Reading list for Advanced Philosophy of Physics: the philosophy of statistical mechanics

(revised David Wallace, February 2010)

This is a reasonably thorough reading list for the philosophy of statistical mechanics: it generally contains more material on each topic than is practical for a weekly tutorial, but it may serve as a starting point for constructing tutorial reading lists, as a source for further reading or revision, and as inspiration, starting point or reference for extended essays and theses.

The philosophy of statistical mechanics is a very chaotic discipline – much more so than, for instance, philosophy of quantum mechanics. As such, even working out how to organise the material is a non-trivial philosophical activity, and my own way of organising it doubtless betrays various philosophical prejudices. (One prejudice that I’m aware of: the list errs towards a non-historical approach. The review article by Uffink, below, is a good starting point for those who want to engage with the historical development of the subject.)

Whenever I put more than a few readings, I have picked out a few “starting points” or “core readings” with asterisks. Again, there is some subjectivity in the choice, no doubt.

I have put electronic links, where possible, for any reference which is not in a standard academic journal. Most journals should already be available online via SOLO.

General textbooks and review articles

Some recent, accessible philosophical introductions
(introductory, but not at all neutral – Albert has a very strong line on the problem. The style is unusual – people either like it or hate it.)

(The anti-Albert, in a way – very scholarly, very even-handed, sometimes it can be difficult to see the wood for the trees)

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1 Suggestions from Simon Saunders, Hilary Greaves, Chris Timpson and Charlotte Werndl gratefully acknowledged.


(Very recent review article – does a pretty good job of surveying the terrain)

(Extremely thorough, somewhat historically oriented review; longer and more technically demanding than Frigg’s review)

General discussions from a more physics-oriented viewpoint
(Fairly technical; largely concerned with quantum mechanics, not statistical mechanics)

(Somewhat less technical than Schulman)

(Technically oriented, detailed survey article by one of the leading practitioners. (NB: this is not Roger Penrose; it’s Oliver Penrose, his brother.)

Classic texts, still relevant


More general books on statistical mechanics and thermodynamics
There are literally hundreds of textbooks on statistical mechanics and equilibrium thermodynamics; trying to survey the field seems pointless, and everyone has their own favourites. It is important, though, for students of the field to make sure they’ve studied from or at least looked at mainstream physics accounts of statistical mechanics, and not just the foundational versions – otherwise it can be easy to forget just how predictively powerful statistical mechanics can be, despite its foundational perplexities.

**The direction of time in thermodynamics, and the Second Law**


**Boltzmann’s H-theorem, and the reversibility and recurrence objections**

(NB: many of the issues with the H theorem can also be understood from the perspective of the simpler wind-tree model or the Kac ring model; see references below.


**Ergodicity and Gibbs’ characterization of equilibrium**


**Coarse-graining and the approach to equilibrium**

The general issue


Wallace, D. (2009), “The logic of the past hypothesis”, available online at users.ox.ac.uk/~mert0130

The interventionist strategy
Blatt, J.M. (1959), "An Alternative Approach to the Ergodic Problem", Progress of Theoretical Physics 22(6), 745-756. (The original text where the idea was introduced)


The Brussels-Austin school


Jaynes’ objective-Bayesianism approach
viewpoint; only read the foundational parts.)


The (neo)-Boltzmannian approach and the Past Hypothesis
(see also the papers on Gravity, below)


Callender, C. (2004), 'Measures, Explanations and the Past: should "special" initial conditions be explained?', British Journal for the Philosophy of Science 55, 195--217.


**Maxwell’s Demon and Landauer’s Principle**

(NB: Leff and Rex (2003) contains an exhaustive bibliography of practically everything ever written on Maxwell’s demon)


(*) Bennett, C. H. (2003), 'Notes on Landauer's principle, reversible computation, and


Weinstein, S. (2003), 'Objectivity, Information, and Maxwell's Demon', *Philosophy of

**Identical Particles and the Gibbs Paradox**


Specialised topics

Gravity and statistical mechanics


The von Neumann entropy and the entropy-entanglement link


Decoherence and the approach to equilibrium


The GRW theory and the approach to equilibrium


The thermodynamic limit


The nature of the probabilities in statistical mechanics
Philosophy of Science 75(1), 28--44.


