Chaos, Fractals, and the Arts

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Porter College 34B, UCSC
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Tentative Syllabus by Week

- A. Vibrations and Forms
  - A1. Models of Consciousness
  - A2. Cymatics
  - A4. Consciousness (the self), B4. Chaotic attractors
  - A5. Symmetric chaos
  - A6. Midterm, B6. FPUT history
  - A7. Guest: Dr. Juan Acosta-Urquidi

Meeting #6, February 9

- Midterm
- Discussion
- Lecture
  - B. FPUT history
  - C. Image entropy model
- Projects

B. Fermi-Pasta-Ulam-Tsingou
LANL Cast of Characters

- Enrico Fermi, b. 1901, Rome, Italy
- John von Neumann, b. 1903, Budapest, Hungary
- Stan Ulam, b. 1909, Lvov, Ukraine
- John Pasta, b. 1918, New York City
- Mary Tsingou Mentzel, b. 1928, Milwaukee, WI
- Paul R. Stein, b. 1930 ???

B. Fermi-Pasta-Ulam-Tsingou Early LANL publications

- 1947, Ulam and Von Neumann (1D logistic chaos)
- 1955, Fermi, Pasta, Ulam, Tsingou (FPUT)
- 1959, Mentzel, Stein, and Ulam (2D quadratic chaos)

B. Fermi-Pasta-Ulam-Tsingou The experiment, Summer 1953

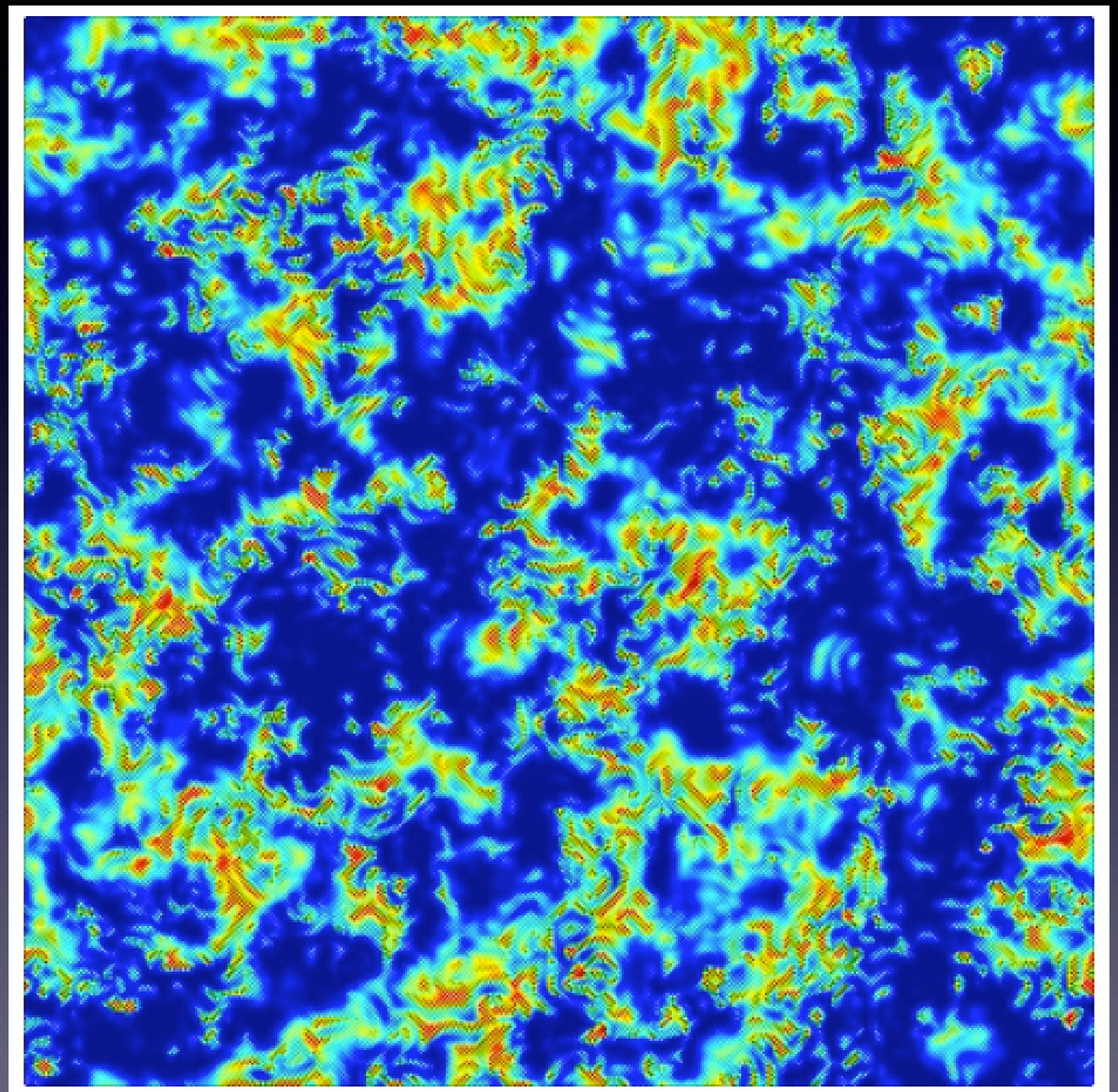
- The birth of experimental math and chaos theory
- Computer model for vibrating string
- Approximate as a chain with 32 links
- Couple each vibrating link with its nearest neighbors
- Model each coupling as a nonlinear spring

B. Fermi-Pasta-Ulam-Tsingou Expectation of ergodic behavior

- The trajectory in 64 D space should be dense
- Instead, find periodic and chaotic attractors

B. Fermi-Pasta-Ulam-Tsingou
A recent experiment

A 2D lattice, 400 x 400 chaotic flows
with nearest neighbor coupling
Super computer simulation by Michael Nivala
(see RA MS#138)



Porter 34B 2016 Meeting #6

The End