Material for Week 4

Physics 4488/6562: Statistical Mechanics

https://sethna.lassp.cornell.edu/Teaching/562/

Exercises due Mon. Feb 20

Last correction at December 22, 2022, 2:09 pm

Exercises marked N#.## are available at
https://sethna.lassp.cornell.edu/StatMech/NewStatMechExercises.pdf.

Monday

In-class question: 5.4 *Black hole thermodynamics*

In-class question: 5.22 *The Dyson sphere*

Wednesday

Read: Chapter 5, Sec. 5.2.2 (Residual entropy of glasses)

Pre-class question: 5.18 *Entropy of socks*

In-class question: 5.12 *Rubber band*

In-class question: 5.23 *Entropy of the galaxy*

Friday

Read: Chapter 5, Sec. 5.3.1 (Entropy as ignorance: Non-equilibrium)

Pre-class question: 5.19 *Aging, entropy, and DNA*

In-class question: 5.13 *How many shuffles?*

Monday

Read: Chapter 5, Sec. 5.3.2 (Information entropy)

Pre-class question: 5.20 *Gravity and entropy*

Exercises for everyone

5.11 *Entropy of glasses.* (Condensed matter) You can count the number of glass atomic configurations experimentally!

Select one (4488) or two (6562)

4.4 *Jupiter! and the KAM theorem.* (Astrophysics, Mathematics, Computation, Dynamical systems) The solar system is not ergodic. Why? Hints at https://sethna.lassp.cornell.edu/StatMech/EOPCHintsAndMaterials.html

5.2 *Burning information and Maxwellian demons.* (Computer science), Can we burn information as fuel?

5.7 *Does entropy increase?* (Mathematics) Physics is time-reversal invariant. How can entropy increase as time moves forward?

5.25 *Equilibration in phase space.* How stirring increases the entropy. (It's subtle.)

N1.3 *Accelerators vs. ergodicity.* Synchrotrons push particles around billions of orbits with nonlinear magnets. Why don't the particles escape the beam? Hints at https://sethna.lassp.cornell.edu/StatMech/EOPCHintsAndMaterials.html