PAUL SCHERRER INSTITUT

CONDENSED MATTER THEORY SEMINAR

Topological quantum phase transition in Ising-like antiferromagnet $BaCo_2V_2O_8$

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Abstract:

Since the seminal ideas of Berezinskii, Kosterlitz and Thouless [1,2], topological excitations are at the heart of our understanding of a novel class of phase transitions. In most of the cases, they are controlled by a single type of topological objects. There are however some situations, still poorly understood, where two dual topological excitations fight to control the transition. Finding experimental realization of such cases is thus of considerable interest. I will show in this presentation that this situation occurs in $BaCo_2V_2O_8$, a spin-1/2 Ising-like quasi-one dimensional antiferromagnet [3], when subjected to a uniform magnetic field transverse to the Ising axis (the c-axis) [4]. Indeed, the application of a transverse magnetic field along the b direction, because of the non-diagonal anisotropic g-tensor of $BaCo_2V_2O_8$, induces a staggered field along the a direction [5]. As a result, a quantum phase transition occurs at about 10 T. By using inelastic neutron scattering experiments combined with theoretical calculations, we have shown that this transition is well described by the so called dual-field double sine-Gordon model, reflecting the competition of two dual topological objects.

References

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[2] J. M. Kosterlitz and D. J. Thouless, Journal of Physics C: Solid State Physics, Vol. 6, p. 1181 (1973).
[3] S. Kimura et al., Phys. Rev. Lett., Vol. 100, p. 057202 (2008).
[4] Q. Faure et al., arXiv:1706.05848 (Nature Physics, adv. online publication May 7, 2018)
[5] S. Kimura et al., J. Phys. Soc. Japan, Vol. 82, p. 033706 (2013).

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