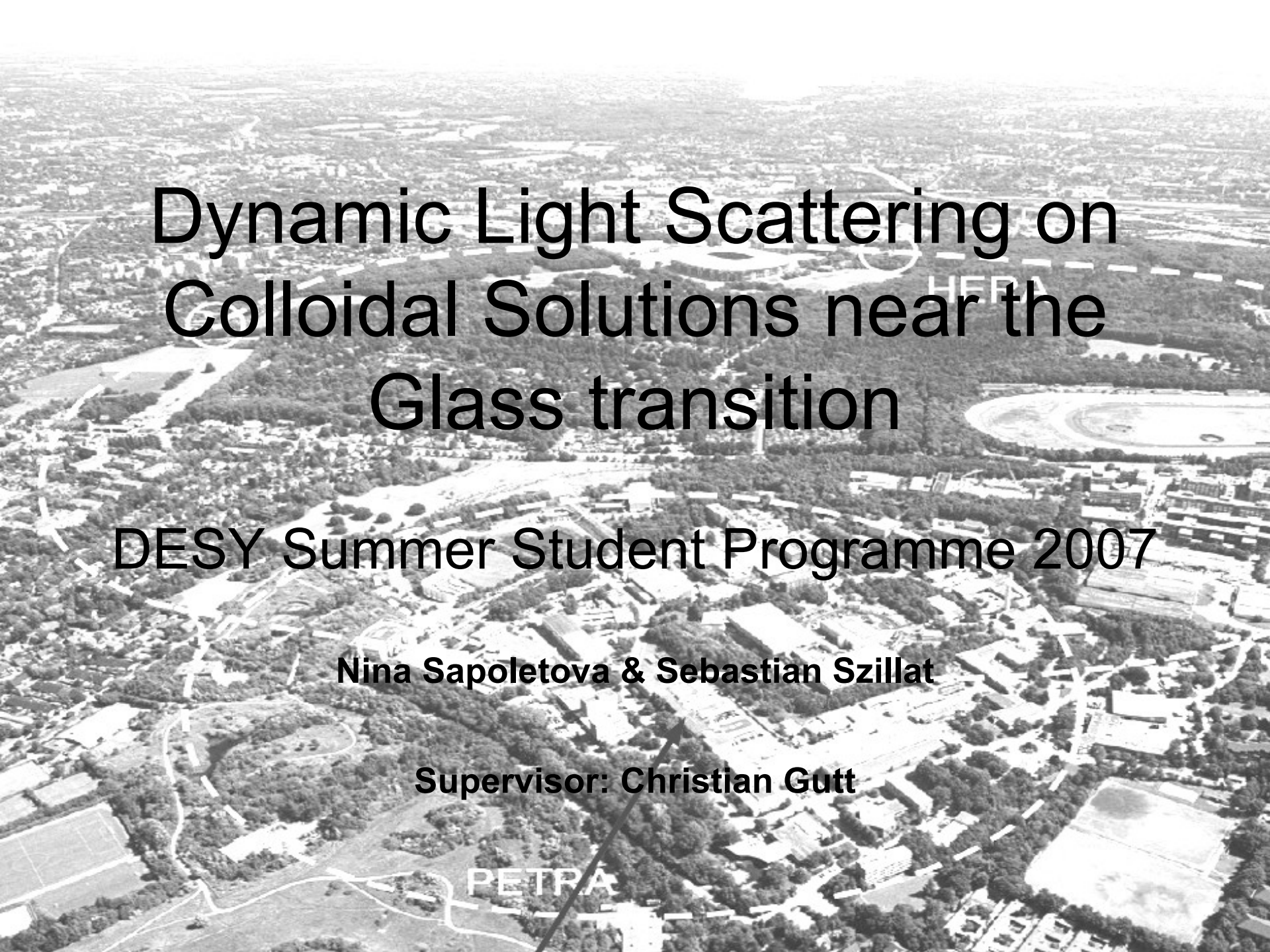

Dynamic Light Scattering on Colloidal Solutions near the Glass transition

DESY Summer Student Programme 2007

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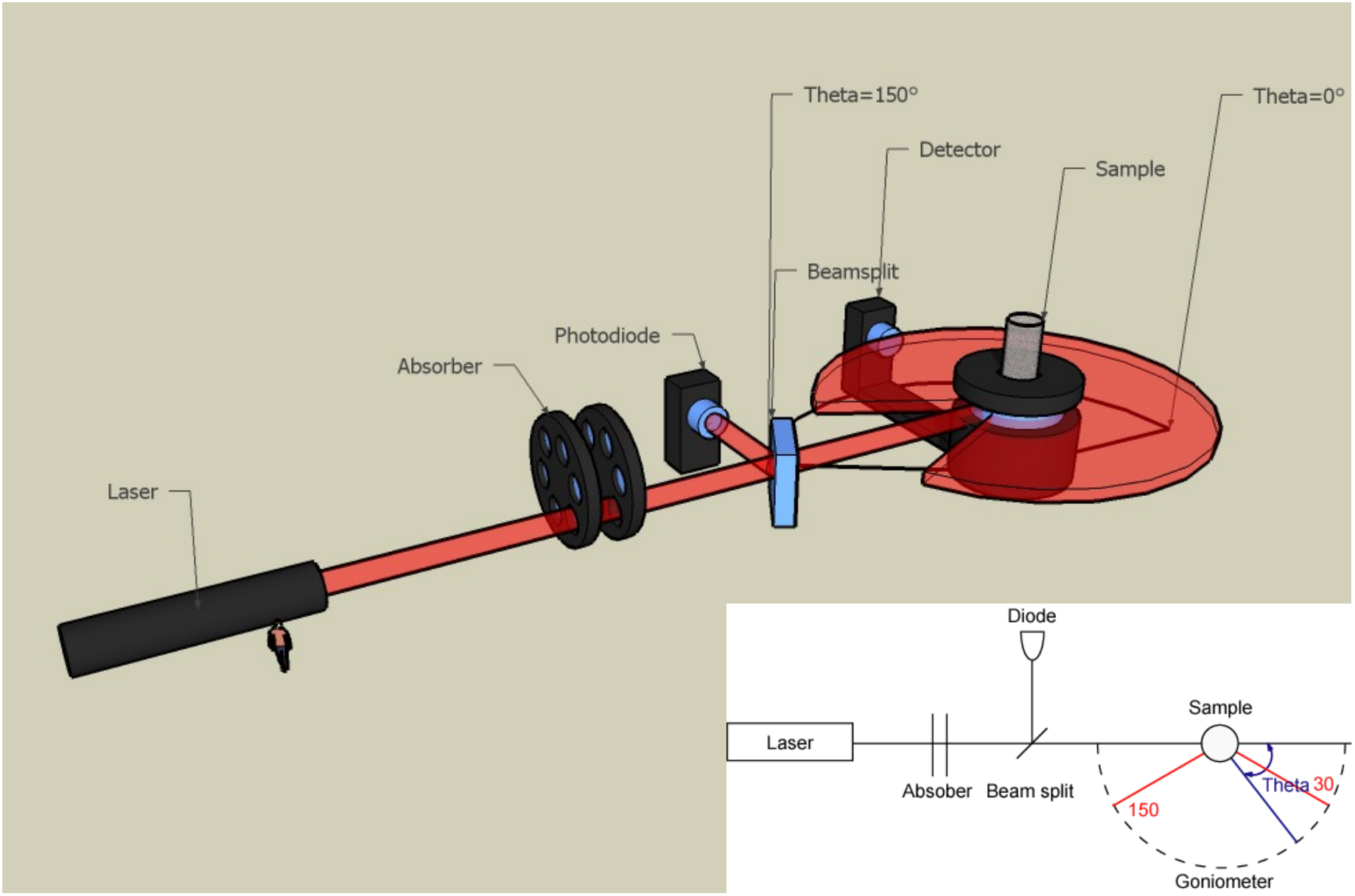
Supervisor: Christian Gutt

