



**UNIVERSITÄT  
BIELEFELD**



Faculty of Physics



Faculty of Mathematics



THE UNIVERSITY OF  
MELBOURNE

# Seminar

Bielefeld - Melbourne Random Matrices

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## Leading Eigenvalue and Right Eigenvector of Infinitely Large, Directed Graphs

Complex systems, such as, neural networks, ecosystems, and the World Wide Web, consist of components that interact along the edges of large, directed graphs. The eigenvalues and right (or left) eigenvectors of the associated adjacency matrix determine the linearised dynamics of dynamical systems in the vicinity of a fixed point.

In this seminar, we will discuss the properties of the leading eigenvalue of the adjacency matrix of random directed graphs with a prescribed distribution of indegrees and outdegrees. The leading eigenvalue of directed graphs has a couple of remarkable properties: the leading eigenvalue of directed graphs is finite even if the maximal outdegree of the graph diverges (contrary to the case of nondirected graphs). In addition, the leading eigenvalue admits a simple analytical expression that only depends on a few parameters of the network. We also determine the inverse participation ratio of the leading right eigenvector and find that there exist a phase transition between a localised and delocalised phase. Remarkably, the phase transition between these two phases is independent of the fluctuations in the indegrees and outdegree of the graph, and thus exhibits also a high degree of universality.

**Wednesday, 16 December 2020, 0900 hrs CET**

Zoom Konferenzschaltung— Please contact Thorsten Neuschel  
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