SPring-8/SACLA Research Frontiers 2018

CONTENTS

Preface	5
Editor's Note	6
Scientific Frontiers	7
Reviews	
Ultrafast dynamics in atoms, molecules, and clusters induced by an XFEL pulse H. Fukuzawa and K. Ueda	8
Imaging the increase in pulmonary blood flow at birth S. B. Hooper, J. T. Pearson and M. J. Kitchen	12
Life Science	
Protein crystallography: Crystal structures of the gastric proton pump reveal the mechanism for the proton extrusion K. Abe	16
Protein crystallography: High-resolution crystal structure of the LH1-RC complex from <i>Thermochromatium tepidum</i> LJ. Yu and JR. Shew	18
Protein crystallography: Structural basis of signal recognition and regulation at the full-length glucagon receptor A. Qíao, Q. Zhao and B. Wu	20
Protein crystallography: Crystal structure of the human Frizzled-4 receptor S. Yang and F. Xu	22
Protein crystallography: Structural basis of type IVb pilus-mediated bacterial adhesion to the intestinal epithelium K. Kawahara, H. Oki and S. Nakamura	24
Protein crystallography: Structural mechanisms underlying anion selectivity and high-speed gating in anion channelrhodopsins H. E. Kato-	26
Time-resolved crystallography: Observation of enzymatic reactions by time-resolved X-ray crystallography using photosensitive caged substrate T. Tosha and M. Kubo	28
Bio-SAXS: Missing piece of two-component signal transduction systems unveiled by SEC-SAXS H. Sawai and Y. Shiro-	30
Medical imaging: CT dose reduction factors in the thousands using X-ray phase contrast M. J. Kitchen, T. E. Gureyev and S. B. Hooper	32
Insect biology: Hidden morphological novelty enabling the evolution of female penis in the sex-role reversed cave insects K. Yozhizawa and A. Blanke	e 34

Physical Science

 Excitonic insulator: Revealing the pressure-induced layer-sliding transition in Ta₂NiSe₅ by X-ray diffraction under high pressure A. Nakano and H. Sawa 	36
Phonon engineering: Extreme disorder-phonon competition and liquid-like thermal conduction in AgCrSe ₂ B. Li	38
Phonon engineering: Microscopic origin of heat properties in ScN epitaxial film revealed by inelastic X-ray scattering spectroscopy H. Uchiyama	40
Superconductivity: Nature of charge density waves in the cuprate high- T_c superconductors H . Míao and M. P. M. Dean	42
Magnetism: Three-dimensional observation of magnetic domain structure by scanning hard X-ray microtomography M. Suzuki and T. Ono-	44
Metal-semiconductor junction: Direct band bending observation by angular-resolved HAXPES for semiconductor films in contact with metal nanoparticles S. Sato and T. Moríkawa	46
Topological insulator: Experimental determination of the topological phase diagram by soft X-ray angle-resolved photoemission spectroscopy K. Kuroda and T. Kondo	48
RIXS : Tensile-strain-dependent spin states in epitaxial $LaCoO_3$ thin films Y. Yokoyama and H. Wadatí	50
Magnetism: Shedding light on the coercivity mechanism in Nd-Fe-B sintered magnets through high-field magnetic domain observations D. Billington, Y. Kotani, K. Toyoki and T. Nakamura	52
Raman spectroscopy: Charge and lattice fluctuations in molecule-based spin liquids <i>T. Yamamoto</i>	54
Liquid dynamics: Roles of mesoscale dynamics in shear viscosity of high alcohol revealed by γ-ray quasielastic scattering T. Yamaguchi and M. Saito	56
Agl nanoparticles: Stabilization of the superionic conducting phase of silver iodide by size and pressure effects T. Yamamoto, M. Maesato and H. Kítagawa	58
Hydrogen storage material: Synthesis of H ₂ -rich molecular compounds by laser heating at high pressures J. Binns, P. Dalladay-Simpson and R. Howie	60