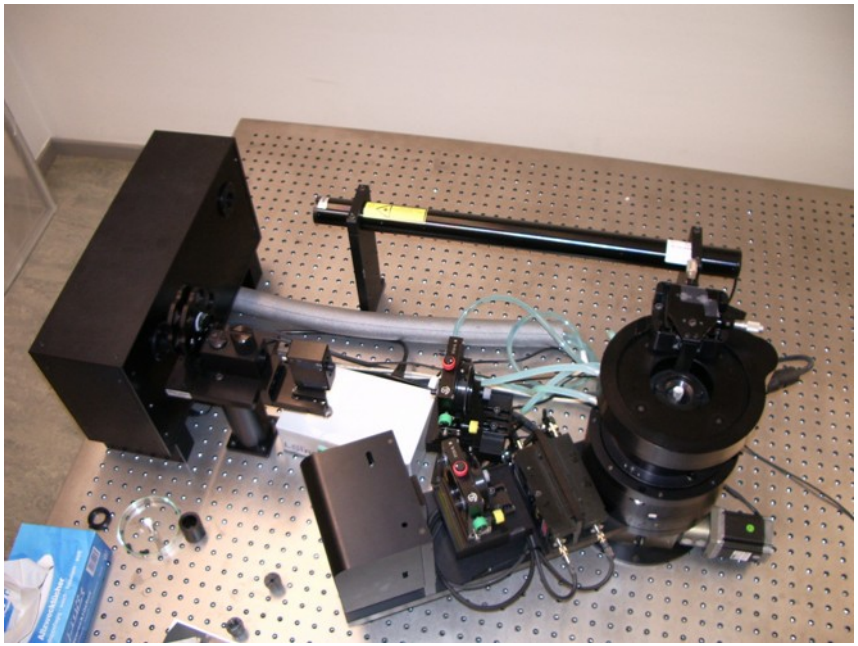
Outline

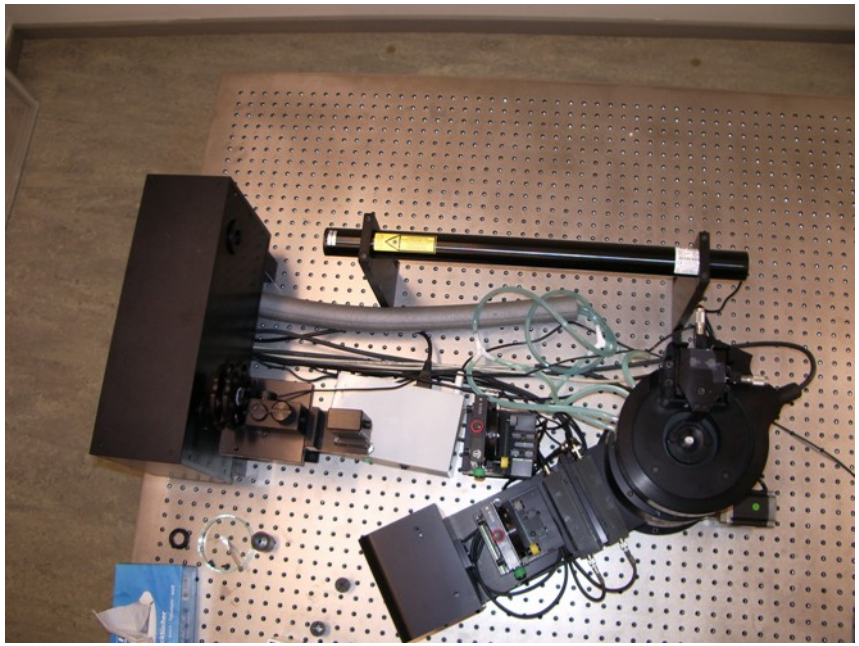
- **Experiment**
- **Colloidal Solutions**
- **Glass transition**
- **Dynamic Light Scattering**
- **Results**

Experiment - scheme



Experiment - photos





Colloidal system

Colloidal dispersion: particles (1-1000 nm) dispersed in a liquid solvent

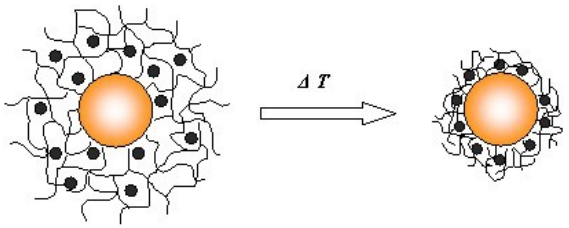
Colloidal solutions – our samples

PMMA (in water) - poly methyl metacrylate (60 nm)

pNIPA (in water) - poly N-isopropyl-acryl amid

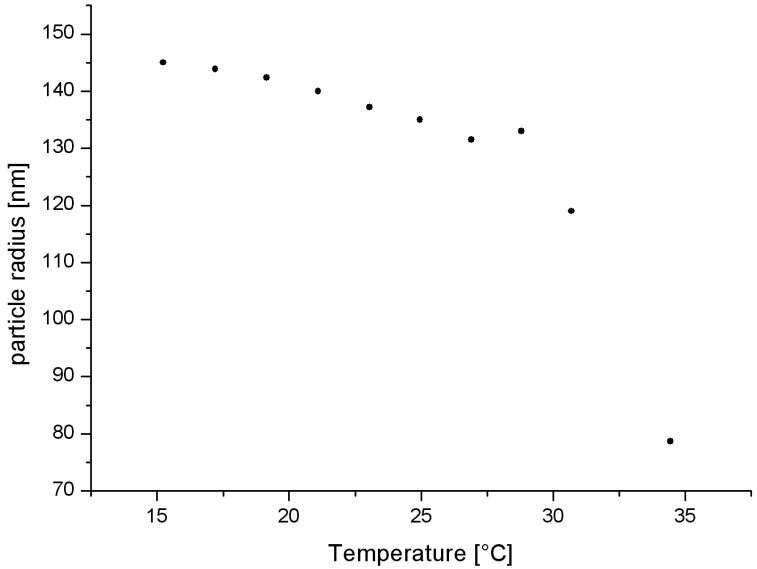
special feature:

