

THE 17TH INTERNATIONAL CONFERENCE ON ATOMIC PROCESSES IN PLASMAS (ICAPIP)

Belfast, Northern Ireland, UK 19 – 22 July 2011

EDITORS

Dr. Kanti Aggarwal
Dr. Francesca Shearer

Queen's University Belfast, Belfast, Northern Ireland, UK

All papers have been peer reviewed.

SPONSORING ORGANIZATIONS

Royal Astronomical Society
European Office of Aerospace Research and Development
Air Force Office
AWE Aldermaston
Office of Science for Fusion Energy Sciences
U.S. Department of Energy
Atomic and Molecular Interactions Group of the Institute of Physics



Melville, New York, 2012
AIP | CONFERENCE PROCEEDINGS ■ 1438

Editors

Dr. Kanti Aggarwal
Astrophysics Research Centre
School of Mathematics and Physics
Queen's University Belfast
Belfast BT7 1NN
Northern Ireland, UK

E-mail: K.Aggarwal@qub.ac.uk

Dr. Francesca Shearer
Department of Applied Mathematics
and Theoretical Physics
School of Mathematics and Physics
Queen's University Belfast
Belfast BT7 1NN
Northern Ireland, UK

E-mail: f.shearer@qub.ac.uk

Authorization to photocopy items for internal or personal use, beyond the free copying permitted under the 1978 U.S. Copyright Law (see statement below), is granted by the American Institute of Physics for users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that the base fee of \$30.00 per copy is paid directly to CCC, 222 Rosewood Drive, Danvers, MA 01923, USA: <http://www.copyright.com>. For those organizations that have been granted a photocopy license by CCC, a separate system of payment has been arranged. The fee code for users of the Transactional Reporting Services is: 978-0-7354-1029-9/12/\$30.00

© 2012 American Institute of Physics

No claim is made to original U.S. Government works.

Permission is granted to quote from the AIP Conference Proceedings with the customary acknowledgment of the source. Republication of an article or portions thereof (e.g., extensive excerpts, figures, tables, etc.) in original form or in translation, as well as other types of reuse (e.g., in course packs) require formal permission from AIP and may be subject to fees. As a courtesy, the author of the original proceedings article should be informed of any request for republication/reuse. Permission may be obtained online using RightsLink. Locate the article online at <http://proceedings.aip.org>, then simply click on the RightsLink icon/“Permissions/Reprints” link found in the article abstract. You may also address requests to: AIP Office of Rights and Permissions, Suite 1NO1, 2 Huntington Quadrangle, Melville, NY 11747-4502, USA; Fax: 516-576-2450; Tel.: 516-576-2268; E-mail: rights@aip.org.

L.C. Catalog Card No. 2012931381
ISBN 978-0-7354-1029-9 **Qtli kpcrlRtkpv+
ISBN 978-0-7354-1028-2 (Set) **Qtli kpcrlRtkpv+
ISBN 978-0-7354-1030-5 (DVD) **Qtli kpcrlRtkpv+
ISSN 0094-243X
Printed in the United States of America

AIP Conference Proceedings, Volume 1438
The 17th International Conference on Atomic Processes in Plasmas
(ICAPiP)

Table of Contents

**Preface: 17th International Conference on Atomic Processes in Plasmas
(ICAPiP)**

Kanti Aggarwal and Francesca Shearer 1

Committees and Sponsoring Organizations 3

Meetings in this Series 4

LOW TEMPERATURE ATMOSPHERIC PLASMAS

Antiparticle plasmas for antihydrogen trapping

M. Charlton, G. B. Andresen, M. D. Ashkezari, M. Baquero-Ruiz,
W. Bertsche, P. D. Bowe, E. Butler, P. T. Carpenter, C. L. Cesar,
S. Chapman, S. Eriksson, J. Fajans, T. Friesen, M. C. Fujiwara,
D. R. Gill, A. Gutierrez, J. S. Hangst, W. N. Hardy, R. S. Hayano,
M. E. Hayden, A. J. Humphries, J. L. Hurt, R. Hydomako, S. Jonsell,
L. Kurchaninov, N. Madsen, S. Menary, P. Nolan, K. Olchanski, A. Olin,
A. Povilus, P. Pusa, F. Robicheaux, E. Sarid, D. M. Silveira, C. So,
J. W. Storey, R. I. Thompson, D. P. van der Werf, J. S. Wurtele,
and Y. Yamazaki 7

Kinetic phenomena in charged particle transport in gases and plasmas

Zoran Lj. Petrović, Saša Dujko, Olivera Šašić, Vladimir Stojanović,
and Gordana Malović 17

**Cold atmospheric pressure plasma jets: Interaction with plasmid DNA
and tailored electron heating using dual-frequency excitation**

