E. I. Kats and V. V. Lebedev. *Dynamics of freely suspended smectic films.* In recent years thin bilayered and even multilayered films of smectic liquid crystals have been obtained and are being investigated.[1,2] The very possibility of the existence of such films in a freely suspended state is associated with the layer structure characteristic of all smectics, i.e., the presence of internal forces which compel the center of mass of the molecules to lie in a single layer. In making the transition to a nematic or isotropic phase this layered structure disappears and the freely suspended films become unstable. Thus, freely suspended smectic films are a new aggregate state of matter: a two dimensional object imbedded in three dimensional space. We note that in actual fact we do not necessarily have in mind multilayered films. All our results refer to multilayered films, but in these cases the thickness of the film restricts the allowable range of wave vectors in which we do not have to take into account the variation of the hydrodynamical variables across the thickness of the film.

As hydrodynamic variables of the film we can choose two-dimensional densities of the mass ρ, entropy σ, momentum $\mathbf{j}$ and displacement vector $\mathbf{u}$. For films of C and B smectics we must add to these variables the angle φ which describes the orientational degree of freedom in the plane of the layer. In B smectics the layer possesses hexagonal symmetry, while the films of C smectics possess an anisotropy vector determined by the projection of the director of the layer.

A simple analysis shows that the fluctuations of ρ, σ and $\mathbf{u}$ are unimportant for the static properties of the films. However in films of C smectics fluctuations of the anisotropy vector lead to a logarithmic renormalization of the moduli of orientational elasticity. The film of a C smectic becomes isotropic on a large scale, and so becomes equivalent to a film of B smectic.

The equations of hydrodynamics of freely suspended films can be derived from Poisson brackets for three-dimensional hydrodynamic variables which have to be integrated over the thickness of the film. As a result of this we arrive at formulas which involve only two-dimensional densities. The specific properties of freely suspended smectic films are related to the possibility of a bending motion of the film. Strong fluctuation effects in the dynamics of the films are associated specifically with this circumstance.[2] The bending motion of a film can be propogated along it and represents a mode of bending sound. The damping of the sound is anomalously weak. It is proportional to only the fourth power of the wave vector q. However the fluctuational damping turns out to be much stronger. Calculations[2] show that fluctuational damping of shear sound is proportional to q^3.

In their turn the nonlinear equations of hydrodynamics couple the mode of bending sound with the mode of the usual longitudinal sound and the viscous diffusion mode. This interaction gives a fluctuational contribution to the imaginary part of these modes, proportional to $q^{5/3}$ which in the long wavelength limit exceeds the regular q^2.

Thus, the spectrum of the eigenoscillations of freely suspended smectic films cannot be described within the framework of traditional hydrodynamics. The damping of the bending and longitudinal sounds and the diffusion coefficient of the viscous mode are determined by fluctuational effects.

The same results are also valid for films of smectics of low symmetry with the additional consideration that the fluctuational contribution also determines the spectrum of the orientational mode.

[1]D. E. Moncton and R. Pindak, Phys. Rev. Lett. **43**, 701 (1979).
[2]E. I. Kats and V. V. Lebedev, J. Phys. (Paris) **46**, 2093 (1985); Kristallografiya **31**, 23 (1986) [Sov. Phys. Crystallogr. **31**, 10 (1986)].