particles do grow and shrink with temperature



We are interested in

- Particle size
- Static and dynamic behavior
- Glass transition



Glass transition

Liquid state

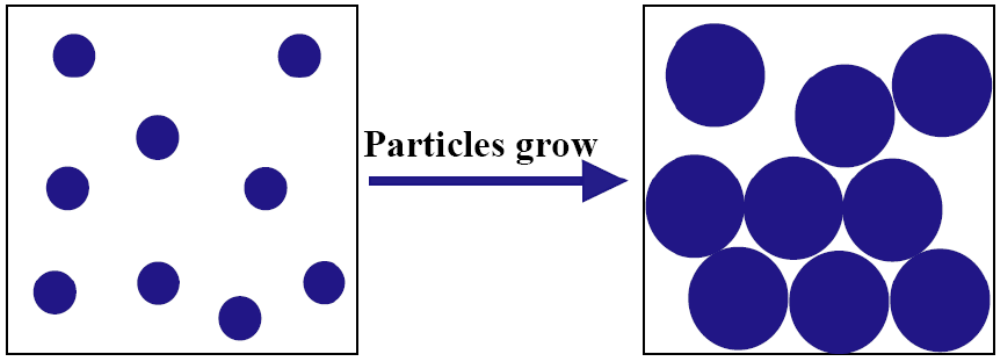
- Free movement of colloidal particles
- No order or arrangement

Glassy state

- Particles “feel” each other
- Amorphous structure appears

Transition can be reached by

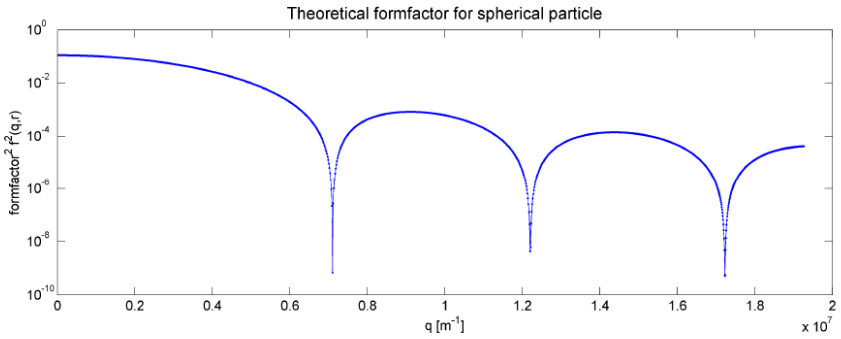
- increasing concentration
- growth of particles (→ pNIPA)



