THE SUPERFLUID STATE OF BOSE LIQUID ^{4}He AS A SUPERPOSITION OF SINGLE-PARTICLE AND PAIR COHERENT CONDENSATES

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S u m m a r y

We consider the superfluid (SF) state of a Bose liquid with a strong repulsion between bosons, in which there exists an intensive pair coherent condensate (PCC), analogous to the Cooper condensate in a Fermi liquid with an attraction between fermions, at $T = 0$, along with a weak single-particle Bose—Einstein condensate (BEC). The collective effects of renormalization ("screening") of the initial interaction, which are described by the bosonic polarization operator, due to its negative sign on the "mass shell", lead to a suppression of the repulsion and an enhancement of the effective attraction in the respective domains of the momentum space. In the construction of a self-consistent model of the SF state, it is the ratio of the BEC density to the full density of the liquid $n_0/n \ll 1$ that is used as a small parameter—unlike in the Bogolyubov theory for a quasiideal Bose gas, in which the small parameter is the ratio of the number of supracondensate excitations to the number of particles in an intensive BEC, $(n-n_0)/n_0 \ll 1$. A closed system of nonlinear integral equations for the normal $\tilde{\Sigma}_{11}(\mathbf{p},\omega)$ and anomalous $\tilde{\Sigma}_{12}(\mathbf{p},\omega)$ self-energy parts is obtained. In the framework of the soft-spheres model, a spectrum of quasiparticles is obtained, which is in good accordance with the experimental spectrum of elementary excitations in superfluid ^{4}He. We also consider the structure of the SF state at $T \neq 0$ with account for the appearance of the normal component ρ_n and a branch of second sound, whose speed tends to zero at the λ point.