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On the relations between condensed matter structures and topological invariants Jerzy Warczewski, Pawel Gusin**,** Department of Physics of Crystals, Institute of Physics, University of Silesia, ul. Uniwersytecka 4, PL40007 Katowice, Poland. E-mail: warcz@us.edu.pl

Keywords: condensed matter, structure, topological aspects of structure

The magnetization, the particular case of the condensed matter phase, has been discussed using such quantities like a. o. correlation function (Green function) and certain subspace in Hilbert space. These quantities have been applied in terms of the mean field theory to the general magnetic structures described by either the Hubbard or Heisenberg spin Hamiltonian. It turns out that the magnetization of a given system under consideration occurs only if the corresponding topological invariants assume special values. This approach has been applied to different magnetic structures. A general hypothesis has been put forward that different condensed matter phases of a given system can be distinguished – once a concrete correlation function is known – by the values of certain topological invariants of a subspace defined in the space of states. In other words these phases take place if corresponding invariants assume special values [1].

[1] P. Gusin, J. Warczewski, On the relations between the magnetization and topological invariants of the physical system, Journal of Magnetism and Magnetic Materials 281 (2004) 178-187

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Examples of Magnetic Material Studies Using Polarized Polychromatic Neutrons Christina Hoffmann[a], [a]*Neutron Scattering Sciences Division, ORNL, Oak Ridge, TN, USA.*E-mail: hoffmanncm@ornl.gov

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The experimental method of polarizing a white neutron beam is getting more attention at pulsed neutron sources due to its possibility of becoming a routine experimental environment. Laue neutron diffraction experiments were carried out successfully using a ^{3}He spin filter with integrated flipper [1].
Laue SCND is a highly efficient method to collect single crystal diffraction patterns. Multiple orders of reflections are detected simultaneously using energy dispersive detectors. Data have been collected on multiple samples at the single crystal diffractometer (SCD) at the IPNS. We investigated the behavior of a nickel single crystal in a low magnetic field at cryogenic temperature.
The full potential of white beam neutron polarization will be available at the TOPAZ instrument currently under construction at the SNS at ORNL. It is on schedule for commissioning early 2009 as part of a neutron science user facility at ORNL and will be available incorporated in the general user program.
Contributions and support of many more than fit into the author line were necessary to make the experiments a success: The neutron spin filter setup was developed, built and tested by G.L. Jones, B. Collett, F. Diaz, J. Steinberg (Hamilton College), W.T. Lee (ORNL). The ^{3}He cell was prepared by W.C. Chen, D. Richards, T.R. Gentile (NIST). The magnetic sample setup was built by H.Y. Yan, X. Tong, C. Chen, M. Snow (IUCR), calculated by W.T. Lee (ORNL). Samples were measured & analyzed by V.O. Garlea, G. Ehlers (ORNL), C. Chen (IUCR), supplied by B.C. Sales, S.E. Nagler (ORNL), J. Gardner (NIST), M. Crawford. The SCD instrument was supported by P.M.B. Piccoli, M.E. Miller, A.J. Schultz (ANL).
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[1] Jones, G.L. et *al.*, *Nucl. Instrum. Meth.*, 2000, A 440, 772.