Bose-Einstein condensation and superfluidity of magnons in ferromagnetic films.

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Bose-Einstein condensation of magnons in YIG fllm at room temperature under the rf pumping was discovered in 2006 by the Münster experimental team led by S. Demokritov. [1,2] In our talk we propose theoretical explanation of their results and consider the feasibility of magnon superfluidity in YIG films. [3,5]

There are two equal minima of energy in the magnon spectrum of YIG film at non-zero momenta and therefore two condensates. Observation of the interference of the two condensates [2] proved their coherence. The ground state of non-interacting magnons is degenerate with respect to distribution of them between two minima. [3] This degeneration is lifted by magnon interaction. Theory predicts that interaction leads to spontaneous violation of the reflection symmetry and non-equal number of magnons in two condensates for thick films. Dipolar interaction depends on the phase of the condensate wave function and traps the phase in stationary state. It is a consequence of non-conservation of the spin angular moment that turns into the orbital moment by dipolar interaction. The number of magnons is not conserved locally, stationary spin current becomes inhomogeneous. But it conserves globally due to the remaining discrete symmetry [4].

We propose to observe magnon superfluidity creating a soliton bouncing between two reflecting boundaries. Theory of superfluid solitons and prospects to reproduce all these phenomena in nano-scale samples are discussed. [5]

References.

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