

Contents

	<i>Page</i>
Foreword <i>M. Dunne</i>	1
Overview of the Central Laser Facility <i>M. Dunne</i>	2
 <h1>High Power Laser Science</h1>	
1 Short Pulse Plasma Physics	
Manipulation of the spatial energy distribution of laser accelerated proton beams with a separate low intensity laser pulse <i>D. C. Carroll, P. McKenna, O. Lundh, F. Lindau, C.-G. Wahlström, S. Bandyopadhyay, D. A. Pepler, D. Neely, S. Kar, P. T. Simpson, K. Markey, M. Zepf, C. Bellei, R. G. Evans, R. Redaelli, D. Batani, M. H. Xu and Y. T. Li</i>	7
X-ray scattering measurement of the long wavelength limit of the static response function in a dense Li plasma <i>E. García Saiz, F. Y. Khattak, D. Riley, G. Gregori, R. J. Clarke, M. M. Notley, D. Neely, B. Barbrel, M. Koenig, R. L. Weber, R. R. Freeman, L. van Woerkom, A. Pelka, M. Schollmeier, M. Roth, P. Neumayer, D. Price, S. H. Glenzer, O. L. Landen, J. Vorberger, K. Wünsch and D. O. Gericke</i>	10
A wide angle crystal spectrometer for angularly and spectrally resolved x-ray scattering experiments <i>E. García Saiz, F. Y. Khattak, D. Riley, G. Gregori, S. Bandyopadhyay, R. J. Clarke, B. Fell, J. Jeffries, D. Jung, M. M. Notley and R. L. Weber</i>	15
Energy transfer rates in dense two-temperature plasmas with degenerate electrons <i>D. O. Gericke and J. Vorberger</i>	19
The effect of laser intensity on fast electron beam divergence in solid density plasmas <i>J. S. Green, R. G. Evans, R. Heathcote, K. L. Lancaster, P. A. Norreys, C. Bellei, Z. Najmudin, V. M. Ovchinnikov, R. R. Freeman, L. Van Woerkom, K. U. Akli, M. H. Key, A. J. MacKinnon, A. McPhee, J. Waugh, N. C. Woolsey, F. N. Beg, J. A. King, T. Ma, H. Habara, K. A. Tanaka, T. Tanimoto, H. Azechi, K. Takeda, R. Stephens, P. Nilson, W. Theobald, N. C. Lopes, R. Onofrei, J.R. Davies, K. Markey and M. Zepf</i>	21
Petawatt laser synchrotron source <i>S. Kneip, S. R. Nagel, C. Bellei, L. Willingale, P. M. Nilson, S. P. D. Mangles, A. E. Dangor, Z. Najmudin, S. A. Reed, A. Maksimchuk, K. Krushelnick, K. Ta Phuoc, N. Bourgeois, A. Rousse, J. R. Marquès, A. Gopal and M. Tatarakis</i>	25
Divergence reduction of laser accelerated proton beams <i>K. Markey, S. Kar, P. Simpson, B. Dromey, M. Zepf, C. Bellei, S. Nagel, S. Kneip, Z. Najmudin, L. Willingale, J. S. Green, P. Norreys, R. J. Clarke, D. Neely, D. C. Carroll, P. McKenna, E. L. Clarke, K. Krushelnick and A. Schiavi</i>	29
Lateral electron transport in thin foils diagnosed by ion emission <i>P. McKenna, D. C. Carroll, K. W. D. Ledingham, T. McCanny, L. Robson, R. J. Clarke, R. G. Evans, A. P. L. Robinson, D. Neely, F. Lindau, O. Lundh, C.-G. Wahlström, P. T. Simpson and M. Zepf</i>	32
Multiply charged ion acceleration studies using the Vulcan Petawatt laser <i>P. McKenna, D. C. Carroll, L. Robson, K. W. D. Ledingham, T. McCanny, F. Lindau, O. Lundh, C-G. Wahlström, A. P. L. Robinson, R. J. Clarke, D. Neely, P. T. Simpson and M. Zepf</i>	36
Electron acceleration from underdense plasma with the Vulcan Petawatt laser <i>S. R. Nagel, S. P. D. Mangles, S. Kneip, C. Bellei, L. Willingale, A. E. Dangor, Z. Najmudin, R. J. Clarke, R. Heathcote, K. L. Lancaster, A. Gopal, M. Tatarakis, A. Maksimshuk, S. A. Reed and K. Krushelnick</i>	41

