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Andriy Shevchenko · Maksym Barabash ·
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Magnetic Solitons in Extended Ferromagnetic Nanosystems Based on Iron and Nickel: Quantum, Thermodynamic, and Structural Effects

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Preface

This course of lectures is intended for bachelors and masters of the Y. O. Paton Institute of Materials Science and Welding of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute." It is devoted to the study of quantum, thermodynamic and structural properties of "kink"-type magnetic solitons in extended ferromagnetic nanosystems. The course consists of four parts. The first two parts consider quantum and thermodynamic phenomena in uniaxial ferromagnetic films with strong magnetic anisotropy and cylindrical nanowires of different chemical compositions (ferrite-garnet, iron, nickel) that are caused by "kink" solitons—vertical Bloch lines (BLs) and domain walls (DWs) of transverse type, respectively. The third part deals with the effect of the thermal motion of a transverse-type DW on the magnetocaloric effect in cylindrical iron and nickel nanowires. In the fourth part, the conditions under which structural transitions between different types of DWs (transverse, asymmetric, and DW with a Bloch point (zero soliton)) take place are determined. Each part is concluded by a summary of the presented results.

The authors hope that the considerations and results presented in the course of lectures will be interesting and useful both to students of specialized universities and specialists who specialize in the development and implementation of modern nano-, medical and biotechnologies.

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