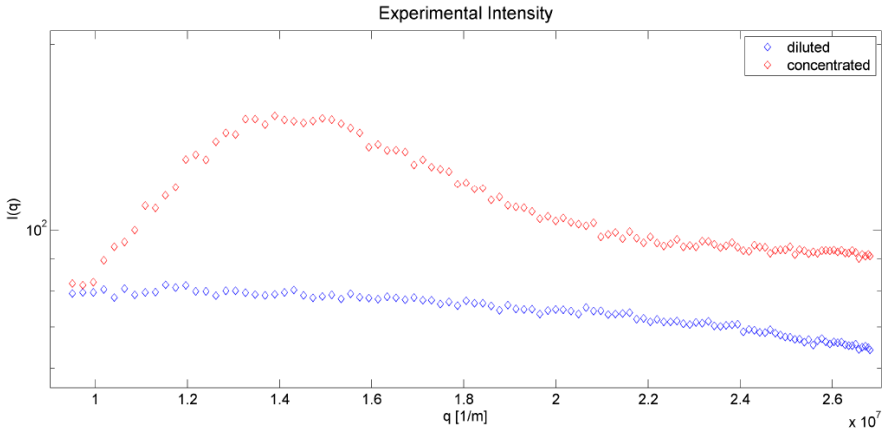
Light scattering

$$I(q) \sim F(q)^2 * S(q)$$

Form factor: Information about shape of scattering particles



Structure factor: Information about arrangement of particles