	Page
Isochoric heating of solid targets to ten million Kelvin by Petawatt laser pulses	44
<i>M. Nakatsutsumi, H. Nakamura, H. Habara, R. Kodama, J. R. Davies, J. S. Green, R. Heathcote, K. L. Lancaster, P. A. Norreys, K. Krushelnick, D. Clark, K. Highbarger, R. L. Weber, R. R. Freeman, L. van Woerkom, K. U. Akli, D. S. Hey, M. H. Key, A. McPhee, A. J. MacKinnon, C. D. Gregory, N. C. Woolsey, T. Ma, M. S. Wei, S. N. Chen, F. N. Beg, M. Tampo, R. Stephens, P. Jaanimagi, M. Storm and W. Theobald</i>	
Image plate response for conditions relevant to laser-plasma interaction experiments	48
<i>I. J. Paterson, R. J. Clarke, G. Gregori and N. C. Woolsey</i>	
Focal properties of laser driven micro-lens to focus and energy select MeV protons	52
<i>T. Toncian, M. Amin, R. Jung, A. C. Pipahl, O. Willi, M. Borghesi, C. A. Cechetti, P. A. Wilson, J. Fuchs, R. C. Clarke and M. M. Notley</i>	

2 | Femtosecond Pulse Physics

Ni-like Mo X-ray lasing on Astra	55
<i>N. Booth, M. H. Edwards, Z. Zhai, G. J. Tallents, T. Dzelzainis, C. L. S. Lewis, A. Behjat, Q. L. Dong, S. J. Wang, D. Neely, P. S. Foster and M. J. V. Streeter</i>	
Intense field techniques for ultrafast quantum control of D₂⁺	57
<i>C. R. Calvert, D. S. Murphy, J. McKenna, J. F. McCann, I. D. Williams, J. Wood, E. M. L. English, W. R. Newell, W. A. Bryan, I. C. E. Turcu, S. J. Hawkes, J. M. Smith, E. J. Divall, K. G. Ertel, O. Chekhlov, C. J. Hooker, A. J. Langley and J. L. Collier</i>	
Bright multi-keV harmonic generation from relativistically oscillating plasma surfaces	61
<i>B. Dromey, S. Kar, K. Markey, P. T. Simpson, M. Zepf, C. Bellei, J. S. Green, S. Kneip, S. R. Nagel, L. Willingale, Z. Najmudin, K. Krushelnick, D. C. Carroll, P. McKenna, R. J. Clarke, D. Neely and P. A. Norreys</i>	
Above threshold dissociation of vibrationally cold HD⁺ molecules	64
<i>P. A. Orr, I. D. Williams, J. B. Greenwood, I. C. E. Turcu, W. A. Bryan, J. Pedregosa-Gutierrez and C. W. Walter</i>	

Astrophysical jet experiments with laser-produced plasmas	66
<i>C. D. Gregory, J. Howe, S. A. Myers, N. C. Woolsey, B. Loupias, M. Koenig, A. Oya, Y. Sakawa and R. Kodama</i>	

