Capillary Turbulence on the Surface of Quantum Liquids

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Liquid hydrogen and superfluid helium He-II are very suitable liquids to study turbulence phenomena in the system of capillary waves due to their extreme low viscosity and density. These properties allow us to investigate wave turbulence and an influence of the discreteness of the wave spectrum, caused by finite size of the experimental cell, on the turbulent distribution. We observed[1] for the first time a wave energy accumulation at high frequencies – a local maximum in the turbulent spectrum – when the He-II surface was pumped by low-frequency harmonic force. Qualitative model of this phenomenon in the frames of weak wave turbulence approach that takes into account discreteness of the spectrum of surface oscillations in the cylindrical resonator was developed. The formation of local maximum can be explained by a detuning effect of nonlinear harmonic frequencies and eigenfrequencies of surface oscillations in the cell. At high frequencies in the dissipative domain the very fast decreasing turbulent cascade was studied[2]. This fall off could be described very well by "quasi-Plank" function in wide frequency range for turbulent state formed by a broad band noisy excitation. Thus our experiments confirmed the theoretical predictions on an important role of discreteness in the formation and decay of turbulent cascade[3].

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