Long Range Correlations and Intermittency In the Slow Dynamics of a Soft Glass

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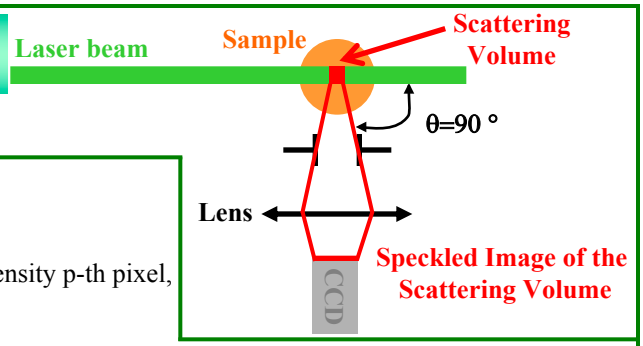
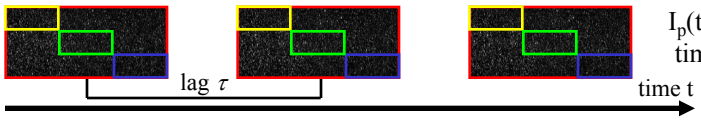
Dynamic Light Scattering (DLS) Multispeckle Set Up

Imaging Geometry



Space and Time Resolved Correlation (TRC)



$I_p(t)$: intensity p-th pixel, time t

Speckled Images of the Scattering Volume

❖**Space and Time Resolved Degree of Correlation :**

$$c_I(t,\tau,\vec{r}) = \frac{\langle I_p(t)\, I_p(t+\tau)\rangle_{p\in V(\vec{r})}}{\langle I_p(t)\rangle_{p\in V(\vec{r})}\langle I_p(t+\tau)\rangle_{p\in V(\vec{r})}} - 1$$

❖**Spatially Resolved Intensity Correlation Function :**

$$g_2(\tau,\vec{r}) - 1 = \overline{c_I(t,\tau,\vec{r})}$$

❖**Spatial Correlation of the Dynamics :**

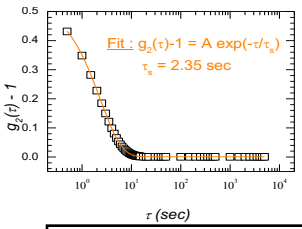
$$\mathrm{corr}(\tau,\vec{r}) = \left\langle \frac{\overline{c_I(t,\tau,\vec{r})\, c_I(t,\tau,\vec{r}+\Delta\vec{r})} - \overline{c_I(t,\tau,\vec{r})}\;\overline{c_I(t,\tau,\vec{r}+\Delta\vec{r})}}{\overline{c_I(t,\tau,\vec{r})^2} - \overline{c_I(t,\tau,\vec{r})}^2} \right\rangle_{\vec{r}}$$

Experimental Results

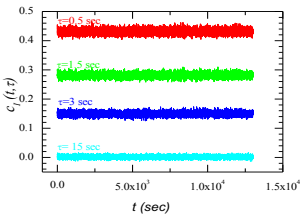
➢TEST : Diluted Brownian Suspension [2]

❖**Sample :** $r_{spheres}$ = 530 nm, Φ = 3.7 10^{-5}

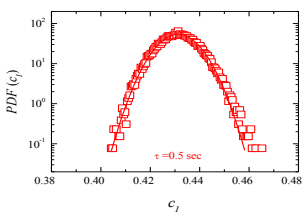
❖**Average Dynamics :**



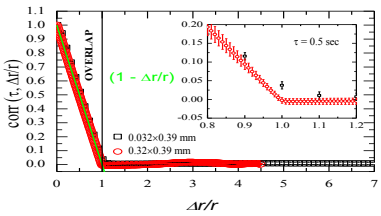
❖**Time Resolved Dynamics :**



❖**Distribution of c_I :**



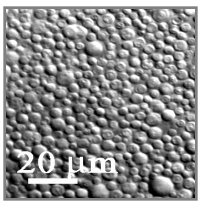
❖**Spatial Correlation Dynamics :**



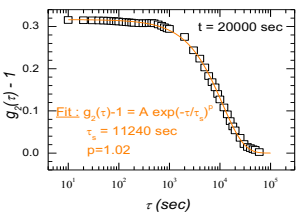
BROWNIAN DYNAMICS :
- **$c_I(t,\tau)$: Stationary and Temporally Homogeneous Dynamics**
- **PDF (c_I) : Gaussian (fluctuations due to measurement noise)**
- **Dynamics Spatially Uncorrelated (0< Δr/r< 1, Corr (τ,Δr/r) = (1 – Δr/r), Regions overlaped)**

➢ONIONS GEL [3]

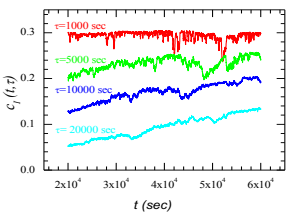
❖**Sample :** Octanol + CpCl decorated with F68



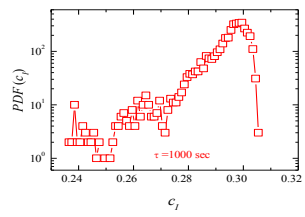
❖**Average dynamics :**



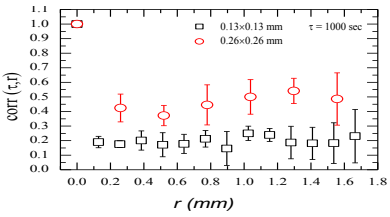
❖**Time Resolved Dynamics :**



❖**Distribution of c_I :**



❖**Spatial Correlation Dynamics :**



INTERMITTENT DYNAMICS :
- **$c_I(t,\tau)$: Large Fluctuations, Heterogeneous Dynamics**
- **PDF (c_I) : Non-Gaussian**
- **Very Long Range Spatial Correlations of the Dynamics**

References :

[1] L. Cipelletti, H. Bissig, V. Trappe, P. Ballesta, S. Mazoyer, *J. Phys. : Condens. Matter*, 2003, **15**, S257

[2] A. Duri, H. Bissig, V. Trappe, P. Ballesta, L. Cipelletti, *Conference Proceedings of the SPIE Fluctations and Noise, Meeting*

[3] F. Castro-Roman, G. Porte, C. Ligoure, *Phys.Rev.Lett*, 1999, **82**, 109