3 | Theory and Computation

Effects of target Z in ultra-high intensity laser solid interactions	71
<i>R. G. Evans</i>	
Time-dependent study of Ar in intense few cycle pulse laser fields	73
<i>M. A. Lysaght, P. G. Burke and H. W. van der Hart</i>	
Self-guided laser wakefield electron acceleration experiments on Astra Gemini – future prospects	75
<i>S. P. D. Mangles, A. G. R. Thomas, L. Willingale, S. R. Nagel, C. Bellei, B. Dangor and Z. Najmudin</i>	
Population inversion with respect to the ground state generated in recombination	80
<i>G. J. Pert</i>	
Light bending in curved plasma channels	83
<i>A. J. W. Reitsma and D. A. Jaroszynski</i>	
Non-local magnetic field dynamics and generation	87
<i>C. P. Ridgers and R. J. Kingham</i>	
Radiation pressure acceleration with circularly polarized laser pulses	90
<i>A. P. L. Robinson, M. Zepf, S. Kar, R. G. Evans and C. Bellei</i>	

	Page
Negative contribution to the resistivity in intense laser-plasma interactions <i>M. Sherlock, A. P. L. Robinson, R. Bingham, A. R. Bell and R. J. Kingham</i>	92
Plasma heating by intense electron beams in fast ignition <i>N. J. Sircombe, M. Sherlock, R. Bingham, T. Mendonça and P. A. Norreys</i>	94

Lasers for Science Facility (LSF) Programme

4 Biology

Fluorescence lifetime imaging of serotonin and other intracellular molecules <i>R. H. Bisby, A. G. Crisostomo, S. W. Botchway and A. W. Parker</i>	101
Fluorescence lifetimes of nucleotide oligomers containing the cytosine analogue pyrrolocytosine <i>S. J. O. Hardman, K. C. Thompson and S. W. Botchway</i>	103
In vivo interactions of higher plant Golgi matrix proteins by fluorescence lifetime imaging <i>C. R. Hawes, A. Osterrieder, S. W. Botchway and C. Stubbs</i>	105
Prospects for the diagnosis of breast cancer using transmission Raman spectroscopy <i>P. Matousek and N. Stone</i>	107
Signalling and repair of prompt double strand breaks and lesions formed at stalled replication forks induced by multiphoton laser microbeam irradiation <i>P. Reynolds, S. W. Botchway, A. W. Parker, J. V. Harper and P. O'Neill</i>	109
Ultrafast structural dynamics in BLUF domains: transient infrared spectroscopy of AppA and its mutants <i>A. Stelling, P. J. Tonge, K. L. Ronayne, J. Nappa and S. R. Meech</i>	113

5 Chemistry

Non-invasive detection of counterfeit drugs using Spatially Offset Raman Spectroscopy (SORS) <i>C. Eliasson and P. Matousek</i>	115
Dissociative fac-to-mer photoisomerisation of a Mn(I) tricarbonyl complex containing a highly flexible SPS-based pincer ligand <i>F. Hartl, T. Mahabiersing, M. Doux, N. Mézailles, P. Le Floch, K. L. Ronayne, M. Towrie and A. W. Parker</i>	117
New exploratory experiments for Raman laser spectroscopy <i>M. Hippler and C. Mohr</i>	120
Spectroscopy and dynamics of isolated porphyrin molecules <i>A. J. Hudson and J. Beames</i>	124
Determination of the triplet state energies of a series of conjugated porphyrin oligomers <i>M. K. Kuimova, D. Phillips, M. Hoffmann, H. A. Collins, M. Balaz, H. L. Anderson, I. P. Clark, S. M. Tavender and A. W. Parker</i>	126
Anthracene as a sensitiser for near-infrared luminescence in complexes of Nd(III), Er(III) and Yb(III): an unexpected sensitisation mechanism based on electron transfer <i>T. Lazarides, M. A. H. Alamiry, H. Adams, J. A. Weinstein, M. D. Ward, S. J. A. Pope and S. Faulkner</i>	129

