SEMINARIUM Z MAGNETYZMU I NADPRZEWODNICTWA

Uprzejmie zawiadamiamy, że w **środę**

08 czerwca 2022 r., o godz.10:00

odbędzie się seminarium **on-line (link podany jest na stronie IF PAN)**,

na którym

prof. dr hab. Andrzej Szewczyk

(Instytut Fizyki PAN, Warszawa)

wygłosi referat na temat:

"Magnetyczne przejście fazowe w TbAl$_3$(BO$_3$)$_4$ poniżej 700 mK – jego kwantowe i klasyczne aspekty"

Co-authors: T. Zajarniuk, P. Wiśniewski, M. U. Gutowska, R. Puźniak , H. Szymczak, I. Gudim, V. A. Bedarev, M. I. Pashchenko, P. Tomczak , and W. Szuszkiewicz

Specific heat, C_B, of a TbAl$_3$(BO$_3$)$_4$ single crystal was studied for temperatures 50 mK $< T <$ 300 K, with emphasis on the $T < 1$ K range, where a phase transition was found at 0.68 K. Nuclear, non-phonon, and lattice contributions to C_B were separated. Based on the C_B and magnetization, M, studies, we found that: (i) the phase transition shifts to lower temperatures with increase in magnetic field $B_\parallel$, parallel to the easy magnetization axis, (ii) the critical, i.e., related to the phase transition, contribution to the specific heat, C_{cr}, shows an unusual dependence on T, $C_{cr} \sim T^{y_0}$, where y_0 is a positive exponent, and (iii) the Grüneisen ratio, Γ, defined as (S denotes entropy):

$$\Gamma = -\frac{1}{T}\frac{(\partial S/\partial B)_T}{(\partial S/\partial T)_B} = -\frac{(\partial M/\partial T)_B}{C_B(T)} = \frac{1}{T}\left(\frac{\partial T}{\partial B}\right)_S$$

diverges for $B_\parallel$ approaching 0.6 T. The behaviors of both C_{cr} and Γ as a function of T (especially scaling of the latter for $B_\parallel \geq 0.30$ T) and of $B_\parallel$ are characteristic of the systems, in which the classical phase transition line is influenced by quantum fluctuations, QF, and ends at a quantum critical point. By using the determined y_0 and Γ values, we assessed the dynamical critical exponent z to be $0.82 \leq z \leq 0.96$. Based on all the results, we suppose that QF dominate the behavior of the system and destroy the long range order, i.e., we suppose the transition found to have a quantum character.

The interpretation that we deal with the transition to the ferromagnetic order of Tb^{3+} magnetic moments is the most natural, intuitive, and supported by the M studies. However, such a transition should be smeared and shifted to higher T by $B_\parallel$, while we observe the opposite effect. Thus, other mechanisms can not be ruled out *a priori*.

The lecture will be given in Polish and the slides will be in English.

Serdecznie zapraszamy

Roman Puźniak
Andrzej Szewczyk
Henryk Szymczak