L. P. Pitaevskii, Properties of the spectrum of elementary excitations near the disintegration threshold of the excitations, Sov. Phys. JETP 9, 830 (1959)

In his 1959 JETP article, Lev Pitaevskii theoretically investigated the quasiparticle decays and related singularities appearing in the excitation spectra of Bose liquids. Specifically, he was interested in the two-roton decay processes, which exist in liquid helium, the only quantum Bose liquid known at that time. The remarkable shape of the excitation spectrum of the superfluid ^{4}He with continuously connected phonon and roton branches was suggested in a short note by L. D. Landau in 1947 [1]. It took another decade before the first observation of rotons was achieved in the inelastic neutron scattering experiments by Palevsky and collaborators [2]. Landau's main motivation was to explain the anomalous hydrodynamic and thermodynamic properties of the superfluid state. Accordingly, Landau did not concern himself with the details of the dispersion curve for high-energy excitations, which make a negligible contribution into the thermodynamics below the superfluid transition temperature $T_c = 2.17$ K. Neutron-scattering techniques rapidly developed in the 1950's and 1960's provided a powerful tool to study physics of high-energy excitations in quantum liquids.

Scattering processes with nonconserving quasiparticle numbers may appear in the superfluid state because of particle exchange with the Bose condensate and, generally, require presence of certain broken symmetries, as the gauge symmetry breaking in the superfluid state. The self-energy correction to the boson Green's function determined by two-particle decays turns out to be singular near the decay threshold. Analyzing the energy and momentum conservation laws, Pitaevskii classified all such singularities in three dimensions and for the case of roton decays predicted the termination or end point on the dispersion curve $\varepsilon(p)$ at the energy equal twice the roton gap. This theoretical prediction stimulated a lot of experimental studies on the dynamic properties of liquid helium using neutron, X-ray, light scattering, and ultrasonic techniques. The experimental efforts culminated in the direct observation of the end point in the spectrum of liquid ^{4}He [3].

As was emphasized by Pitaevskii himself, the obtained results are not restricted to liquid helium but may apply to other condensed matter systems with bosonic excitations. These include, for example, phonons in anharmonic crystals and cold atomic gases in optical traps. Recently, similar effects have been predicted and experimentally studied for magnons in quantum antiferromagnets [4]. Different magnetic materials provide various magnon dispersion laws $\varepsilon(p)$ with one-, two-, or three-dimensional character leading to new spectacular effects, which are most prominent in low dimensions. For many decades condensed matter theorists were preoccupied with singularities that arise due to phase transitions, strong correlations, and many-body effects. The first effect of such type in quantum Bose systems was predicted by Pitaevskii in 1959.

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