	Page
PIRATE studies of dinuclear cyanoacetylide complexes	132
<i>P. J. Low, M. E. Smith, R. L. Cordiner, E. L. Flynn, A. Trottier, E. Wrede, F. Hartl, K. L. Ronayne, M. Towrie and A. W. Parker</i>	
Non-invasive bulk analysis of pharmaceutical tablets and capsules using transmission Raman method	135
<i>P. Matousek and A. W. Parker</i>	
Hydrogen bonding and wavelength dependence in time-resolved infrared spectroscopy of selective ion-sensors	138
<i>A.-K. Duhme-Klair, R. N. Perutz, N. Reddig, K. L. Ronayne and M. Towrie</i>	
Probing early picosecond dynamics in transition metal complexes using PIRATE	141
<i>M. T. Pryce, N. Boyle, A. Coleman, C. Long, W. R. Browne, B. L. Feringa, K. L. Ronayne and M. Towrie</i>	
Towards the elucidation of the 3D Structure of the N-linked glycoproteins: does rigidity play an important role?	143
<i>E. C. Stanca-Kaposta, B. Liu, E. J. Cacinero, T. D. Vaden, J. Frey, J. P. Simons and L. C. Snoek</i>	
Photon-induced processes in model interstellar ices	147
<i>J. D. Thrower, M. P. Collings, M. R. S. McCoustra, D. J. Burke, W. A. Brown, P. Kendall, P. D. Holtom, A. Dawes, N. J. Mason, H. J. Fraser, I. P. Clark and A. W. Parker</i>	
Nanosecond transient absorption studies of Ru(II) complexes with tris(1-pyrazolyl)methane unit and an intercalating benzo[i]dipyrido[3,2-a:2',3'-c]phenazine (dppn) ligand	149
<i>M. A. H. Alamiry, S. Foxon, J. A. Weinstein and J. A. Thomas</i>	

6 Physics

Ultraviolet light induced single step all-optical poling in lithium niobate	151
<i>C. L. Sones, A. C. Muir, S. Mailis and R. W. Eason</i>	
Ultrafast optically induced spin dynamics in single-crystal Fe ultra thin films and patterned dot arrays	154
<i>J. Wu, S. Lepadatu, C. Bunce, X. Zou, N. Kazantseva, D. Hinzke, U. Nowak, R. Chantrell, D. Niu and Y. B. Xu</i>	

7 Laser Science and Development

Astra

Progress on the Astra Gemini project	161
<i>J. L. Collier, O. Chekhlov, E. J. Divall, K. Ertel, P. S. Foster, S. Hancock, S. J. Hawkes, P. Holligan, C. J. Hooker, D. Neely, B. Parry and B. E. Wyborn</i>	
Beam switching and beam transport for the Astra Gemini project	165
<i>O. Chekhlov, E. J. Divall, K. Ertel, S. J. Hawkes, C. J. Hooker and J. L. Collier</i>	
Astra Gemini control system	168
<i>E. J. Divall</i>	
Automatic beam alignment system for Astra: second stage	171
<i>K. Ertel, C. J. Hooker and J. L. Collier</i>	
Artemis: a sub 10-fs XUV source for ultrafast time-resolved science	173
<i>C. A. Froud, S. Bonora, E. Springate, A. J. Langley, D. S. Wolff, S. P. Blake, P. A. Brummitt, A. Cavalleri, S. S. Dhesi, L. Poletto, P. Villoresi, J. P. Marangos, J. W. G. Tisch, E. A. Seddon, G. J. Hirst, J. Underwood, H. H. Fielding, M. McCoustra, I. C. E. Turcu and J. L. Collier</i>	

