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Landau criteria for superfluidity for a mixture of Boson & Fermions

The phenomena of superfluidity was first observed in liquid Helium by Kapitza in 1938. Superfluidity is the friction less flow of atoms or molecules without dissipation at very low temperatures. There is a critical temperature below which the assembly of interacting particles , bosons , or fermions , or a mixture of bosons and fermions becomes superfluid leading to a phase transition from the so -called normal phase to superfluid phase. Thus there was a need to explain why a mass of atoms could be transported without friction and dissipation in the superfluid phase . Such a criteria was proposed by Landau according which the mass transport can take place without dissipation for some critical velocity. To calculate the critical velocity, first the quasi-particle energy expression for an interacting assembly of bosons and fermions is obtained by diagonalizing the model Hamiltonian of an assembly of interacting bosons and fermions . At the minimum value of the momentum in the superfluid state, the critical velocity is calculated .

The assembly sustain superfluidity if the velocity of flow is less than the Landau Critical velocity. The mixtures studied are Li 6 (fermion)+Li 7(boson); Rb 87 (boson)+K40(fermion)

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