Electronic Supplementary Material (ESI) for Soft Matter

Supplementary Information: Fluorescence correlation spectroscopy and Brownian dynamics simulation of protein diffusion under confinement in lipid cubic phases

Shinpei Tanaka*

School of Integrated Arts and Sciences,

Hiroshima University, 1-7-1 Kagamiyama,

Higashi-Hiroshima 739-8521, Japan

*shinpei@hiroshima-u.ac.jp

I. TESTS OF THE FITTING FUNCTION

The applicability of our empirical fitting function,

$$g(t) = 1 + a_0 \left\{ 1 + \left(\frac{t}{\tau} \right)^{\beta} \right\}^{-1} \left\{ 1 + \left(\frac{t}{k^2 \tau} \right)^{\beta} \right\}^{-1/2} \tag{1}$$

was tested here. See also [1]. Figures 1–5 show several examples where a distribution of τ_i, $P(\tau_i)$, was made artificially and the auto correlation function (ACF) was calculated as

$$g(t) = 1 + \sum_i a_i \left(1 + \frac{t}{\tau_i} \right)^{-1} \left(1 + \frac{t}{k^2 \tau_i} \right)^{-1/2}. \tag{2}$$

ACFs were then fitted with Eq. (1). Logarithmic average of τ_i was calculated as

$$\langle \tau \rangle_l = \exp \left\{ \sum_i P(\tau_i) \log \tau_i \right\}, \tag{3}$$

and compared with τ obtained by the fitting.

The fitting was good except cases where apparent double shoulders exist (Fig. 2 and 3). Even if the distribution of τ_i was very broad as in the case of Fig. 5, the fitting function reproduced the ACF well with a small value of β. The fitting failed when there are shoulders with obvious reason that the fitting function has only one shoulder. Even so, as in the case of Fig. 2, the logarithmic average of τ_i could be approximated by τ.

Figure 6 shows how β changes with the distribution width. To evaluate β, ACFs were constructed from a distribution which was made from five logarithmicaly evenly distributed modes from the minimum value $\tau_{\rm min}$ to the maximum value $\tau_{\rm max}$, like the one shown in Fig. 5(a). The width of the distribution was evaluated by $\tau_{\rm max}/\tau_{\rm min}$. From Fig. 6, one can estimate the width of the distribution from the value of β. For example, if $\beta \simeq 0.7 - 0.8$, $\tau_{\rm max}/\tau_{\rm min} \simeq 20 - 60$.

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[1] S. Tanaka, J. Chem. Phys., **133**, 095103 (2010).

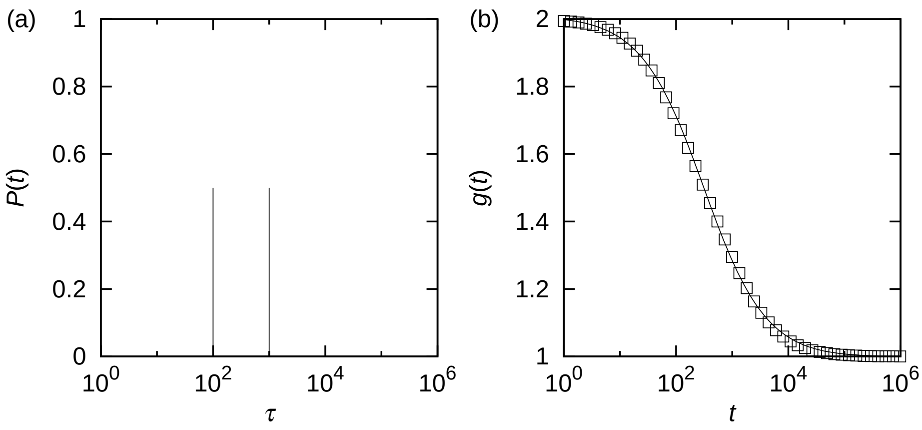

FIG. 1. Fitting gave $\tau = 310$ and $\beta = 0.78$ whereas $\langle \tau \rangle_l = 316$.

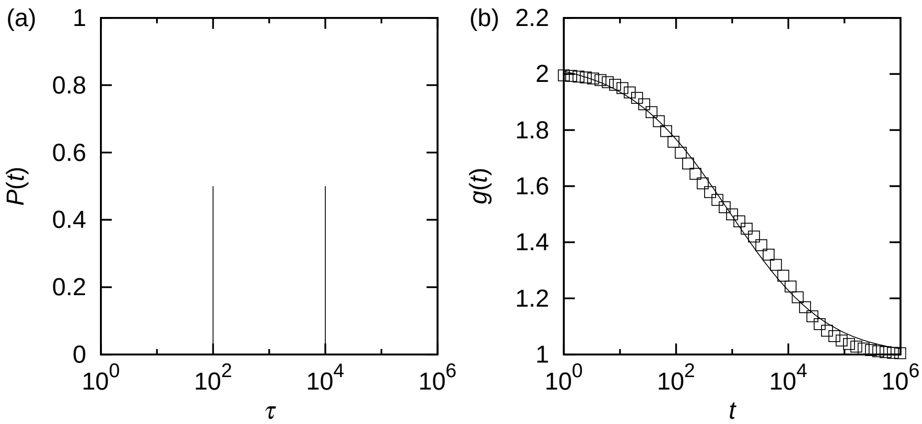

FIG. 2. Fitting gave $\tau = 902$ and $\beta = 0.48$ whereas $\langle \tau \rangle_l = 1000$.

