Colloquium

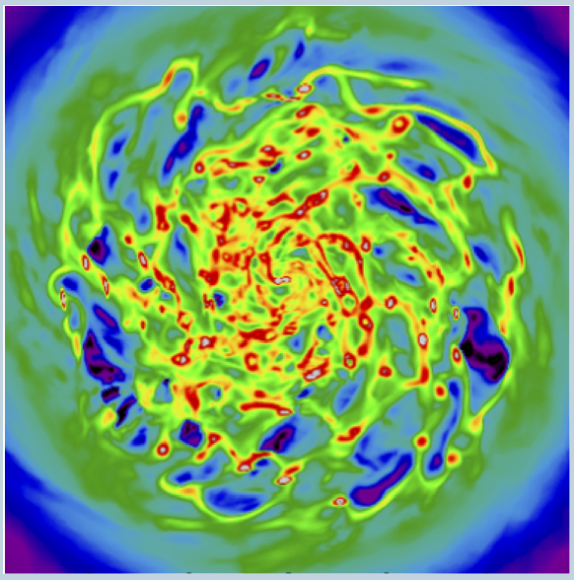
SFB 956

Conditions and Impact of Star Formation

22.02.2016

Monday 4:00 pm

Physikalische Institute Köln
Lecture Hall III
Zülpicher Straße 77 | 50937 Köln



Wolfram Schmidt

Hamburg Observatory

The Small and the Beautiful: How the Star Formation Law Affects Galactic Disk Structure

Star formation and supernova feedback cannot be numerically resolved in global simulations of disk galaxies. I will show how analytical models of star formation can be utilized as subgrid-scale models for simulations, here the star formation efficiency is locally expressed as a function of the turbulent Mach number and viral parameter on sub-resolution scales.

However, there are substantial variations in the theoretical prescriptions. A systematic study of the impact of different star formation models in galaxy simulations reveals which models reproduce expected properties of galaxies. A roughly constant global star formation rate and a nearly linear relation between the local star formation rate and the molecular hydrogen column density in agreement with observational constraints is found for multi free-fall models. This means that the local free-fall time scale is integrated over the probability density function of numerically unresolved fluctuations with respect to the cell-averaged gas density. In other words, these models assume multiple free-fall time scales corresponding to the distribution of density fluctuations produced by turbulence in each grid cell.

For simpler models, differences become apparent when the disc structure and the distribution of the gas over the different phases of the ISM are considered. In particular, the self-regulation of star formation is broken and a very clumpy disk not even remotely resembling a Milky-Way-like galaxy is produced in some cases.