

Direct Energy Transformation in a System of Nonlinear Second Sound Waves

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Experimental studies of nonlinear second sound waves in superfluid helium in a high quality resonator have revealed unexpected and interesting results. For example, a direct energy cascade at multiple harmonics of the driving frequency was observed. It resulted in a flux of energy from the driving frequency to the high energy edge of the spectrum [1]. Sometimes a small shift in the driving frequency or amplitude relative to resonance resulted in the formation of subharmonics in addition to the higher harmonics [2]. The energy pumped into the system was then split into fluxes in both directions, towards high edge of the frequency spectrum as well as towards low frequencies.

In our most recent experiments we have observed the possibility of generating a standing wave of nonlinear second sound of frequency equal to multiples (double, treble and so on) of the pumping frequency f_p , even in the case of a big detuning of f_p from resonance frequency $f = n * c_2 / (2 * L)$, where c_2 is the second sound velocity and L is the length of the resonator. Thus we have observed experimentally the direct transformation of energy into multiple harmonics. We will discuss possible reasons of this effect.

References

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