



HAL
open science

Long range correlations and intermittency in the slow dynamics of a soft glass

Agnès Duri, Luca Cipelletti

► **To cite this version:**

Agnès Duri, Luca Cipelletti. Long range correlations and intermittency in the slow dynamics of a soft glass. XIX Sitges conference, Jun 2004, Barcelone, Spain. hal-02921560

HAL Id: hal-02921560

<https://hal.inrae.fr/hal-02921560>

Submitted on 27 Aug 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

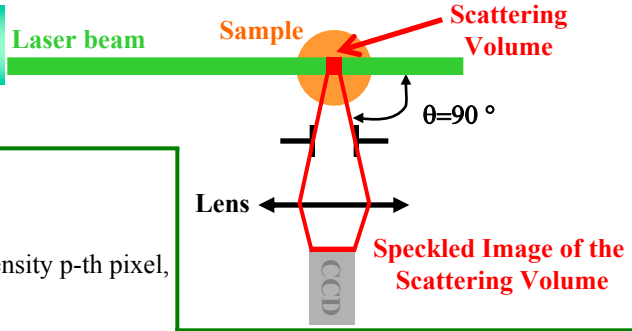
L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Agnès Duri and Luca Cipelletti

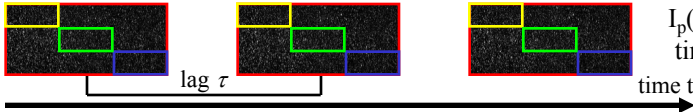
Groupes de Dynamique des Phases Condensées, UMR 5581, Université Montpellier II, 34095 Montpellier, France

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

Spatially Resolved Intensity Correlation Function :

$$g_2(\tau, \vec{r}) - 1 = \overline{c_1(t, \tau, \vec{r})}$$

Space and Time Resolved Degree of Correlation :

$$c_1(t, \tau, \vec{r}) = \frac{\langle I_p(t) I_p(t + \tau) \rangle_{p \in V(\vec{r})}}{\langle I_p(t) \rangle_{p \in V(\vec{r})} \langle I_p(t + \tau) \rangle_{p \in V(\vec{r})}} - 1$$

Spatial Correlation of the Dynamics :

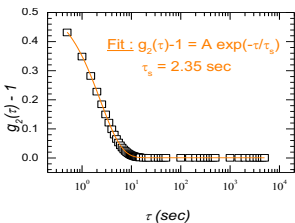
$$\text{corr}(\tau, \vec{r}) = \left\langle \frac{c_1(t, \tau, \vec{r}) c_1(t, \tau, \vec{r} + \Delta \vec{r}) - c_1(t, \tau, \vec{r}) c_1(t, \tau, \vec{r} + \Delta \vec{r})}{c_1(t, \tau, \vec{r})^2 - c_1(t, \tau, \vec{r})} \right\rangle_{\vec{r}}$$

Experimental Results

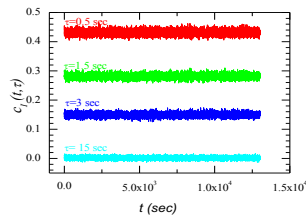
TEST : Diluted Brownian Suspension [2]

Sample : $r_{\text{spheres}} = 530 \text{ nm}$, $\Phi = 3.7 \cdot 10^{-5}$

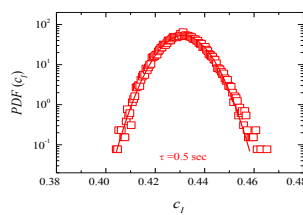
Average Dynamics :



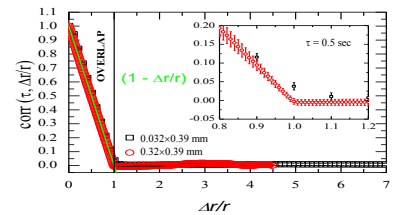
Time Resolved Dynamics :



Distribution of c1 :

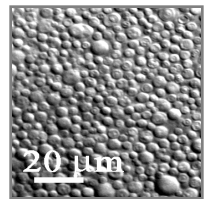


Spatial Correlation Dynamics :



BROWNIAN DYNAMICS :

- $c_1(t, \tau)$: Stationary and Temporally Homogeneous Dynamics
- PDF(c_1) : Gaussian (fluctuations due to measurement noise)
- Dynamics Spatially Uncorrelated ($0 < \Delta r/r < 1$, $\text{Corr}(\tau, \Delta r/r) = (1 - \Delta r/r)$, Regions overlapped)

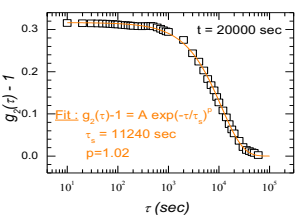


ONIONS GEL [3]

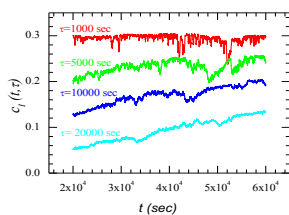
Sample :

Octanol + CpCl decorated with F68

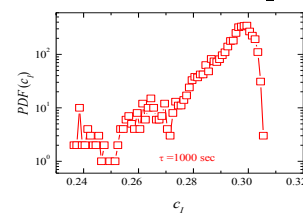
Average dynamics :



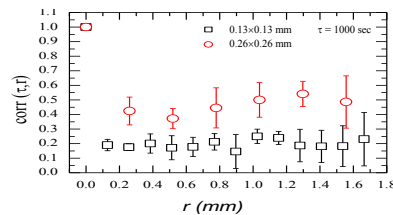
Time Resolved Dynamics :



Distribution of c1 :



Spatial Correlation Dynamics :



INTERMITTENT DYNAMICS :

- $c_1(t, \tau)$: Large Fluctuations, Heterogeneous Dynamics
- PDF(c_1) : 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 Fluctuations and Noise, Meeting*
- [3] F. Castro-Roman, G. Porte, C. Ligoure, *Phys.Rev.Lett*, 1999, **82**, 109