Schedule of Lectures for “Foundational Problems of Thermodynamics and Statistical Mechanics”

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http://strangebeautiful.com/lmu/2017-winter-thermo-sm.html

Winter, 2017–2018
Wed. 12:00–14:00 C.T.
Ludwigstr. 31, 028

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Lectures: “Foundations of Thermodynamics and Statistical Mechanics”

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References

N.b.: many of the required and suggested readings are available online at the course’s website, though they may not be listed as such in the bibliography:

http://strangebeautiful.com/lmu/2017-winter- thermo-sm.html

Lecture 1: Introduction (18. Oct)

Required Reading


Lecture 2: Thermodynamics I (25. Oct)

Required Reading

1. Fermi (1956), Thermodynamics: Intro., pp. ix–x; chs. 1–iii, pp. 1–45

Suggested Reading

1. Ehrenfest-Afanassjewa (1956), Die Grundlagen der Thermodynamik: chs. 1–iii
5. Emch and Liu (2002), The Logic of Thermostatistical Physics, ch. 1
9. Planck (1926), Treatise on Thermodynamics: Prefaces to the first through fifth editions, pp. vii–xii; Parts i–ii, pp. 1–77
Lectures: “Foundations of Thermodynamics and Statistical Mechanics”

Lecture 3: HOLIDAY, NO LECTURE (01. Nov)

Lectures 4–5: Thermodynamics II (08–15 Nov)

Required Reading


Suggested Reading

2. Carathéodory (1909), “Untersuchungen über die Grundlagen der Thermodynamik”
3. Carnot (1824), *Réflexions sur la Puissance Motrice du Feu et sur les Machines Propres à Développer Cette Puissance*
5. Gibbs (1876), “On the Equilibrium of Heterogeneous Substances. i”
7. Maxwell (1871), *The Theory of Heat*: chs. vii–viii; ch. xii, pp. 185–195
8. Planck (1926), *Treatise on Thermodynamics*: Part III, pp. 78–124
9. Planck (1915), *Eight Lectures on Theoretical Physics, Delivered at Columbia University in 1909*: Lecture 1
10. Prigogine (1967), *Introduction to Thermodynamics of Irreversible Processes*

Lecture 6: Statistical Mechanics I — Boltzmannian Picture (22. Nov)

Required Reading


Suggested Reading

1. Boltzmann (1877), “Über die Beziehung zwischen dem zweiten Hauptsätze der mechanischen Wärmetheorie und der Wahrscheinlichkeitsrechnung resp. den Sätzen über das Wärmegleichgewicht”
Lectures: “Foundations of Thermodynamics and Statistical Mechanics”


8. Jaynes (1965), *Gibbs vs Boltzmann Entropies*


Lecture 7: Statistical Mechanics II — Gibsonian Picture (29. Nov)

**Required Reading**


2. Schrödinger (1960), *Statistical Thermodynamics*: ch. i; ch. ii, pp. 5–7


**Suggested Reading**


2. Emch and Liu (2002), *The Logic of Thermostatistical Physics*, ch. 8


5. Gibbs (1902), *Elementary Principles of Statistical Mechanics, Developed with Especial Reference to the Rational Foundation of Thermodynamics*

Lectures: “Foundations of Thermodynamics and Statistical Mechanics”

11. Tolman (1938), *The Principles of Statistical Mechanics*


Lecture 8: Equilibrium and Thermodynamical Processes (20. Dec)

Required Reading


Suggested Reading

Lectures: “Foundations of Thermodynamics and Statistical Mechanics”

Lectures 9–10: Probability in Statistical Mechanics (10. Jan, regular time, 12:00–14:00; 10. Jan, special time, 14:00–16:00, Ludwigstr. 31/028 (normal room))

Required Reading

1. Frigg (2008), “A Field Guide to Recent Work on the Foundations of Statistical Mechanics”: §2.3.2 (pp. 22–25 in the arXiv preprint); §2.4 (pp. 30–37 in the arXiv preprint); §2.6 (pp. 43–47 in the arXiv preprint); §§3.2.1–3.2.2 (pp. 59–60 in the arXiv preprint); §§3.2.1–3.2.2 (pp. 59–60 in the arXiv preprint); §§3.3–3.4 (pp. 62–74 in the arXiv preprint); §3.6 (pp. 89–96 in the arXiv preprint)

