Dynamics of the erythrocyte flickering with a stochastic phase field model

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Erythrocyte flickering is the common name given to the fluctuations that suffer the membrane of the red blood cell mainly due to the thermal bath and its soft behaviour. Nowadays it still keeps being researched due to its simple structure but complex geometry and by its apparent active nature in theoretical and experimental works [1, 2, 3].

In this work the fluctuations of the red blood cell membrane are studied by simulations based on a stochastic phase field model. This work is based on existing phase field models for cellular membranes, where the bending energy reigns, this time including a thermal-driven noise that cause the fluctuations. The results are compared with experimental data for several simulated geometries of the membrane. An auto-correlation function for the phase field order parameter is derived. Then the correlation function for both, the phase field and the membrane displacement, is computed obtaining a behaviour for the simulations similar to the experimental data.

Then, by Fourier analysis the power spectral density is computed for the fluctuations, obtaining an algebraic dependence for the wave-vector q that corresponds to non-local fluctuations coupling the membrane with the surrounding fluid.

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