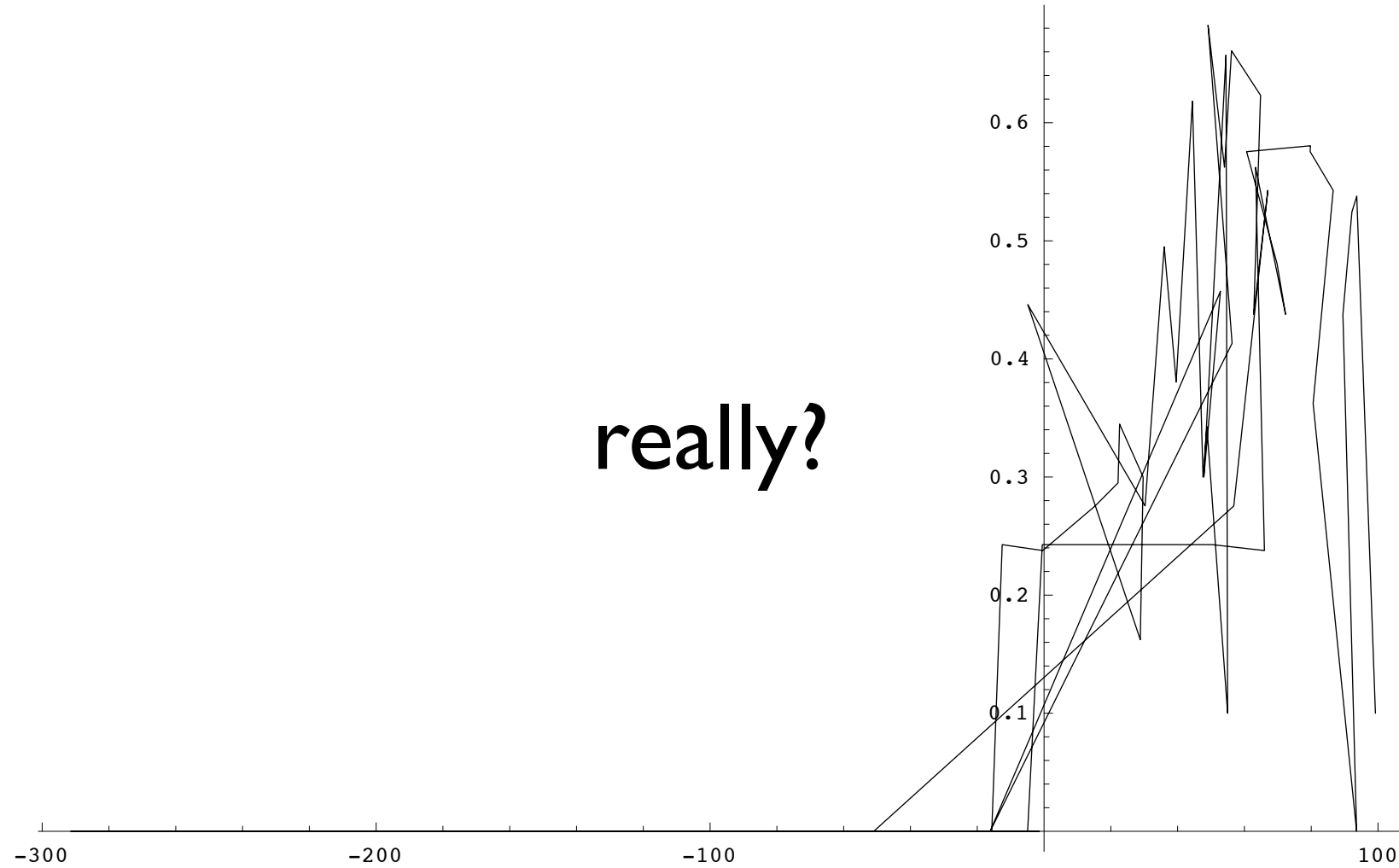


Entropy Rate vs. Lyapunov Exponent

