

未来創成学国際研究ユニットセミナー
(令和元年度)

講演題目

NMR Insight to Quantum Magnets

– pure and “healed” $\text{BaCuSi}_2\text{O}_6$,
spin-1/2 chain $\beta\text{-TeVO}_4$, and $\text{SrCu}_2(\text{BO}_3)_2$ –

講演者 Professor Raivo STERN

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日時 : 2019年5月24日 (金) 14:00-16:00

May 24, Friday 場所 : 理学部6号館571会議室
Room 571 Faculty of Science Bldg. No.6

Abstract:

Ancient pigment, Han Purple ($\text{BaCuSi}_2\text{O}_6$) is a valuable model material for studying Bose-Einstein condensation (BEC) of magnons in high magnetic fields. We have characterized the BEC phase by Cu and Si NMR at 50 mK and around 23-27 T. In parallel, our density-functional calculations have resulted in a magnetic model with two types of nonequivalent spin dimers, in excellent agreement with the $^{63,65}\text{Cu}$ NMR data, implying also the lack of magnetic frustration in $\text{BaCuSi}_2\text{O}_6$.* The “healed” $\text{Sr}_{0.1}\text{Ba}_{0.9}\text{CuSi}_2\text{O}_6$ with suppressed structural phase transition and just single set of dimers at low-T is a new extension of this study.**

For a frustrated zigzag spin-1/2 chain compound $\beta\text{-TeVO}_4$, we verify the absence of the structural phase transition and address the possible existence of the high field low-T nematic phase.***

The spin-dimer antiferromagnet $\text{SrCu}_2(\text{BO}_3)_2$ is the most prominent realization of the Shastry-Sutherland lattice model. We performed NMR measurements in pulsed magnetic fields up to 72 T using ^{11}B nuclei.**** We observed a transition from a high-temperature, paramagnetic state to a low-T, commensurate superstructure of field-induced spin-dimer triplets on the 1/3 magnetization plateau. Our approach to measure broadband NMR in pulsed magnetic fields opens the door not only to the exploration of the higher-field groundstates of $\text{SrCu}_2(\text{BO}_3)_2$, but also to studies of many other quantum magnets with complex interactions that stabilize new phases of matter in very strong magnetic fields.

* V.V. Mazurenko, M.V. Valentyuk, R. Stern, A.A. Tsirlin, *PRL* **112**, 107202 (2014).

** P. Puphal, D. Sheptyakov, N. van Well, L. Postulka, I. Heinmaa, F. Ritter, W. Assmus, B. Wolf, M. Lang, H. O. Jeschke, R. Valenti, R. Stern, C. Rüegg, C. Krellner, *PRB* **93**, 174121 (2016).

*** F. Weickert, N. Harrison, B.L. Scott, M. Jaime, A. Leitmäe, I. Heinmaa, R. Stern, O. Janson, H. Berger, H. Rosner, A. A. Tsirlin, *PRB* **94**, 064403 (2016).

**** J. Kohlrantz, J. Haase, E.L. Green, Z. T. Zhang, J. Wosnitza, T. Herrmannsdörfer, H.A. Dabkowska, B.D. Gaulin, R. Stern, H. Kühne, *J. Magn. Reson.* **271**, 52 (2016).

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