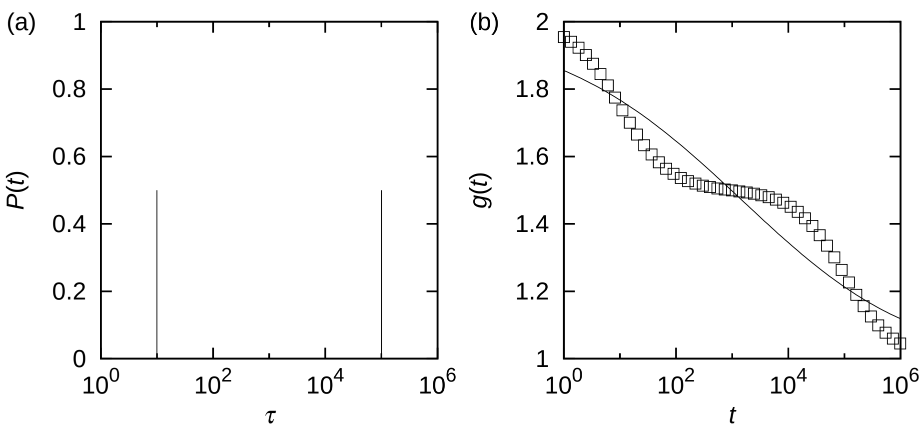

FIG. 3. Fitting gave $\tau = 2183$ and $\beta = 0.25$ whereas $\langle \tau \rangle_l = 1000$.

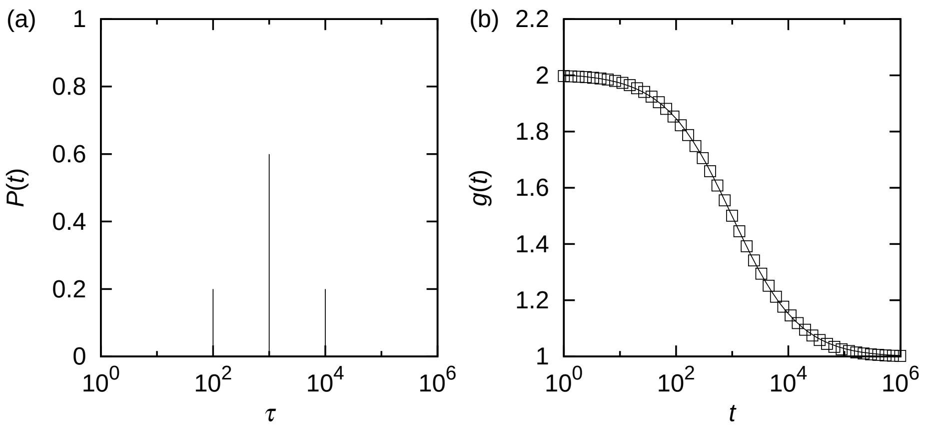

FIG. 4. Fitting gave $\tau = 997$ and $\beta = 0.72$ whereas $\langle\tau\rangle_l = 1000$.

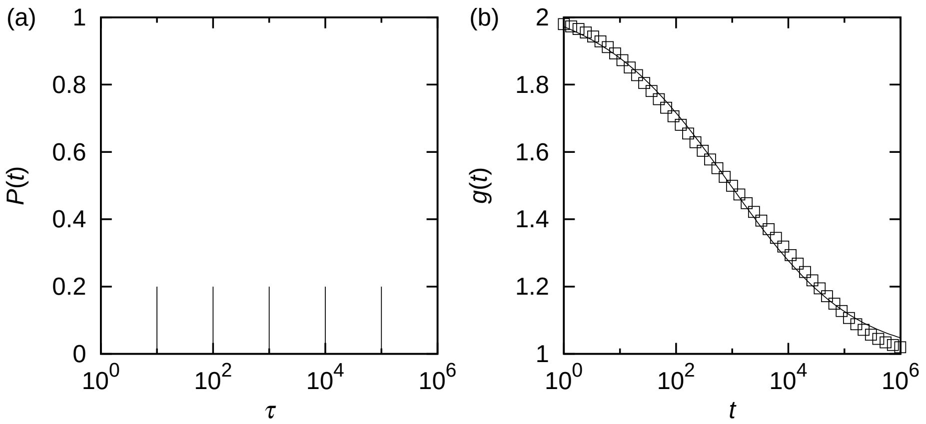

FIG. 5. Fitting gave $\tau = 996$ and $\beta = 0.36$ whereas $\langle\tau\rangle_l = 1000$.

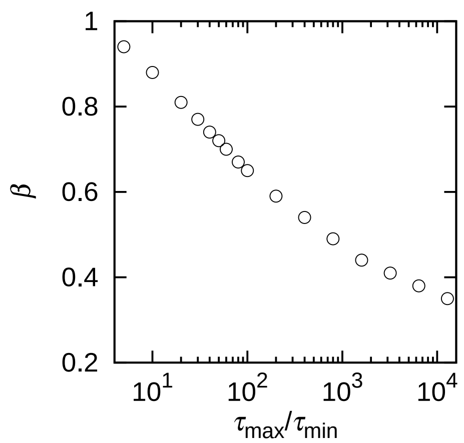

FIG. 6. β versus the width of distribution.