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## Spectral signatures of breaking of ensemble equivalence

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# Stellingen

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Spectral Signatures of Breaking of Ensemble Equivalence

van

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1. The intuitive idea of equivalence in the thermodynamic limit of canonical and microcanonical ensembles must be verified case by case rather than taken as an assumption.

[Chapter 1]

2. Given the possible differences between canonical and microcanonical ensembles, the decision which of the two is best to model a complex network must be taken with care.

[Chapter 1]

3. Spectral properties of random graphs can significantly elucidate differences between various random graph models.

[Chapters 2, 3, 4]

4. Breaking of Ensemble Equivalence (BEE) can be detected through the analysis of the spectral radius of non-centered and non-normalized adjacency matrices.

[Chapters 2, 3, 4]

5. In the modeling of complex networks, the advantage of having hard constraints rather than soft constraints comes at a steep price: it introduces dependence between the relevant random variables that makes computations difficult if not unfeasible.

[Chapters 2, 4]

6. A sufficiently large spectral gap between the largest eigenvalue and the second to largest eigenvalue is needed to expand the largest eigenvalue as a power series of the centered adjacency matrix.

[Chapters 3, 4]

7. Events for microcanonical ensembles can be upper bounded through canonical estimates in a way similar to the upper tail of Sanov's theorem in large deviation theory. Whether a similar lower bound exists is unknown.

[Chapter 2]

8. While fluctuations at the edge of the bulk of the spectrum for matrices with independent entries follow a Tracy-Widom law, the largest eigenvalue of the non-centered and suitably normalized adjacency matrix follows a central limit theorem.

[Chapter 3]

9. The probability that "a sandwich with peanut butter is considered a proper lunch" decays exponentially fast with the distance to the Dutch border.
10. After four years of intensive study in probability theory it remains difficult to estimate the likelihood of arriving at work soaked by rain, even after having consulted "Buienradar".