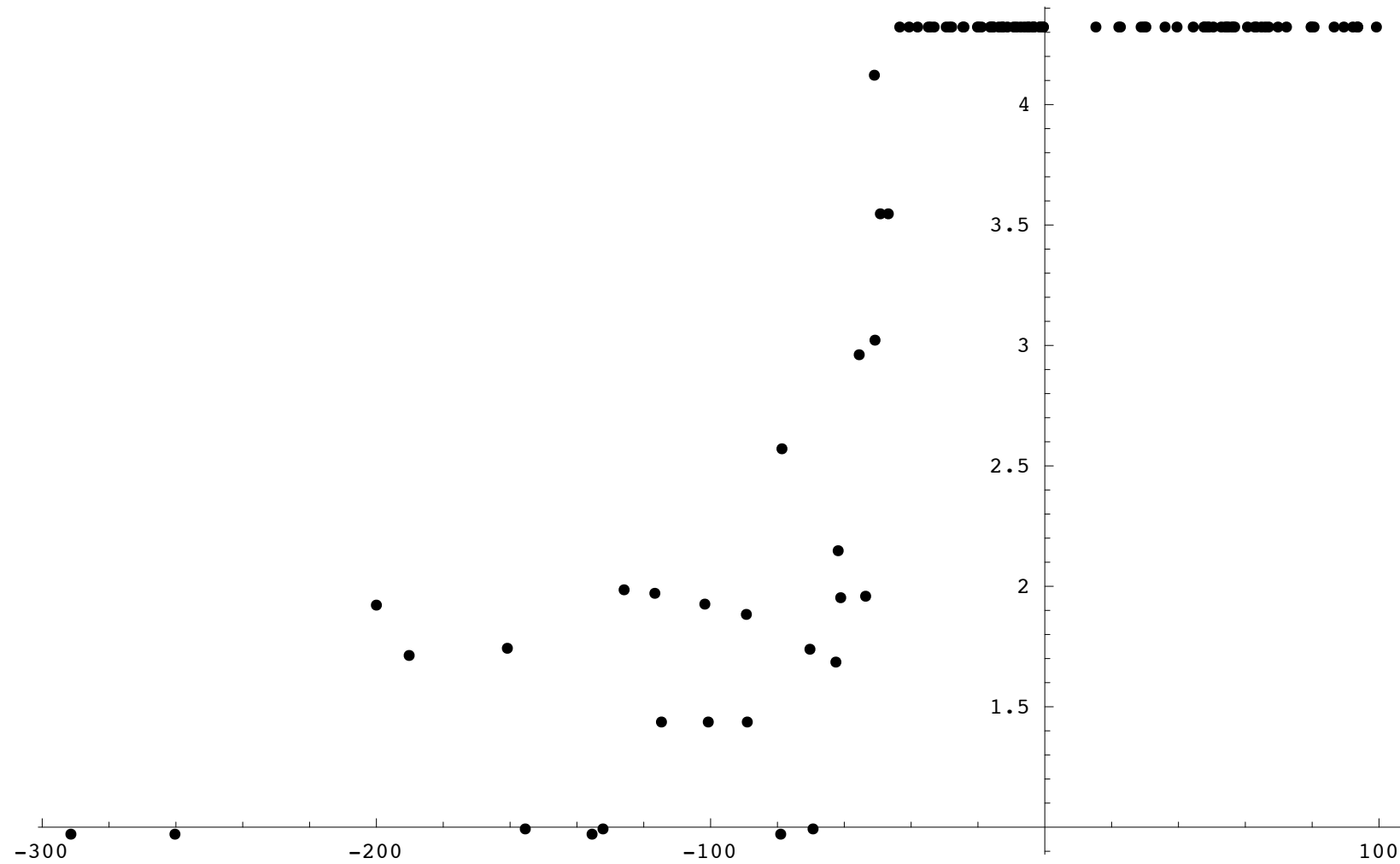


FOILED!

really?



Just for fun



Entropy vs Lyapunov Connected

