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## **Kinetics and Bose-Einstein condensation of parametrically driven magnons at room temperature**

Magnons are quantum-mechanical counterparts of spin waves. They can be considered as a gas of quasiparticles obeying the Bose-Einstein statistics. I discuss the room-temperature kinetics and thermodynamics of the magnons gas in yttrium iron garnet films driven by a microwave pumping and investigated by means of the Brillouin light scattering (BLS) spectroscopy. I show that the thermalization of the driven gas results in a quasi-equilibrium state described the Bose-Einstein statistics with a non-zero chemical potential, the latter being dependent on the pumping power. For high enough pumping powers Bose-Einstein condensation (BEC) of magnons can be experimentally achieved at room temperature.

To observe BEC in a gas of quasiparticles having a gap in their spectrum, one should drive the gas away from the true equilibrium using an external source. In the case of magnons a parametric microwave pumping is a perfect tool for this purpose. The process of the parametric pumping can be understood as a creation of two primary magnons by a microwave photon of the pumping field. As a result, a manifold of magnon pairs are excited with the allowed values of  $\mathbf{k}$  building an elliptic contour on the  $(k_{\parallel}, k_{\perp})$ -plane, where  $k_{\parallel}$  and  $k_{\perp}$  correspond to the components of the wavevector parallel and perpendicular to the static magnetic field, respectively.

Kinetics of these magnons has been studied in detail using BLS. During first 40-100 ns the magnons are redistributing over the phase space in such a way that the maximum occupation is continuously shifted with time towards the point corresponding to the minimum frequency of the magnon spectrum ( $f_{\min}$ ). As a result a quasi-equilibrium thermodynamic state described by the Bose-Einstein statistics is formed. Further magnon kinetics is a gradual narrowing of the distribution. At the end of this process a very narrow distribution of magnons is formed having the form of a peak centred at the point of the phase space corresponding to  $f_{\min}$ . The energy width of the distribution is below 1mK in the temperature units. This is a clear demonstration of BEC of magnons. Based on the measured width of the distribution in the  $(k_{\parallel}, k_{\perp})$ -plane we determined the effective spatial correlation length of the condensate, which appears to be anisotropic, reflecting the anisotropy of the magnon dispersion spectrum.