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$Ba_3CoSb_2O_9$ and the dynamical structure factor of the triangular Heisenberg model

We will review recent inelastic experiments in the triangular lattice S=1/2 Heisenberg antiferromagnet, $Ba_3CoSb_2O_9$ [1-5], revealing large deviations from the dynamical spin structure factor $S(q,\omega)$ obtained from non-linear spin wave theory (NSWT). We will see that, while NSWT works very well inside the magnetic field induced magnetization plateau (up-up-down phase) [5], it fails at zero magnetic field (120-degree ordering). This observation strongly suggests that the failure of a semiclassical treatment is due to strong quantum fluctuations, which are indeed expected for frustrated 2D antiferromagnets. In an attempt of finding alternative ways of modelling the $S(q,\omega)$ of *ordered* low dimensional antiferromagnets, we will derive the zero temperature $S(q,\omega)$ of the triangular lattice Heisenberg model using a Schwinger Boson approach that includes the Gaussian fluctuations (1/N correction) around the saddle point solution [5]. While the ground state of this model exhibits a well-known 120-degree magnetic ordering, the excitation spectrum revealed by $S(q,\omega)$ has a strong quantum character, which is not captured by low-order 1/S expansions. The low-energy magnons consist of a spinon gas interacting via gauge fluctuations of the auxiliary fields. This composite nature of the magnons potentially leads to an internal structure of the magnon peaks. In addition, the continuum of high-energy spinon modes extends up to three times the single-magnon bandwidth.

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