

Material for Week 4

Physics 4488/6562: Statistical Mechanics

<https://sethna.lasp.cornell.edu/Teaching/562/>

Exercises due Mon. Feb 19

Last correction at November 29, 2023, 9:46 pm

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Exercises marked N#.## are available at

<https://sethna.lasp.cornell.edu/StatMech/SethnaExercises.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 zero – one (4488) or one – 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.lasp.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.* (Accelerator, Mathematics) Synchrotrons push particles around billions of orbits with nonlinear magnets. Why don't the particles escape the beam? Hints at <https://sethna.lasp.cornell.edu/StatMech/EOPCHintsAndMaterials.html>