K. Niemi, C. O'Neill, L. J. Cox, J. Waskoenig, W. B. Hyland,
S. J. McMahon, S. Reuter, F. J. Currell, W. G. Graham, D. O'Connell,
and T. Gans 23

**Comparing optical Thomson scattering with emission spectroscopy in He
plasmas induced by laser breakdown at 1 atmosphere**

E Nedanovska, D. Riley, C. L. S Lewis, T. Morgan, L. Hüwel,
G. Nersisyan, and W. G. Graham 29

HIGH ENERGY DENSITY (HED) PLASMAS

The use of lasers for achieving extreme conditions of matter, and fusion P. D. Roberts	35
Measurements of the properties of highly compressed degenerate matter using X-ray Thomson scattering A. L. Kritcher, T. Doeppner, C. Fortmann, T. Ma, O. L. Landen, R. Wallace, and S. H. Glenzer	43
Diagnosing implosions at the National Ignition Facility with X-ray spectroscopy S. P. Regan, R. Epstein, B. A. Hammel, L. J. Suter, J. Ralph, H. Scott, M. A. Barrios, D. K. Bradley, D. A. Callahan, G. W. Collins, S. N. Dixit, M. J. Edwards, D. R. Farley, S. H. Glenzer, I. E. Golovkin, S. W. Haan, A. Hamza, D. G. Hicks, N. Izumi, J. D. Kilkenny, J. L. Kline, G. A. Kyrala, O. L. Landen, T. Ma, J. J. MacFarlane, A. J. MacKinnon, R. C. Mancini, F. J. Marshall, R. L. McCrory, N. B. Meezan, D. D. Meyerhofer, A. Nikroo, K. J. Peterson, T. C. Sangster, P. Springer, and R. P. J. Town	49
X-ray Thomson scattering measurements from shock-compressed deuterium P. Davis, T. Doeppner, J. R. Rygg, C. Fortmann, W. Unites, J. Salmonson, G. W. Collins, O. L. Landen, R. W. Falcone, and S. H. Glenzer	55
Warm dense aluminum plasma generated by the free-electron-laser FLASH U. Zastrau, S. M. Vinko, J. S. Wark, S. Toleikis, T. Tschentscher, S. H. Glenzer, R. W. Lee, A. J. Nelson, T. W. J. Dzelzainis, D. Riley, B. Nagler, E. Galtier, F. B. Rosmej, and E. Förster	61

MEASUREMENTS OF ATOMIC PROCESSES

From X-rays to visible photons –What do we learn from the plasma observations? Elisabeth Rachlew	67
--	----

Compton polarimeters for the study of hard X-rays arising from energetic collisions of electrons and ions with matter G. Weber, H. Bräuning, S. Fritzsche, A. Gumberidze, R. Martin, R. Reuschl, M. Schwemlein, U. Spillmann, A. Surzhykov, D. F. A. Winters, and Th. Stöhlker	73
Photoionizing trapped highly charged ions with synchrotron radiation J. R. Crespo López-Urrutia, M. C. Simon, C. Beilmann, J. Rudolph, R. Steinbrügge, S. Eberle, M. Schwarz, T. M. Baumann, B. L. Schmitt, F. Brunner, R. Ginzel, R. Klawitter, K. Kubićek, S. W. Epp, P. H. Mokler, V. Mäckel, J. Ullrich, G. V. Brown, A. Graf, M. Leutenegger, P. Beiersdorfer, E. Behar, R. Follath, G. Reichardt, and O. Schwarzkopf	80
Magnetic-dipole transitions in tungsten and other heavy elements observed with the NIST EBIT J. Reader, J. D. Gillaspy, D. Osin, and Yu. Ralchenko	86
Spectroscopy of highly charged tungsten ions with Electron Beam Ion Traps Hiroyuki A. Sakaue, Daiji Kato, Xiaobin Ding, Izumi Murakami, Fumihiro Koike, Tomohide Nakano, Norimasa Yamamoto, Hayato Ohashi, Junji Yatsurugi, and Nobuyuki Nakamura	91
Overview of recent atomic spectroscopy at the NIST Electron Beam Ion Trap (EBIT) facility J. D. Gillaspy	97
ASTROPHYSICAL PLASMAS	
Probing the properties of nebular plasmas with optical and infrared spectroscopy M. J. Barlow	103
Atomic physics of shocked plasma in winds of massive stars Maurice A. Leutenegger, David H. Cohen, and Stanley P. Owocki	111
Dielectric recombination and stability of warm gas in AGN Susmita Chakravorty, Ajit K. Kembhavi, Martin Elvis, Gary Ferland, and N. R. Badnell	118
Powering the intra-cluster filaments in cool-core clusters of galaxies Gary J. Ferland	124

