

## CONTENTS

### Special Issue: Third International Symposium on Physical Sciences in Space (ISPS 2007)

#### Plenary

Microgravity Research Activity in Japanese Community .....	T. HIBIYA • 177
Atomic Diffusion in Liquid Alloys .....	A. MEYER, A. GRIESCHE, J. HORBACH and T. VOIGTMANN • 183

#### Agency

A Comprehensive Plan for Development and Maintenance of a Flourishing Space Physical Science Community in Countries with Modest Population Base .....	P. J. GREEN, L. LEFEBVRE and N. BUCKLEY • 189
The German Microgravity Programme in Physical Sciences .....	R. KUHL • 193

#### Fluid Science

Numerical Analysis of Bubble Behavior with Thermocapillary Flows in an Open Cylindrical Container .....	H. OHIRA, S. MATSUMOTO, T. MASHIKO, S. YODA and Y. KAMOTANI • 201
Oscillatory Thermocapillary Flow of High Prandtl Number Fluid and Its Dependence on Free Surface Heat Transfer .....	A. WANG, Y. KAMOTANI and S. YODA • 207
Wall Heat Transfer Induced by Surface Tension Driven Flow- a numerical Prediction for a Sounding Rocket Flight Experiment SOURCE .....	E. FUHRMANN and M. DREYER • 213
Effect of Rotation on the Equilibrium Shapes and Stability of Liquid Bridges in a Lateral Gravity Field .....	A. L. SIMAVILLA, V. LAPUERTA, J. RODRÍGUEZ and J. M. PERALES • 219
Effects of Small and Lateral Vibrations on the Surface Oscillation of Isothermal Liquid Bridge .....	R. Q. LIANG and M. KAWAJI • 225
Dynamics of a Liquid Film Produced by Spray Impact onto a Heated Target .....	O. KYRIOPOULOS, I. ROISMAN, T. G. ROISMAN, P. STEPHAN and C. TROPEA • 231
High Speed Video Observation of Gas Bubble Evolution Phenomena Accompanying Water Electrolysis on Transparent Electrode under Quasi-Microgravity .....	M. OHNO, G. SAKUMA, H. MATSUSHIMA and Y. FUKUNAKA • 235
Foam Research in Microgravity .....	M. ANDERSSON, J. BANHART, H. CAPS, D. DURIAN, F. G. MORENO, S. HUTZLER, B. KRONBERG, D. LANGEVIN, O. PITOIS, M. SAADATFAR, A. S. JALMES, N. VANDEWALLE, M. V. ADLER and D. WEAIRE • 241
Transport-Mechanisms During Boiling in Microgravity Environment .....	J. STRAUB • 245

