Parametric excitation and kinetic instability as a way to Bose-Einstein condensation of magnons

Victor L'vov[1]

[1] *Department of Chemical Physics, The Weizmann Institute of Science*

I will provide an overview of the nonlinear theory of interacting spin waves (magnons) in YIG under powerful external electromagnetic field, resulting in their Bose-Einstein condensation.

First, the basic Landau-Lifshits equations for magnetization were presented in Hamiltonian form,which placed the problem within the realm of theoretical physics.

The second step involved the S-theory of parametric excitation of magnons, based on an analogy between this problem and Cooper-pairing in superconductors.

Next, I will describe the kinetic instability of magnons, which results in an exponential growth of their numbers in a strongly nonlinear system.

The last analytical step involves the nonlinear theory of kinetic instability, which covers (i) the saturation of kinetically unstable waves due to their feedback effect on the waves (ii) in the pump region and (ii) the widening of the package of kinetically unstable waves (iii) due to their scattering on the waves in the pumped region. (iv) The theory qualitatively agrees with experimental data obtained using Brillouin light (v) scattering spectroscopy while parametrically pumping magnons in room-temperature films (vi) of yttrium-iron garnet.

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Kurt-Gödel-Hörsaal, Boltzmanngasse 5, ground floor, 1090 Wien