Preface

A magnetic field directly affects the spin state and orbital motion of an electron, causing exotic quantum phenomena at low temperatures. Magnetic, electric, and even structural phase transitions are induced when the Zeeman energy and/or cyclotron energy become as large as the interactions or energy gaps in the matter.

Recently, the techniques of generating a high magnetic field and measurement using a high magnetic field have advanced significantly. The highest magnetic field with high controllability and applicability in materials science has reached the 1000 T region. In terms of measurement, electric resistivity, magnetization, magnetostriction, ultrasound, optical spectra, the magnetocaloric effect, and specific heat can be precisely measured in high magnetic fields of up to 60 T. Magnetic field–induced phenomena are discovered in low-dimensional frustrated magnets, topological compounds, and strongly correlated materials.

High magnetic field facilities have been constructed worldwide, such as in the United States of America, China, and Europe. Furthermore, inter-facility networking forums, such as High Magnetic Field Collaboratory in Japan and the Global High Magnetic Field Forum, have been recently launched. The application of high magnetic fields to a wider range of research areas is expected to contribute to the advancement of cutting-edge science.

Hence, reviewing recent developments in pulse magnetic field experiments and demonstrating the current status of high magnetic field science would be worthwhile. The Special Topic “Modern physics discovered by pulsed high magnetic fields” aims to show the usefulness of magnetic fields in condensed matter physics and inspire scientists to develop novel applications for high magnetic fields.

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