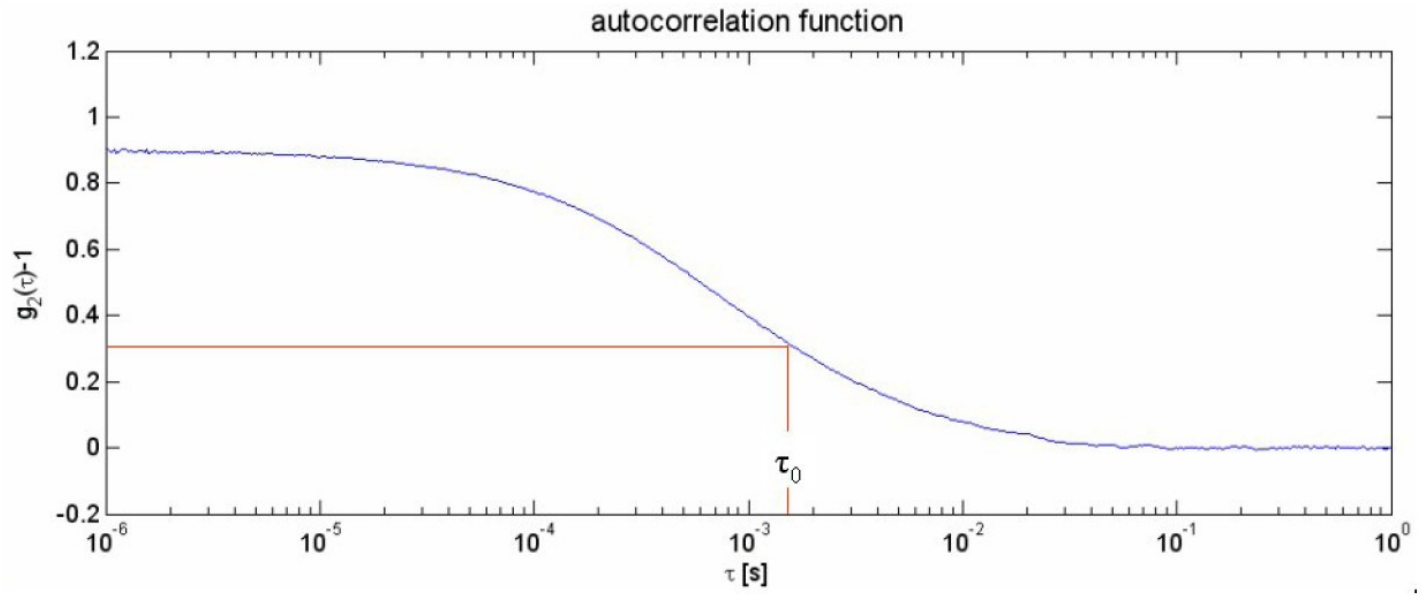
Dynamic light scattering

Intensity autocorrelation compares a signal with it's time shifted signal

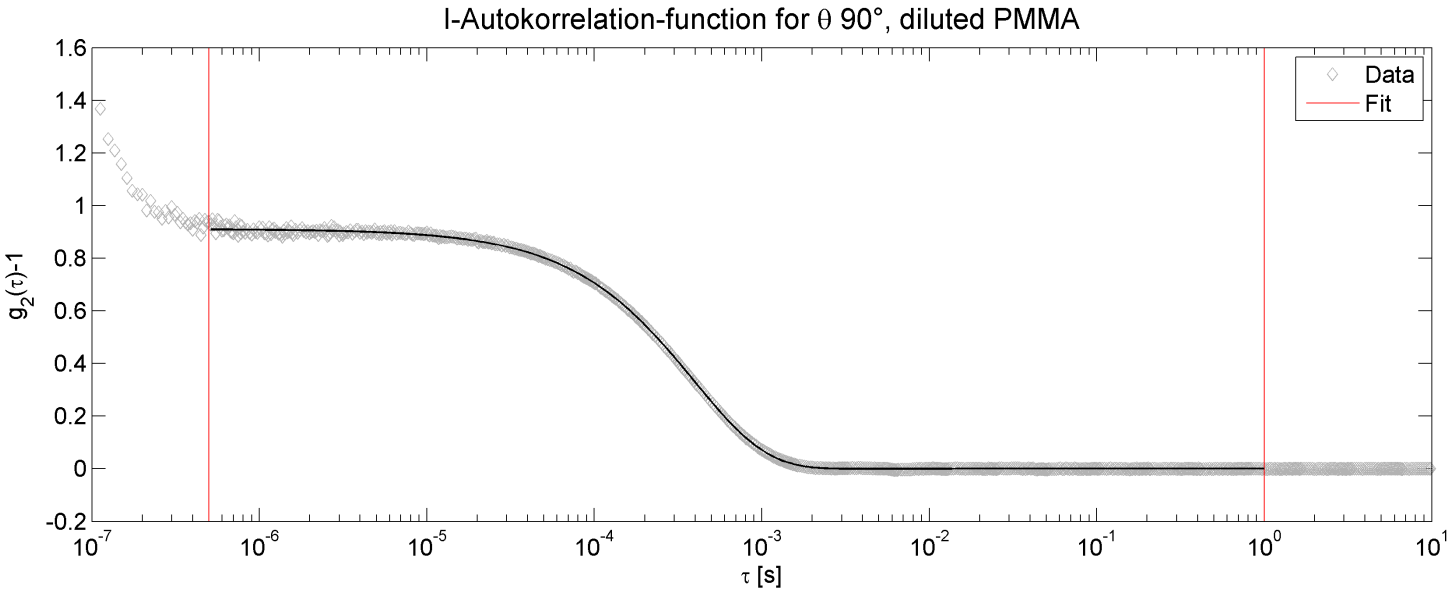
Particles move in dispersion

