

PREFACE



It is my great pleasure to publish SPring-8/SACLA Research Frontiers 2021. JASRI has stewardship responsibility over SPring-8 and SACLA, whereas RIKEN has ownership. SPring-8 and SACLA are located on the same campus; thus, their synergy produces groundbreaking results.

Despite continuing COVID-19 issues, the activities of SPring-8 and SACLA in FY2021 recovered to prepandemic levels, although users from abroad are still subject to entry restrictions by the Japanese government. Moreover, many precautionary measures are still in place for users on site.

In FY2021, SPring-8 welcomed about 13,500 users who came to perform 1,996 experiments. Currently, there are more than 1,000 and about 70 research papers published by SPring-8 and SACLA users, respectively.

Two SPring-8 and SACLA users were conferred prestigious awards in 2021 for their achievements in science and technology. Professor T. Arima and Professor T. Kimura (The University of Tokyo) were awarded the Nishina Memorial Prize for the discovery and exploration of spin-induced multiferroics, developed by precise structural analysis using X-rays at SPring-8.

Director General M. Kawai (Institute for Molecular Science) was designated as a Person of Culture for the realization of the unimolecular reaction by scanning tunneling microscopy at SPring-8.

Director T. Ishikawa, Dr. H. Tanaka and Dr. M. Yabashi (RIKEN SPring-8 Center) were awarded the Yamazaki Teiichi Prize for their contribution to science through the development of a compact X-ray free-electron laser named SACLA and its application in research.

This volume includes two comprehensive review articles. In one article, Professor S. P. Cramer (University of California, Davis, USA) and Dr. H. Wang (SETI Institute, USA) describe research progress on the characterization of Fe–H bonding in hydrogenases and model compounds by nuclear resonant vibrational spectroscopy (NRVS) performed at SPring-8. In the other article, Professor K. Hirose (Tokyo Institute of Technology) and Professor S. Tagawa (The University of Tokyo) describe recent research on hydrogen and other light elements in the Earth's core on the basis of the results of X-ray diffraction (XRD) and inelastic X-ray scattering (IXS) performed at high pressures and high temperatures.

In the main part of this volume, active SPring-8 users describe the importance of their findings in various fields that include life science, physical science, chemical science, earth and planetary science, and industrial applications. In addition, report on the principal activities of SPring-8/SACLA facilities are included in the sections of Accelerators & Beamlines Frontiers and Facility Status.

I am very grateful to the many authors and experts who contributed their papers to this volume. Special thanks are due to Dr. Naoto Yagi, Ms. Marcia Obuti-Daté, and the members of the editorial board for their relentless effort.

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