Nonlinear Response of the Torsional Oscillation of the Vortex Tangle. Relation Between Dissipation and Period shift.

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Torsional oscillation of the vessels with quantum fluids is one of oldest and most popular methods for the study of quantized vortices. The recent and very bright example is the discovery of the supersolidity of the solid helium. In the torsion oscillation experiments the drop in the period of oscillations with achievement of some small temperature has been observed. This effect was attributed to the appearance of the superfluid component. There are ideas that specific response of the oscillator appears due to existence of the vortex fluid (vortex tangle) in this system. In the present talk we submit the approach describing the vortex tangle nonlinear relaxation model for large torsional oscillation of quantum systems, having in mind to apply it for the study of solid ^{4}He. The study of this problem shows that there is a quasi-linear solution with the amplitude dependent relaxation time. Both the dissipation $\Delta Q^{-1}/Q$ and the shift of period $\Delta P/P$ are the functions of amplitude oscillations V_n and temperature T. The maximum of the relative dissipation $\Delta Q^{-1}/Q$ over $\Delta P/P$ (taking at zero temperature) have various values on the $T-V_n$ plain, with the maximum differing essentially from the value 1/2, which is prescribed by the linear Debye model.