	Superconductivity: High- T_c superconducting phases of $FeSe_{1-x}S_x$ at high pressure K. Matsuura, Y. Mízukamí and T. Shíbauchí	62
	 Semiconductor device: Three-dimensional atomic imaging of dopant sites in As-doped Si using spectro-photoelectron holography K. Tsutsuí, T. Matsushíta and Y. Moríkawa 	64
SACLA	Water science: The origin of water's anomalous properties revealed by X-ray lasers K. H. Kim, A. Späh and A. Nilsson	66
SACLA	Fracture: How to make materials more resistant to extreme deformation B. Albertazzi, N. Ozaki and V. Zhakhovsky	68
SACLA	Nonlinear optics: Element selectivity in second-harmonic generation by using a soft-X-ray Free Electron Laser I. Matsuda	70
SACLA	Nonlinear optics: X-ray two-photon absorption spectroscopy K. Tamasaku	72
	Particle physics: Different quark-antiquark production mechanism of $u\overline{u}$ from $d\overline{d}$ and $s\overline{s}$ studied by linearly polarized high energy photon beams at BL33LEP <i>H. Kohri</i>	74
Cł	nemical Science	
	Layered material: Observation of weak interlayer interaction in layered 2D material $\rm TiS_2$ H. Kasaí, E. Níshíborí and B. B. Iversen	76
	Molecule-in-molecule: Arrayed CH-π hydrogen bonds in a circle for single-axis rotations of a bowl in a tube T. Matsuno, S. Sato and H. Isobe	78
	 Hydrogen storage: High-pressure synthesis of novel hydrides with high-hydrogen densities – Li₃AlFeH₈ and LiAlFeH₆ H. Saitoh 	80
	Magnetism: Microscopic mechanisms of the electric-field effect on proximity-induced magnetism in Pt revealed by X-ray absorption spectroscopy K. Yamada, M. Suzuki and T. Ono-	82
	Catalysis: Visualization of heterogeneous oxygen storage in platinum-supported cerium-zirconium oxide three-way catalyst particles by hard X-ray spectro-ptychography M. Hirose, N. Ishiguro, M. Tada and Y. Takahashi	84

Fuel cell research: Simultaneous operando time-resolved XAFS-XRD measurements of a Pt/C cathode catalyst in polymer electrolyte fuel cell under the transient potential cyclic operations
 O. Sekizawa, T. Uruga and Y. Iwasawa

Earth & Planetary Science

Mantle dynamics: Complete agreement of the post-spinel transition pressure with the 660-km seismic discontinuity depth T. Ishúi and T. Katsura	88
 Planetary science: Moganite in a lunar meteorite NWA 2727 as a trace of water ice in the Moon's subsurface M. Kayama, N. Tomíoka and E. Ohtaní 	90
Core dynamics: Synchrotron Mössbauer spectroscopy measurements of Fe-Si alloys: Implications for planetary cores S. Kamada, F. Maeda and N. Hírao	92
Industrial Applications	
Food science: Application of X-ray computed tomography using synchrotron radiation to frozen food M. Sato	94
Thermal conductivity: Investigation of collective dynamics of solvent molecules in nanofluids by inelastic X-ray scattering K. Yano and K. Yoshida	96
Biorefinery: Structural change of cerium oxide-supported ruthenium catalyst during the biorefinery of platform chemicals T. Mizugaki	98
Accelerators & Beamlines Frontiers	100
SPring-8 Beam Performance	101
 New Apparatus, Upgrades & Methodology Ultraprecision ellipsoidal mirror with two-dimensional 100 nm focusing capability H. Yumoto- 	102
 High-resolution display-type retarding field analyzer T. Muro and T. Matsushita 	104
SACLA Beam Performance	106
Facility Frontiers	107
SPring-8 Facility Status	108
Introduction Machine Operation Beamlines User Program and Statistics Research Outcome Budget and Personnel Research Complex SPring-8 Users Community (SPRUC) Outreach Activities	108 109 113 116 116 116 116 118 119
SACLA Facility Status	120

Note: The principal publication(s) concerning each article is indicated with all author's names in italics in the list of references.