Quenching Experiments at Reduced Gravity .....	G. P. CELATA, M. CUMO and G. ZUMMO •	251
Pool Boiling Heat Transfer in Mmicrogravity .....	J. F. ZHAO, N. YAN, J. LI, Z. D. LI, W. R. HU and H. OHTA •	257
Saturated Pool Boiling in Microgravity in ARIEL Experiment .....	P. D. MARCO and W. GRASSI •	261
On The Way of Detecting Negative Thermophoresis (Results of Microgravity Experiments and Gas-Kinetic Analysis) .....	A. VEDERNIKOV, S. BERESNEV and A. MARKOVICH •	267
The Study of Heat Transfer in a Closed Domain of Supercritical SF <sub>6</sub> with the Laboratory and Numerical Instruments .....	V. EMELYANOV, A. GORBUNOV and A. LEDNEV •	273
Optical Cells for Study of Water Properties Near its Liquid-Gas Critical Point .....	Y. GARRABOS, C. LECOUTRE, F. PALENCIA, D. BEYSENS, V. NIKOLAYEV and P. EVESQUE •	279
Preparation for the VIP-CRIT Space Experiment on the ISS: An Analysis of MIR Experiments and Ground-Based Studies of Heat Transfer and Phase Separation in Near-Critical Fluid .....	V. POLEZHAEV, V. EMELYANOV, A. GORBUNOV, G. PUTIN, A. ZYUZGIN, A. IVANOV, D. BEYSENS and Y. GARRABOS •	285
Geometry Pumping on Spacecraft (The CFE-Vane Gap Experiments on ISS) .....	M. M. WEISLOGEL, R. M. JENSON, Y. CHEN, S. H. COLLICOTT and S. WILLIAMS •	291
GeoFlow: European Microgravity Experiments on Thermal Convection in Rotating Spherical Shells under Influence of Central Force Field .....	T. V. LARCHER, B. FUTTERER, C. EGBERS, R. HOLLERBACH, P. CHOSSAT, P. BELTRAME, L. TUCKERMAN and F. FEUDEL •	297
The Fluid Science Laboratory on the ISS Columbus Module-Performances and Operations .....	G. TRINCHERO, M. CARDANO, E. PENSAVALLE, E. BASSANO, P. DELL'AVERSANA, M. LAPPA and M. TACCONI •	303
Effect of Eccentric Rotation on the Equilibrium Shapes and Stability of Liquid Bridges in an Axial Gravitational Field .....	V. LAPUERTA, A. L. SIMAVILLA, J. RODRÍGUEZ and M. A. GONZÁLEZ •	309
Cluster Hhydrodynamic Model of Heat-mass Transfer during Crystal Growth Process .....	V. GINKIN, S. GANINA and A. KARTAVYKH •	315
Development of Heated Narrow Channels with Enhanced Liquid Supply in Forced Convective Boiling .....	Y. INADA, S. MIURA, K. HARA, Y. SHINMOTO and H. OHTA •	321
Planning of Aircraft Experiments for the Clarification of Heat Transfer Mechanisms in Microgravity Nucleate Boiling .....	S. AKAGI, Y. SAKATA and H. OHTA •	327
Numerical Simulation of Thermo-Solutal Marangoni Convection in the Floating-Zone under Microgravity Fields .....	K. HIRATA, A. ISHIDA, Y. OKANO and S. DOST •	333

## Complex Plasmas

Liquid-Vapor Critical Point in Complex Plasmas under Microgravity Conditions: Theoretical Approach .....	S. A. KHRAPAK and G. E. MORFILL •	339
Thermodynamic Instability in Strongly Coupled Fine Particle Plasmas and Critical Phenomena .....	H. TOTSUJI •	343

Experiments on Fine-Particle Plasmas for Observation of Critical Phenomena .....	Y. HAYASHI, K. TAKAHASHI, H. TOTSUJI, O. ISHIHARA, S. HAMAGUCHI, N. SATO, Y. WATANABE, S. ADACHI and M. TAKAYANAGI •	349
---	---	-----

Dust Dynamics in Wake Channel .....	C. KOJIMA, J. KUBOTA, Y. TASHIMA and O. ISHIHARA •	353
--	--	-----

## Combustion

Measurements of Oxygen Depletion of a Laminar Diffusion Flame Over PMMA in Microgravity Using Wavelength Modulation Laser Absorption Spectroscopy .....	M. REIMERT and C. EIGENBROD •	357
---	-------------------------------	-----

Preparations of the NO <sub>x</sub> Measurements for the Combustion of an n-Decane Droplet Array Under Microgravity Conditions .....	K. G. MÖSL, T. SATTELMAYER, M. KIKUCHI and S. YODA •	361
--	--	-----

Comparison of Experimental and Numerical Results of the Autoignition of n-Heptane Sprays under Machine Conditions .....	P. RICKMERS, J-C. DITTMER and C. EIGENBROD •	367
---	--	-----

Numerical Simulation on the Flame Propagation in Acoustic Fields .....	M. TANABE, T. YANO and T. KUWAHARA •	371
---	--------------------------------------	-----

Comparison of the Structure of a Boundary Layer Type Diffusion Flame in Normal and Microgravity Environment .....	P. JOULAIN and A. FUENTÉS •	375
--	-----------------------------	-----