Atomic data for astrophysics. Calculations, benchmarking and distribution	
G. Del Zanna	130
Laboratory calibration of density-dependent lines in the extreme ultraviolet spectral region	
J. K. Lepson, P. Beiersdorfer, M. F. Gu, P. Desai, M. Bitter, L. Roquemore, and M. L. Reinke	136
Stellar and laboratory XUV/EUV line ratios in Fe XVIII and Fe XIX	
E. Träbert, P. Beiersdorfer, and J. Clementson	142

SMALL LASER PLASMAS

Laser produced plasma diagnostics by cavity ringdown spectroscopy and applications	
S. Milošević	149
Laser produced plasma for efficient extreme ultraviolet light sources	
Tony Donnelly, Thomas Cummins, Colm O' Gorman, Bowen Li, Colm S. Harte, Fergal O'Reilly, Emma Sokell, Padraig Dunne, and Gerry O'Sullivan	155
A new technique for X-ray spectroscopy of laser-plasmas with simultaneous 2D spatial resolution over a broad spectral range	
L. Labate, C. A. Cecchetti, A. Giulietti, D. Giulietti, P. Köster, T. Levato, N. Pathak, and L. A. Gizzi	161

MAGNETIC FUSION PLASMAS

Non-statistical simulations for neutral beam spectroscopy in fusion plasmas	
O. Marchuk, Yu. Ralchenko, D. R. Schultz, E. Delabie, A. M. Urnov, W. Biel, R. K. Janev, and T. Schlummer	169
Modelling of VUV/XUV spectra from the JET tokamak	
K. D. Lawson, K. M. Aggarwal, I. H. Coffey, F. P. Keenan, R. H. G. Reid, J. Zacks, and JET-EFDA Contributors	175

Modelling spectral emission from fusion plasmas H. P. Summers, N. R. Badnell, A. R. Foster, A. Giunta, F. Guzmán, L. Menchero, C. H. Nicholas, M. G. O'Mullane, A. D. Whiteford, A. Meigs, and JET-EFDA Contributors	181
Charge exchange recombination spectroscopy on fusion devices B. P. Duval	189
Interpretation of EUV spectra in the 20 nm region from tungsten ions observed in the LHD C. Suzuki, C. S. Harte, D. Kilbane, T. Kato, H. A. Sakaue, I. Murakami, D. Kato, K. Sato, N. Tamura, S. Sudo, M. Goto, R. D'Arcy, E. Sokell, and G. O'Sullivan	197
FUNDAMENTAL DATA AND MODELLING	
Quasi-contiguous approximation for line-shape modeling in plasmas E. Stambulchik and Y. Maron	203
Non-LTE modeling for the National Ignition Facility (and beyond) H. A. Scott, B. A. Hammel, and S. B. Hansen	210
The effect of the Breit interaction on electron-impact excitation Christopher J. Fontes, Hong Lin Zhang, Daniel B. Thorn, and Alexandre Gumberidze	216
Databases and coordinated research projects at the IAEA on atomic processes in plasmas Bastiaan J. Braams and Hyun-Kyung Chung	222
Dielectronic recombination of heavy species: The tin $4p^64d^q - 4p^64d^{(q-1)}4f + 4p^54d^{(q+1)}$ transition arrays for $q = 1-10$ N. R. Badnell, A. Foster, D. C. Griffin, D. Kilbane, M. O'Mullane, and H. P. Summers	228
Atomic-orbital close-coupling calculations for collisions involving fusion relevant highly charged impurity ions using very large basis sets Katharina Igenbergs, Markus Wallerberger, Josef Schweinzer, and Friedrich Aumayr	232

Progress on precision measurements of inner shell transitions in highly charged ions at an ECR ion source Csilla I. Szabo, Paul Indelicato, Eric-Olivier LeBigot, Alexandre Vallette, Pedro Amaro, Mauro Guerra, and Alex Gumberidze	236
 NEXT GENERATION LIGHT SOURCES	
Characteristics of laser-induced plasma as a spectroscopic light emission source Q. L. Ma, V. Motto-Ros, W. Q. Lei, X. C. Wang, M. Boueri, F. Laye, C. Q. Zeng, M. Sausy, A. Wartelle, X. S. Bai, L. J. Zheng, H. P. Zeng, M. Baudelet, and J. Yu	243
Intense X-ray FEL-molecule physics: Highly charged ions B. F. Murphy, L. Fang, T. Y. Osipov, M. Hoener, and N. Berrah	249
Non-linear processes related to laser-atom interaction in XUV domain F. Reynal, K. Stefańska, and H. Bachau	254
 List of Participants	 261
Author Index	271