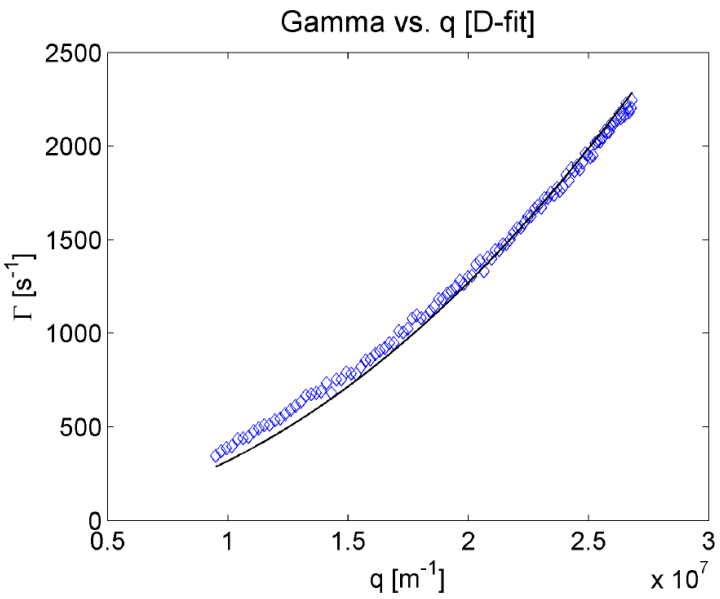
→ Scattered intensity changes

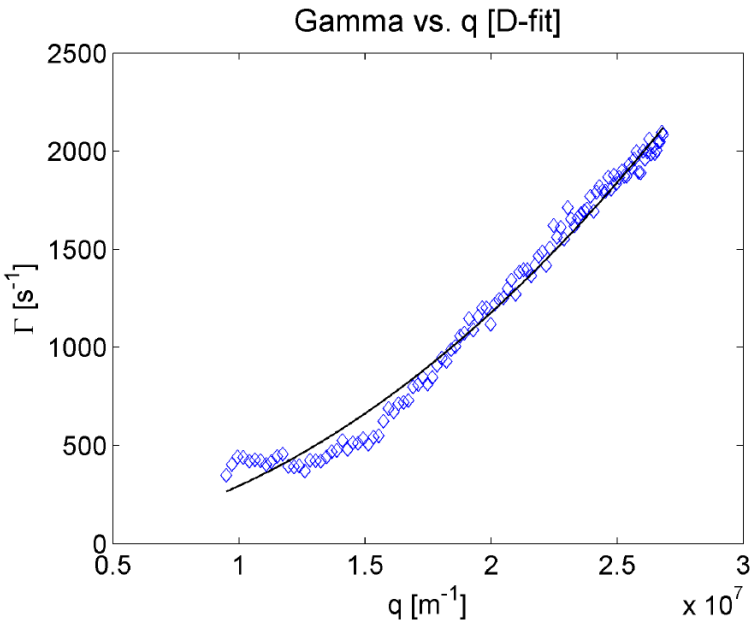
→ Information about dynamics in sample



Results PMMA - dynamics

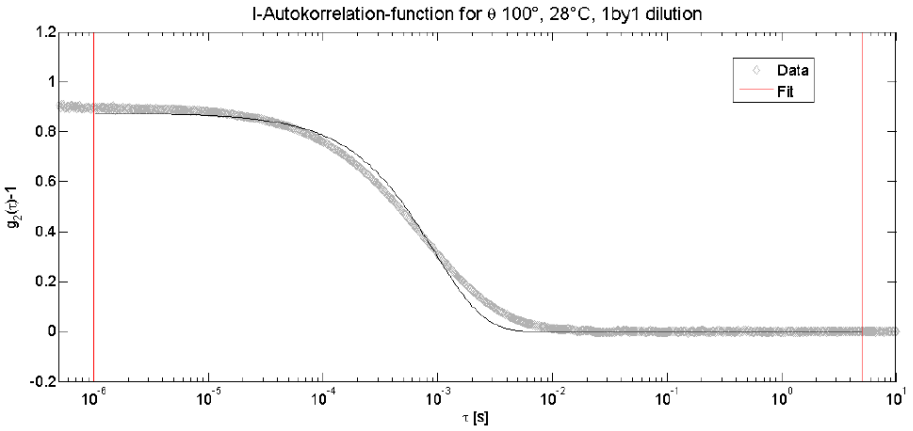