Flame Characteristics of a n-Octane Droplet under Electrical Field .....	K. YAMASHITA, O. IMAMURA, J. OSAKA, S. NAKAYA, M. TSUE and M. KONO •	381
---	--	-----

## Thermophysical Properties

Evaluation of Thermophysical Data from Electromagnetic Levitation Experiments with Digital Image Processing .....	S. SCHNEIDER, I. EGRY, R. WUNDERLICH, R. WILLNECKER and M. PÜTZ •	387
---	---	-----

Dynamics of Levitated Two-Phase Liquid Drops .....	I. EGRY and M. KOLBE •	393
---	------------------------	-----

Development of Non-Contact Electrical Resistivity Measurement Technique Using an Electrostatic Levitator .....	T. ISHIKAWA, P-F. PARADIS, Y. WATANABE and N. KOIKE •	399
---	---	-----

Differential Scanning Calorimetry as a Tool for Following Emulsion Evolution in Microgravity Conditions from the MAP-Project FASES .....	D. CLAUSSE, I. PEZRON, F. GOMEZ, C. DALMAZZONE, L. SACCA and A. DRELICH •	403
--	---	-----

Study of Molten Lanthanum, Praseodymium, and Neodymium by Electrostatic Levitation .....	P-F. PARADIS, T. ISHIKAWA, N. KIOKE and Y. WATANABE •	407
---	---	-----

## Fundamental Physics

Cold Atom Clocks in Microgravity: The ACES Mission .....	L. CACCIAPUOTI and C. SALOMON •	413
---	---------------------------------	-----

Test of Modified Newtonian Dynamics in Picogravity the Dark Matter Alternative Solution .....	R. J. SLOBODRIAN and C. RIOUX •	419
--	---------------------------------	-----

Test of the Equivalence Principle with Optical Readout in Space .....	J. LUO, F. GAO, Y-Z. BAI, C.-G. SHAO and Z-B. ZHOU •	423
--	--	-----

Inertial Sensor and Its Application to Space Fundamental Physics .....	Y. Z. BAI, H. B. TU, Z. B. ZHOU, S. C. WU and J. LUO •	427
---	--	-----

Wave Form of a Density Pulse in the Supercritical Fluid Generated by the Piston Effect .....	Y. MIURA, M. OHNISHI, S. YOSHIHARA and M. ISHIKAWA •	433
---	--	-----

## Materials Science

Non-Equilibrium Solidification, Modeling for Microstructure Engineering of Industrial Alloys (NEQUISOL)	
..... D. M. HERLACH, R. LENGSDORF, S. REUTZEL, P. GALENKO, H. HARTMANN, Ch.-A. GANDIN, S. MOSBAH, A. Garcia-ESCORIAL and H. HENEIN •	437
In-situ Investigation of Liquid-Liquid Phase Separation in Hypermonotectic Alloys	
..... P. L. SCHAFFER, R. H. MATHIESEN and L. ARNBERG •	443
The Effect of Eutectic Undercooling on Microsegregation of Rapidly Solidified Al-Cu Droplets	
..... A. PRASAD, H. HENEIN and Ch.-A. GANDIN •	449
Synthesis of TiO <sub>2</sub> Photo Catalysis Films on A2024 Alloy for Astronautics Applications by Sol-Gel Method	
..... H. KIMURA, R. TANAHASHI, M. TOSA, K. OZAWA and F. URAYAMA •	453
Surface Oxidation of the Silicon Carbide Ceramics during Space Environment Exposure up to 3.8 Year	
..... T. TOBITSUKA, E. MIYAZAKI, T. YANO and O. ODAWARA •	457
Interaction of a Dendritic Solidification Front with Ceramic Particles	
..... M. KOLBE, T. LIERFELD, S. SCHNEIDER, G. F. EGGELER and D. M. HERLACH •	463
Furnace Technology for Experiments on Sounding Rockets : Directional Solidification of Al-cast Alloys in ARTEX	
..... S. STEINBACH and L.. RATKE •	467
Photochemical Effects on Optical Properties of Molecular Contaminants	
..... F. URAYAMA, M. FURUKAWA, K. OZAWA, M. TOSA and H. KIMURA •	473
Unidirectional Crystallization of Charged Colloidal Silica under Temperature Gradient	
..... A. TOYOTAMA, J. YAMANAKA, M. YONESE, T. SAWADA, F. UCHIDA and Y. OHKI •	479
Validation of “Heat Bath” Effect in a Vertically Vibrated Granular System	
..... S. TATSUMI and M. SANO •	483

