Long-term development strategy
of the V. G. Baryakhtar Institute of Magnetism of the NAS of Ukraine

V. G. Baryakhtar Institute of Magnetism of the National Academy of Sciences of Ukraine is a leading research institution in Ukraine specializing in the physics of magnetic phenomena and magnetic materials. The Institute's main areas of scientific activity are fundamental research on the physics of condensed matter and magnetic phenomena, and applied research and development on using magnetic phenomena and materials for electronics and computing, medicine, the energy industry, heavy industry, and other economic sectors.

The Institute's activities include:

– conducting fundamental and applied research in the field of magnetic phenomena and magnetic materials to obtain new, world-class knowledge and implement it, taking into account the interests of national industry;
– publishing the results in leading scientific journals and promoting them at international scientific conferences, congresses, and forums to further integrate into the global scientific community;
– searching for and analyzing current scientific and technological problems, forming priority scientific directions;
– obtaining patents, implementing inventions created at the Institute, cooperating with industry, commercializing research results;
– extensive cooperation with domestic and foreign scientific institutions, higher education institutions, and industry;
– training of PhDs and DSc candidates in postgraduate and doctoral programs in the specialties E5 - “Physics and Astronomy” and E6 - “Applied Physics and Nanomaterials.”

The strategic development goals of the Institute:

- Transforming the Institute into a leading scientific, educational, and innovative center in Ukraine in the field of physics of magnetic phenomena and materials physics.
- Creating favorable conditions for existing and new scientific schools at the Institute to function as a center for training modern, highly qualified specialists with in-depth knowledge of the physics of magnetic phenomena and materials.
- Enhancing the Institute's international reputation by ensuring high-quality scientific research, joint research projects, and grant activities.
- Updating the Institute's equipment base and creating new experimental facilities for conducting advanced research in the field of condensed matter physics.
- Involving young people in scientific activities at the Institute, in particular by creating joint educational and scientific laboratories with higher education institutions in Ukraine and providing opportunities for pre-diploma internships and diploma thesis completion in the Institute's departments.
- Introducing modern mechanisms to motivate the Institute's scientific staff to pursue continuous professional growth, self-development, and creative self-realization, particularly by encouraging and facilitating professional development, internships (including abroad), and membership in relevant organizations and societies.

Main directions of the Institute's perspective scientific research for 2023-2032:

1. ***Development of the fundamental principles of condensed matter physics and magnetic phenomena:***
   – Mesoscopic and quantum effects in magnetics and magnetic nanostructures;
   – Ultrafast spin dynamics in magnetically ordered systems;
   – Fundamental problems of thermodynamics and kinetics of condensed matter.
2. ***Research and development of new functional magnetic materials:***
   – Physical bases for creating materials with controlled magnetostructural and magnetocaloric characteristics, magnetically controlled phase transitions;
   – Methods of creating and modifying composite functional materials and surfaces under extreme conditions;
   – Metamaterials, multiferroics, and functional magnetic materials and structures for microwave electronics;
   – Magnetoplastic and magnetorheological effects in functional structures.
3. ***Spintronics and magnonics:***
   – Magnetotransport properties and spin transfer in heterogeneous magnetics, spin valves, spin tunnel, and spin injection nanostructures;
   – Spin waves in nanostructured magnetics, nonlinear spin-wave interaction and magnetic solitons;
   – Development of the operating principles of magnon logic elements and systems, as well as analog spin-wave information processing systems and non-Boolean systems;
   – Control of the magnetic state of spintronic nanostructures, development of the principles of creating magnetic random access memory;
   – Spin-calorimetry.
4. ***Magnetic sensors, systems for energy and resource conservation, and environmental protection:***
   – Development of magnetic sensors and matrix transducers;
   – Methods of magnetic non-destructive testing and diagnostics of functional and structural materials;
   – Optical systems for diagnosing the human body.
5. ***Biomagnetism and the interaction of magnetic fields with biological objects.***