Bose-Einstein Condensation of Magnons at Room Temperature: Creation, Spatio-Temporal Properties and Possible Superfluidity

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Magnons are the quanta of waves of spin precession in magnetically ordered media. In thermal equilibrium, they can be considered as a gas of quasiparticles obeying the Bose-Einstein statistics with zero chemical potential and a temperature dependent density. We will discuss the room-temperature kinetics and thermodynamics of the magnon gas in yttrium iron garnet films driven by a microwave pumping and investigated by means of the Brillouin light scattering (BLS) spectroscopy. We show that the thermalization of the driven magnon gas results in a quasi-equilibrium state, which is described by 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. Spatio-temporal kinetics of the BEC-condensate will be discussed in detail. Among others interference of two condensates, persistent quantized vortices, and propagating waves of the condensate density will be addressed. Finally, our recent experiments on moving condensates will be discussed.

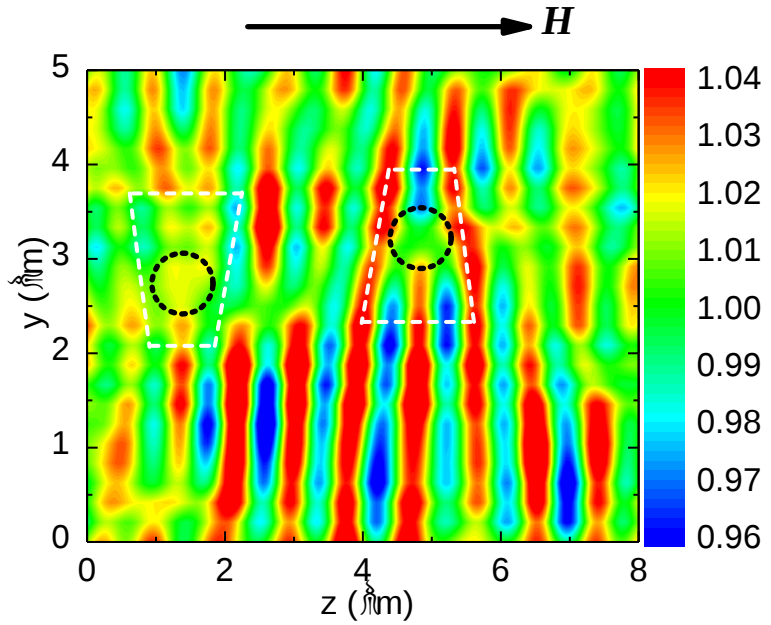

Figure 1: Measured two-dimensional spatial map of the BLS intensity proportional to the magnon condensate density. Note a periodic structure resulting from interference between two condensates. Dashed circles show the positions of topological defects in the standing-wave pattern corresponding to persistent quantized vortices existing in the condensate.