## Materials Processing

Validation of a Front-Tracking Model of the Columnar to Equiaxed Transition Using Solidification Results from the Maxus 7 Microgravity Platform	
..... S. MCFADDEN, L. STURZ, H. JUNG, N. MANGELINCK-NOËL, H. NGUYEN-THI, G. ZIMMERMANN, B. BILLA, D. J. BROWNE, D. VOSS and D. JARVIS •	489
Nucleation and Phase Selection in Undercooled Melts: Magnetic Alloys of Industrial Relevance (MAGNEPHAS)	
..... W. LÖSER, R. HERMANN, T. G. WOODCOCK, J. FRANSAER, M. KRIVILYOV, L. GRANASY, T. PUSZTAI, G. I. TOTH, D. M. HERLACH, D. HOLLAND-MORITZ, M. KOLBE and T. VOLKMANN •	495
<i>In Situ</i> Observation of a Levitated SiO <sub>2</sub> -SiC Pellet Irradiated by a CO <sub>2</sub> Laser	
..... Y. NISHIMURA, Y. FUKUNAKA, K. NAGASHIO, T. NOHIRA, R. HAGIWARA and K. KURIBAYASHI •	501
<i>In Situ</i> Observation of a Levitated SiO <sub>2</sub> -SiC Pellet Irradiated by a CO <sub>2</sub> Laser	
Study of Dendritic Growth in Electrodeposition under Microgravity Conditions	
..... E. CHASSAING and M. ROSSO, K. NISHIKAWA and Y. FUKUNAKA •	507
One to Two-Phase Electrolysis Processes Behavior under Spatial Conditions	
..... Ph. MANDIN, H. MATSUSHIMA, Y. FUKUNAKA, R. WÜTHRICH, E. HERRERA CALDERON and D. LINCOT •	511
Interfacial Phenomena of Bubble Evolution in Water Electrolysis under Microgravity	
..... Go SAKUMA, Hisayoshi MATSUSHIMA and Yasuhiro FUKUNAKA •	517
Numerical Simulation of Coupling Phenomena between Ionic Mass Transfer Rate and Morphological Variations of Electrodeposited Copper (Part 1: Current Density Distribution)	
..... S. KAWAI, Y. FUKUNAKA, and S. KIDA •	521

Bulk Amorphous Formation and Magnetic Properties of Nd-Fe-TM-Al Alloys by Containerless Process .....	S. AZUMO, H. YONEMURA and K. NAGAYAMA •	527
Undercooling Solidification Behavior of B or C Coated Bulk Si by Electromagnetic Levitating Process .....	Y. SAKUDA, S. AZUMO and K. NAGAYAMA •	531
Microstructure and High Coercive Force Metastable Phase in Nd-Fe and Pr-Fe Alloys by Using The Gas Jet Levitation Process .....	H. YONEMURA, S. AZUMO and K. NAGAYAMA •	537
Size Effects of Ferromagnetic Particle by Short Drop Tube Process .....	S. MIYAIRI, S. AZUMO, T. SUGIYAMA, Y. ISHIZAWA, H. YONEMURA and K. NAGAYAMA •	543
Undercooling Solidification Behavior and Magnetic Properties of the Nd-Fe-B Permanent Magnet Materials Solidified by Containerless Process .....	N. KIYOTA, S. AZUMO and K. NAGAYAMA •	549
Microstructure Evolution and Magnetic Properties of Heavy Rare Earth Based Alloys by Containerless Process .....	S. NAKANISHI, S. AZUMO and K. NAGAYAMA •	555
The Effect of SiC Whisker Addition on Bulk Amorphous Formation Abilities of La-Transition Metal-Al System .....	T.KOJIMA, S.AZUMO and K. NAGAYAMA •	561