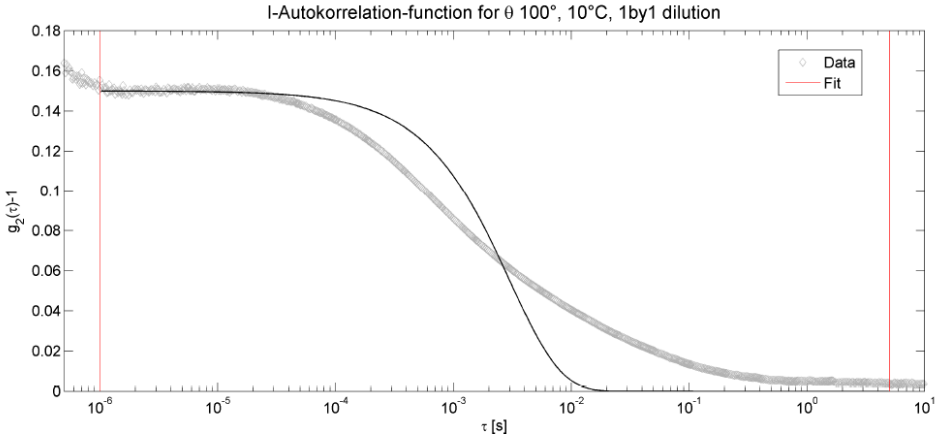


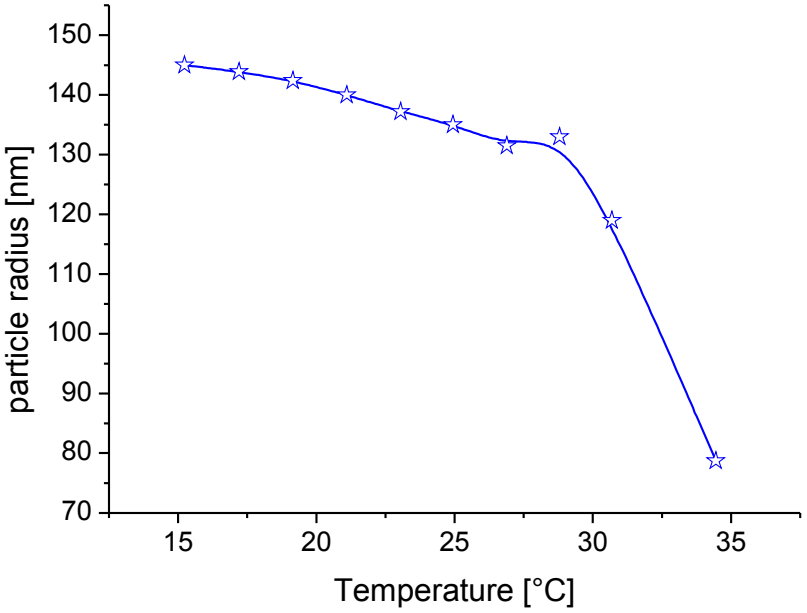


Results pNIPA

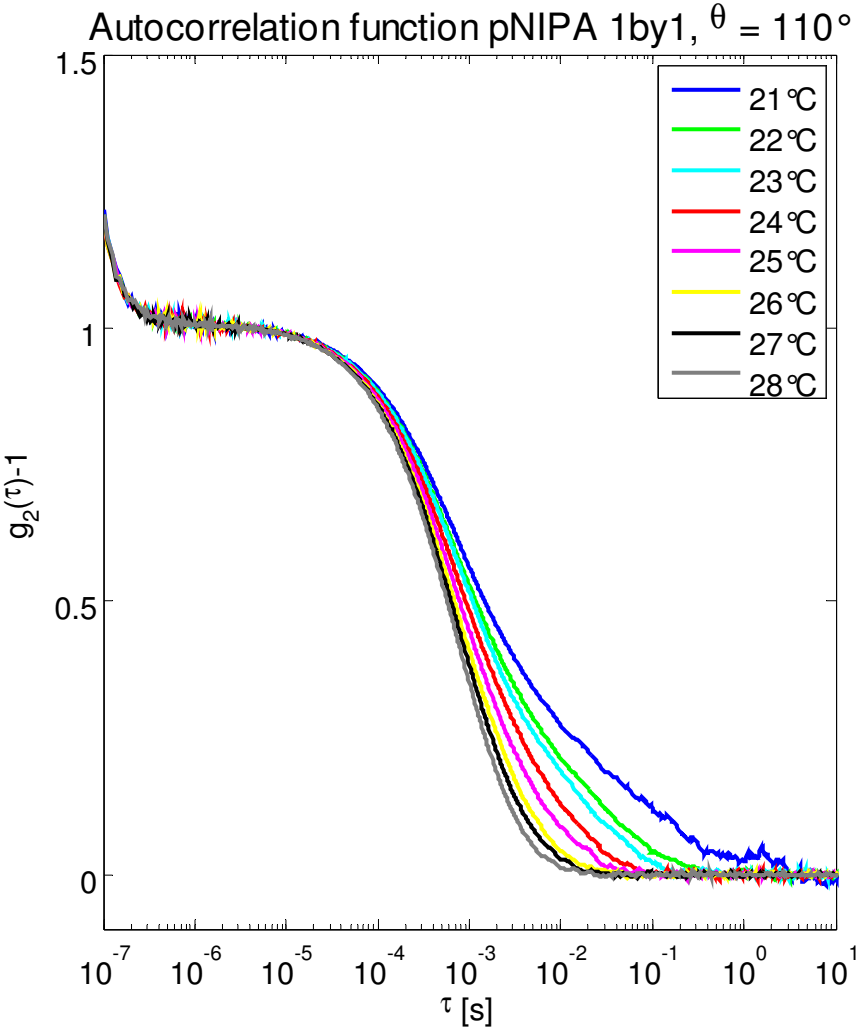
No statics available because of strong absorption