Suggested Reading

1. Arnold and Avez (1968), Ergodic Problems of Classical Mechanics
6. Emch and Liu (2002), The Logic of Thermostatical Physics, chs. 3–7
7. de Finetti (1972), Probability, Induction and Statistics
10. Gillies (2000), Philosophical Theories of Probability
12. Hacking (1975), The Emergence of Probability
13. Hacking (1990), The Taming of Chance
16. Howson and Urbach (2005), Scientific Reasoning: The Bayesian Approach (3rd ed.)
22. Jaynes (2003), Probability Theory: The Logic of Science
26. von Mises (1957), Probability, Statistics and Truth
Lectures: “Foundations of Thermodynamics and Statistical Mechanics”

33. Sklar (1993), Physics and Chance: Philosophical Issues in the Foundations of Statistical Mechanics: ch. 4; ch. 5, §1II (pp. 175–194); ch. 7, §IV (pp. 279–295)

Lecture 11: Thermodynamics and Statistical Mechanics: Reduction, Emergence, or What? (15. Jan, Monday, 12:00–14:00, Ludwigstr. 28, RG/503)

Required Reading


Suggested Reading

1. Batterman (2001), The Devil in the Details: Asymptotic Reasoning in Explanation, Reduction, and Emergence
18. Pincock (2012), Mathematics and Scientific Representation
Lectures: “Foundations of Thermodynamics and Statistical Mechanics”


Lecture 12: The Nature of Entropy (17. Jan)

Required Reading


Suggested Reading

5. Gibbs (1876), “On the Equilibrium of Heterogeneous Substances. i”
7. Gibbs (1902), Elementary Principles of Statistical Mechanics, Developed with Especial Reference to the Rational Foundation of Thermodynamics: chs. xii-xiv
9. Greven, Keller, and Warnecke (2003), Entropy
11. Maxwell (1871), The Theory of Heat: chs. vii–viii; ch. xii, pp. 185–195
13. Reichenbach (1956), The Direction of Time: part III, ch. 8; part IV, ch. 20

Lecture 13: The Second Law and Irreversibility (23. Jan, Tuesday, 12:00–14:00, Amalienstr. 73A/106)

Required Reading

1. Frigg (2008), “A Field Guide to Recent Work on the Foundations of Statistical Mechanics”: §2.3.2, from p. 24 (arXiv version; “Micro-Probabilities” onward); §§2.3.3–2.3.4 (pp. 26–27 in arXiv version); §2.6.3 (pp. 46–47 in arXiv version)
Lectures: “Foundations of Thermodynamics and Statistical Mechanics”


Suggested Reading

1. Albert (2000), *Time and Chance*
15. Maxwell (1871), *The Theory of Heat*: chs. vii–viii; ch. xii, pp. 185–195
17. Planck (1926), *Treatise on Thermodynamics*: Prefaces to the first through fifth editions, pp. vii–xii; Part III
19. Prigogine (1947), *Étude Thermodynamique des Phénomènes Irréversibles*
20. Prigogine (1967), *Introduction to Thermodynamics of Irreversible Processes*
21. Reichenbach (1956), *The Direction of Time*: part III, chs. 7–16
22. Schrödinger (1951), “Irreversibility”
Lectures: “Foundations of Thermodynamics and Statistical Mechanics”

Lecture 14: The Arrows of Time (24. Jan)

Required Reading


Suggested Reading

1. Albert (2000), *Time and Chance*
4. Davies (1977), *The Physics of Time Asymmetry*
17. Lewis (1986a), “Counterfactual Dependence and Time’s Arrow”
19. McTaggart (1908), “The Unreality of Time”
26. Price (1996), *Time’s Arrow and Archimedes’ Point: New Directions for the Physics of Time*
Lecture 15: Black Holes (31. Jan)

Required Reading


Suggested Reading


FEBRUARY: NO LECTURES, DR. CURIEL OUT OF TOWN (07. Feb)

FINAL PAPER DUE: 19. MAR

References


Lectures: “Foundations of Thermodynamics and Statistical Mechanics”


Prunkl, C. and C. Timpson (2017). Black hole entropy is entropy and not (necessarily) information. Unpublished manuscript. Email authors for a copy.