## Crystal Growth

Control of Thermo- and Solutocapillary Flows in FZ Crystal Growth by Magnetic Field and Vibrations .....	T. P. LYUBIMOVA, I. S. FAIZRAKHMANOVA, R. V. SCURIDYN, A. CRÖLI and B. ROUX •	567
The Solution Crystallisation Diagnostics Facility (SCDF) for Microgravity Investigations on Solution Growth Crystals on Board the International Space Station .....	V. PLETSER, S. MAZZONI, R. BOSCH and L. POTTHAST •	573
Preliminary Experiments of Faceted Cellular Array Growth in Microgravity .....	Y. INATOMI, K. IWAMOTO, T. MAKI, Y. TAKAGI and K. KURIBAYASHI •	579
Solidification Behavior of Intermetallic Compounds with Strong Crystallographic Anisotropy .....	K. NOZAKI, K. NAGASHIO and K. KURIBAYASHI •	583
Melt Structural Self-Organization and Viscosity within the Transient Layer during Crystal Growth in Microgravity .....	A. KARTAVYKH and V. GINKIN •	587
Effects of pH and Particle Size on Zeta Potential of Insulin Crystals in their Growth Solutions .....	K. WAIZUMI, S. NAWATA and A. KIMURA •	593
Metastable Phase Formation from Nd-Dy-Fe-B Undercooled Melt .....	S. OZAWA, A. ITOU, K. KURIBAYASHI, N. NOZAWA and S. HIROSAWA •	599
Crystal Growth of C45S Mutant of <i>Arenicola Marina</i> Peroxiredoxin 6 in Microgravity Enviroment. An Unexpected Benefit of Convection on Crystal Quality .....	A. SMEETS, B. KNOOPS and J. P. DECLERCQ •	603
Comparisons of Blood Volume in Upper and Lower Limbs During Exposure to Hyper- and Micro-gravity .....	A. MATSUMOTO, A. MORI and F. NAGATOMO •	607

## Facilities

The MASER Microgravity Sounding Rocket Program and the Ongoing Mission MASER-11 .....	C. LOCKOWANDT, K LÖTH, G. FLORIN, J.THORSTENSSON, P. HOLM and M. TÖRNQVIST •	611
--	--	-----

Non Equilibrium Fluctuations in Microgravity: Initial Results of GRADFLEX Aboard FOTON-M3 .....	A. VAILATI, R. CERBINO, S. MAZZONI, C. J. TAKACS, M. GIGLIO and D. S. CANNELL •	617
Scientific Goals of the Topical Team on Vibration in Granular Media: (The Physics with the Future VIP_Gran Instrument) .....	P. EVESQUE, A. GARCIMARTIN, D. M. OZCODI, N. VANDEWALLE, Y. GARRABOS, C.LECOUTRE, D. BEYSENS, X. JIA and M. HOU •	623
Improvement Plan of the Electrical Equipment in MGLAB .....	M. NOKURA •	629
The ESA Parabolic Flight Programme for Physical Sciences .....	V. PLETSER, A. PACROS and O. MINSTER •	635
Development of the Observation System of Convection-Diffusion Phenomena with Vibration Isolation .....	M. OHNISHI, M.SAKURAI and S.YOSHIHARA •	641

### **Space Exploration**

New Joint Design for Enhancement of Mobility of Spacesuits for Planetary Exploration .....	A. V. GUBAREVICH, T. MARUYAMA and O. ODAWARA •	647
Water Electrolysis Cell that Are Free Liquid-Gas Separation System for Microgravity Conditions in Order to Establish Circulated Life Support System .....	M. SAKURAI, M. OGUCHI, S. YOSHIHARA and M. OHNISHI •	653