Talk 18: 09:00–

Midgap States for Dzyaloshinskii-Moriya Interacting Systems Under Magnetic Field in the Low Dimensions

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For many materials, one finds that the Heisenberg interaction alone cannot sufficiently explain some anomalous and novel properties. It is necessary to consider effects from the symmetric feature of crystalline, the coupling of spin and orbital degrees, etc. These factors often lead to interactions such as anisotropic, next-neighbor and cyclic ones, which is usually one order smaller than the Heisenberg interaction. In general, this kind of interactions is usually regarded as a perturbation, macroscopically resulting in neither distinguishable physical properties nor anomalous phenomena. However, with the development in experimental equipments and theoretical studies in the last decade, some of those interactions are found to be non-perturbative and have importance effects. The Dzyaloshinskii-Moriya interaction, which as a very interesting example has been a consequence of the spin-orbital coupling in the presence of relativistic effects under peculiar symmetry of some crystalline, is a nontrivial interaction , but its effects can be explicitly exhibited only when external magnetic field is applied. In particular, the neutron scattering experimental group in Hopkins university found that copper benzoate $Cu(C_6H_5COO)_2 3H_2O$[1] which is supposed to be described by one dimensional Heisenberg model unexpectedly displays a gap in its spectrum when the sample is exposed in external fields. This experimental discovery is found to be related to the DM interaction[2]. In this talk, we will present our numerical results for the interpretation of the experimental findings as well as possible midgap states [3] in the connection with the Dzyaloshinskii-Moriya interaction, which is now found relevant to more and more quasi-one dimensional materials such as Yb_4As_3, $(CH_3)_2SO_2CuCl_2$, $BaCu_2Si_2O_7$, $[\text{PM-}Cu(NO_3)_2\ (H_2O)_2]_n$ (PM=pyrimidine), etc.

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