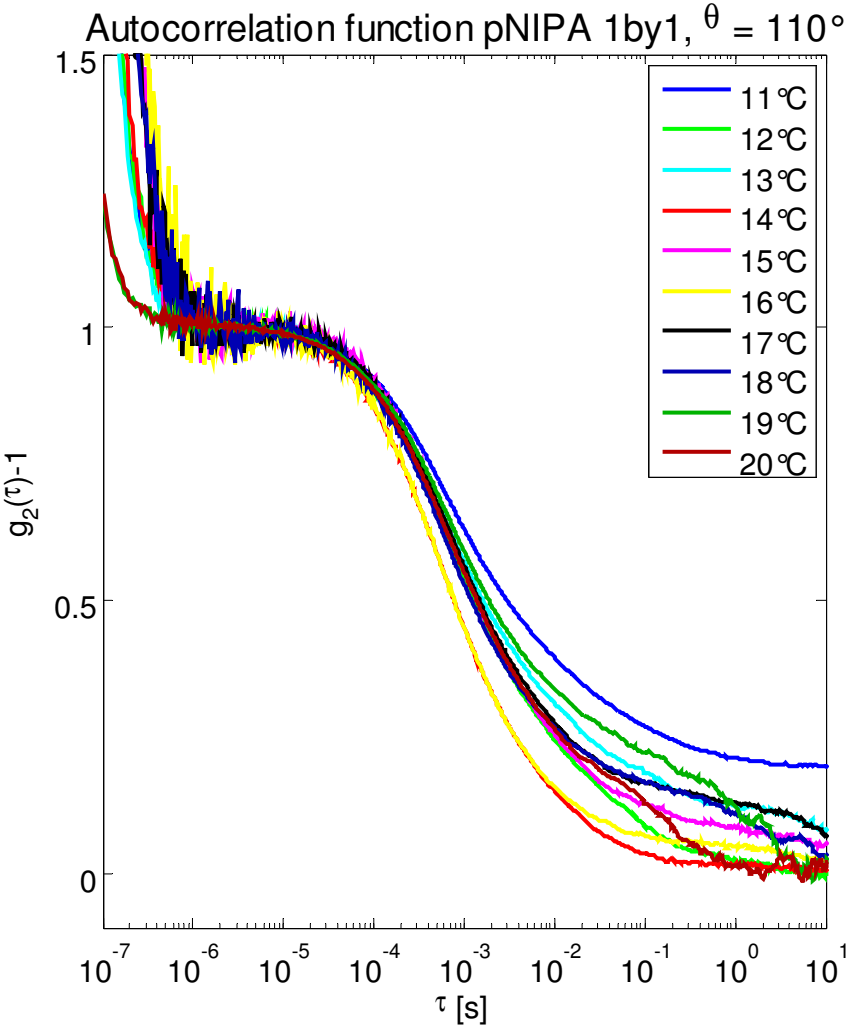






Results pNIPA - dynamics





Conclusions - last slide, so wake up !

- The static and dynamic behavior of PMMA and poly-NIPA suspensions has been investigated by light scattering.
- Poly-NIPA change radius dependent on the temperature.
- It has been shown that for high dilutions we have a very good correspondence between theory for Brownian motion and our results.
- For high concentrations we obtain deviation from the diluted theory. The reason for this is the up-coming particle interaction near the glass transition and in the glassy state.

Thank you for your attention !!!