量子物理学・ナノサイエンス第 155 回セミナー

Spin dynamics in inhomogeneously magnetized systems

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概　要

Worldwide efforts are underway to create revolutionary and energy-efficient data storage technology such as magnetoresistive random access memory (MRAM). An understanding of spin dynamics in inhomogeneously magnetized systems is indispensable for further development of nanoscale magnetic memories. This lecture provides a transparent picture of inhomogeneously magnetized systems, such as magnetic nanowires with domain walls and disks with magnetic vortices, and presents not only technological developments and key achievements but also the unsolved puzzles and challenges that stimulate researchers in the field.

Firstly, the basic concept of an inhomogeneously magnetized system is described by introducing a magnetic vortex structure in a magnetic disk. A magnetic domain wall in a magnetic nanowire is also provided as a typical example. The magnetic field-driven dynamics of these inhomogeneously magnetized systems are described to illustrate the uniqueness of this system.

Secondly, the electric-current-induced dynamics of magnetic vortices and domain walls are described. One can flip the core magnetization in a magnetic vortex using electrical current excitation, and move a domain wall by current injection into a wire. The next part focuses on the applications of the current-induced-magnetization dynamics in devices. The basic operations of two kinds of magnetic memories—magnetic vortex core memory and magnetic domain wall memory—are demonstrated.

The lecture describes not only the current understanding about inhomogeneously magnetized systems, but also the unexpected features that have emerged. It concludes with prospects on future developments, in which more surprises will certainly be found.

※講演は日本語で行います。

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