# SPECIAL CONDENSED MATTER THEORY SEMINAR

Subject: **From Principal Component Analysis to Deep Learning with De-Noising Variational Auto-Encoders**

Speaker: **Dr. Daniel Guterding (Quantitative Analyst at Eurex Frankfurt AG and Technische Hochschule Mittelhessen)**

Date & time: **Wednesday, February 5th, 2020 at 2:15 p.m.**

Venue: **Seminar room 2.116**

Machine learning has recently become a topic of strong interest in various branches of the natural sciences, but even more so in the context of industrial research. Unsupervised techniques for dimensionality reduction are of particular importance, since they address the quickly increasing computational difficulty associated with high-dimensional data sets. Recent progress on dimensionality reduction algorithms has also unexpectedly led to a number of deep learning techniques, which are able to generate realistic new data. Among those are most prominently music, paintings and photographies.

I will give an introduction to the field of unsupervised dimensionality reduction, starting from a review of the well-known principal component analysis. After a brief high-level discussion of artificial neural networks, I will introduce auto-encoders (and some of their variants, such as variational and de-noising variational AEs), which I view as non-linear extensions of principal component analysis. Application of these algorithms to clean and noisy data reveals various insights about their inner workings.