# PREFACE

*This volume is the second issue of the SPring-8 Research Frontiers and presents the results of the most impressive experiments carried out at SPring-8, during the period from September 1998 to June 1999, together with the current status of the X-ray source and beamlines. During this period, the source was in operation for 4650 hours, 72% of which (i.e., 392 shifts) were dedicated to the operation in user service mode. More than 380 experiments were carried out by 2500 users at 15 beamlines.*

*In 1999, remarkable progress was achieved in the X-ray source performance. The optics of the storage ring were changed from the hybrid-optics to HHLV (High Horizontal* β *value and Low Vertical* β *value) optics to improve the brilliance of undulators installed at even-numbered cells. In addition, a fourth RF station was newly installed, resulting in an increase in beam lifetime from 100 hours to 160 hours at a beam current of 100 mA in the multibunch operation mode, with a coupling ratio of 0.1%. In addition, the beam lifetime at 1mA/bunch in a few bunch operation mode was increased from 11 hours to 32 hours. Orbit stability was about 4* μm *(rms) in both the horizontal and vertical planes.*

*Experiments at SPring-8 are classified into five groups: Life Science, Diffraction & Scattering, XAFS, Spectroscopy, and Instrumentation & Techniques development. Structural studies of new proteins, supramolecular complexes, membranes and fibrous specimens are among the most important research activities at SPring-8. This volume describes six experiments in the field of life science, four of them are structural studies and two demonstrate real-time phase-contrast X-ray imaging.*

*The high quality X-ray beam available at SPring-8 is very useful for diffraction and scattering studies under extreme conditions, and also for experiments using high energy X-rays to obtain high-energy resolution measurements. This issue includes eight papers summarizing results of high pressure experiments, structural works and experiments related to nuclear resonant scattering and nuclear excitation.*

*New field in XAFS research have been initiated in SPring-8; results of three such experiments are presented here. As introduced in the last issue of this series, a site-selective XAFS method has been developed. In addition, fluorescence XAFS is being applied to substances at high dilutions by adding site and state selectivity. High energy X-rays are also used for measurement of XAFS at the K absorption edge of heavy elements.*

*The spectroscopic study of condensed matter is one of the most active fields at SPring-8. Although a number of important results have been regularly produced, only six experiments are described in this volume. Magnetic circular dichroism in the soft and hard X-ray regions, together with high-resolution photo-emission spectroscopy, has proven to be a most powerful tools in the study of various types of magnetic materials. Trace elemental analysis is another very important research field at SPring-8 and is being applied to a wide variety of research fields such as environmental science, medical science, semiconductor technology and archeology.*

*The development of new instruments and techniques designed to push the limits of current technology has been enthusiastically pursued at SPring-8. This issue covers seven such experiments, including the following: development of new imaging techniques and microbeam production; successful completion of the soft X-ray beamline, resulting in the setting of a new standard of energy resolution; and a novel technique to measure high energy photons with an analyzing crystal. Finally, gamma rays with energies up to 2.4 GeV were obtained from Compton back scattering of laser light and experiments on nuclear physics are underway.*

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