

# Physikalisches Kolloquium an der Universität Mainz

28. November 2017

Hörsaal des Instituts für Kernphysik  
Johann Joachim Becher-Weg 45

16:15 Uhr – Tee ab 15:45

*Prof. Dr. Volker Springel*  
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## **Supercomputer simulations of the dark and luminous matter in the Universe**

The Universe features a rather strange composition, with unknown dark matter and dark energy components dominating today's energy density. Early numerical simulations have played a pivotal role in demonstrating that this unexpected cosmological model gives rise to a remarkably successful theory for structure formation. Nowadays, hydrodynamical simulations have become our most important theoretical tool to study non-linear multi-scale dynamics in the baryonic sector, allowing us to follow how hydrogen and helium gases condense out in galaxies, form stars, and populate the predicted dark matter structures. However, we still struggle to understand the regulation of star formation, which appears rather inefficient on a global scale, defying simple theoretical expectations. In this talk, I will review some of the current results of galaxy formation simulations and discuss how they help us to identify and constrain the physics shaping galaxies and clusters of galaxies. I will also discuss results of high precision numerical predictions that help the search for dark matter and are needed in observational programs that aim to constrain the physical nature of dark energy.