

# SEMINARIUM Z MAGNETYZMU I NADPRZEWODNICTWA

Uprzejmie zawiadamiamy, że w **środę**

**8 grudnia 2021 r., o godz.10:00**

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

**dr hab. Ewa Jedryka, prof. IF PAN**

(Instytut Fizyki PAN)

wyłosi referat na temat:

## **“Uporządkowana podsieć węglowa w sieci krystalicznej $Mn_5Ge_3C_x$ – superstruktura w $Mn_5Ge_3C_{0.5}$ obserwowana w badaniach $^{55}Mn$ NMR”**

$Mn_5Ge_3$  thin films, epitaxially grown on the Ge(111) substrate, attracted a lot of research interest as a new spintronic material, a potential source of polarized carriers directly into Ge.  $Mn_5Ge_3$  is a metallic ferromagnet crystallizing in the hexagonal  $D8_8$  structure (Nowotny phase, space group  $P6_3/mcm$ ). It has been shown that by doping with carbon, the Curie temperature can be increased from 296 K in pristine  $Mn_5Ge_3$  up to 430 K for the nominal carbon content  $x=0.6$ . A new light on the properties of  $Mn_5Ge_3C_x$  system has been shed by our recent comprehensive Nuclear Magnetic Resonance (NMR) study performed on a series of epitaxial 30 nm thick  $Mn_5Ge_3C_x$  films in the entire concentration range [3]. The data unambiguously show that carbon penetrates the crystal lattice in highly ordered way, occupying every second 2b void located within the chain of Mn(6g) octahedra (Nowotny chimney ladder, NCL) and setting the limit for the carbon uptake at  $x=0.5$ . Moreover, the chains of carbon-filled voids are correlated also in-plane. Eventually, for the end concentration of  $x=0.5$ , a superstructure displaying only two magnetically inequivalent positions within the Mn(4d) sublattice is observed. The most simple atomic arrangement that can be proposed to explain the experimental observations is the nanolaminated structure where the carbon-containing c-planes would alternate with those where the centers of 2b voids remain empty. On the other hand, a more complex ordering is also possible, since the parent structure  $D8_8$  is prone to incorporate carbon in a highly ordered manner, as shown e.g. in the isostructural  $R_5Ge_3$  materials (R-rare earth), where an ordered  $R_{15}Ge_3C$  superstructure was observed for  $R=Ce, Pr$  and  $Nd$ , with the supercell being three times larger than the parent cell [4].

[1] R. Kalvig, E. Jedryka, M. Wojcik, G. Allodi, R. De Renzi, M. Petit and L. Michez, *Phys. Rev. B* 97, 174428 (2018)

[2] R. Kalvig, E. Jedryka, M. Wojcik, M. Petit and L. Michez, *Phys. Rev. B* 101, 094401 (2020)

[3] R. Kalvig, E. Jedryka, M. Wojcik, M. Petit and L. Michez, *submitted to Phys. Rev. B*, Nov 2021

[4] F. Wrubl, K.V. Shah, D. A. Joshi, P. Manfrinetti, M. Pani, C. Ritter and S. K. Dhar, *J. Alloy. Compd.* 509, 6509 (2011)

**Serdecznie zapraszamy**

**Roman Puźniak  
Andrzej Szewczyk  
Henryk Szymczak**