



# Polymer- & Soft-Matter-Seminar

Tuesday,  
18<sup>th</sup> June 2013

at: 5.15 pm

VSP1 1.26

Von-  
Seckendorff-  
Platz 1,  
06120 Halle

## Prof. Nail Fatkullin

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### "PROTON SPIN KINETICS IN POLYMER MELTS: new perspectives for experimental in- vestigations of polymer dynamics in bulk and confinement."

An essential progress was made in recent years [1-9] in understanding of the proton spin kinetics in polymer melts. This opens new perspectives for experimental investigations of polymer dynamics on the basis of different NMR methods. Generally, the proton spin kinetics is determined by intramolecular and intermolecular magnetic dipole-dipole contributions of proton spins. During many decades it was actually postulated that main contribution is coming from magnetic dipole-dipole interactions from intramolecular protons belonging to the same polymer segment. It appears that this postulate is very far from reality. The relative weights of intra and inter contributions are time dependent and very sensitive to details of polymer chain dynamics. It is shown, that for isotropic models of polymer dynamics, when polymer segments displacements do not correlate with the initial chain conformation, the influence of the intermolecular magnetic dipole-dipole interactions increases faster with increasing evolution time (or decreasing frequency) than the corresponding influence of the intramolecular counterpart. On the other hand, an inverted situation is predicted by the tube-reptation model: here the influence of the intramolecular magnetic dipole-dipole interactions increases faster with time (or inverse frequency), than the contribution from intermolecular interactions. Moreover, the intermolecular contribution of proton spins in polymer melts to different spin-kinetic phenomena such as spin-lattice relaxation, Free Induction Decay, Hahn Echo, etc. can be separated using a deuteration technique. It will be shown that data of this sort contain unique dynamic information about mean squared displacements of polymer segments on different macromolecules relative to each other. The diffusion times that can be probed on this basis range from  $10^{-9}$  -  $10^{-3}$  s.

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