Excitation of Surface Waves by Second Sound Waves in Superfluid Helium-4

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We report results of experimental study of interactions between waves on He-II surface and second sound waves in the bulk He-II in a rectangular container. Surface waves are registered by the optical technique developed previously.[1] Under applying AC electric current of frequency ω to a heater, a second sound wave of frequency $\omega_{ss} = 2\omega$ is excited in the volume of superfluid helium – an oscillating counterflow of normal and superfluid components is developed under the surface. When the heating power is below a critical value, a surface wave is formed at the frequency ω_1 equal to the second sound frequency, $\omega_1 = \omega_{ss}$. Also a number of harmonics at frequencies multiple to ω_1 are observed which can be explained by surface waves nonlinear interactions. Upon increasing of the pumping amplitude above the critical value, an additional subharmonic surface wave is developed at the half frequency $\omega_2 = \omega_1/2$ which is probably due to 3-wave decay instability of the surface wave of frequency ω_1.

1. L. V. Abdurakhimov, M. Yu. Brazhnikov, and A. A. Levchenko, Low Temp. Phys. 35, 95 (2009)

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