	<i>Page</i>
Use of ion source to etch thin foil targets for ion acceleration <i>M. J. V. Streeter, P. S. Foster, D. Neely, R. Clarke, R. Bickerton and M. Xu</i>	176
Development of a dual beam facility for multiple wavelength, short pulse optical probing of experiments in Target Area 2 <i>D. R. Symes, E. J. Divall, P. S. Foster, M. J. V. Streeter, D. Neely, J. L. Collier, J. S. Robinson and J. W. G. Tisch</i>	178
Lasers for Science Facility	
The Lambda 950, a new high performance UV/Vis/NIR spectrometer in the CLF <i>E. L. Belcher and I. P. Clark</i>	181
Femtosecond stimulated Raman scattering: development of a new facility for high temporal resolution Raman spectroscopy <i>G. M. Greetham, K. L. Ronayne, M. Towrie, P. Matousek and A. W. Parker</i>	182
Inverse spatially offset Raman spectroscopy for deep spectroscopy of turbid media <i>P. Matousek</i>	185
The development of the Tweezers Nanoprobe Microscope <i>M. Pollard, M. Townie, A. D. Ward, S. W. Botchway, A. W. Parker, P. Matousek, E. Freeman, R. Halsall, A. Clark, M. Prydderch, R. Turchetta, R. Stevens, I. Loader, D. Jenkins, P. O'Neill, S. Cunniffe and W. Fischer</i>	188
Upgrade to the Ultrafast Spectroscopy Laboratory <i>K. L. Ronayne, M. Towrie and P. Matousek</i>	190
A new ultrafast transient absorption facility in the Ultrafast Spectroscopy Laboratory <i>K. L. Ronayne and M. Towrie</i>	192
Transient absorption microscopy <i>K. L. Ronayne, A. D. Ward and M. Towrie</i>	194
SNURF: The Steady state and Nanosecond Ultraviolet Raman Facility <i>S. M. Tavender and D. Smith</i>	197
The polymerisation of emulsion droplets deformed using laser tweezers to create microscopic polymer particle <i>A. Ward, M. Berry, P. Ash, D. Woods and C. Bain</i>	199
Multiphoton induced spectral imaging for biological studies <i>S. W. Botchway and A. W. Parker</i>	202
Vulcan	
Spectral monitoring of the mixed glass rod chain <i>D. J. Canny, I. O. Musgrave and A. K. Kidd</i>	205
Investigation of the contrast ratio from the 9mm preamplifiers <i>M. Galimberti, J. S. Green, R. Heathcote, C. Hernandez-Gomez, A. K. Kidd, K. L. Lancaster, I. O. Musgrave and W. Shaikh</i>	207
The Vulcan 10 PW OPCPA project <i>C. Hernandez-Gomez, J. Collier, D. J. Canny, O. Checkhlov, R. Clarke, M. Dunne, M. Galimberti, S. Hancock, R. Heathcote, P. Holligan, A. Lyachev, P. Matousek, I. O. Musgrave, D. Neely, D. A. Pepler, I. N. Ross, Y. Tang, T. B. Winstone, B. E. Wyborn and G. H. C. New</i>	210
Characterization of a new fibre laser oscillator for the Vulcan laser <i>I. O. Musgrave, D. J. Canny and C. Hernandez-Gomez</i>	212

	Page
Long pulse beamline to TAP	214
<i>B. T. Parry, T. B. Winstone, A. J. Frackiewicz, C. Mendes, I. O. Musgrave, D. J. Canny, E. D. Vernon, S. J. Baxter, S. Hancock and C. Hernandez-Gomez</i>	
Novel Ultra-fast broadband laser source at 910nm for Vulcan 10 PW OPCPA laser system	216
<i>Y. Tang, I. N. Ross, C. Hernandez-Gomez, I. O. Musgrave, J. Collier, O. Chekhlov and P. Matousek</i>	
Characterisation of the backscattered radiation from Petawatt laser matter interactions	219
<i>E. D. Vernon, I. O. Musgrave, J. S. Green, R. Heathcote, K. L. Lancaster, C. Mendes, S. Hawkes and C. Hernandez-Gomez</i>	
 Laser R&D and Instrumentation	
A high average power OPCPA system for the Attosecond Basic Technology Project	221
<i>P. Bates, Y. Tang, E. Springate, I. N. Ross, G. H. C. New, R. A. Smith, J. W. G. Tisch and J. P. Marangos</i>	
Development of the CTF3 photo-injector laser system	225
<i>G. Kurdi, I. O. Musgrave, M. Divall, E. Springate, W. Martin, G. J. Hirst and I. N. Ross</i>	
Calibration of an intensified CCD camera at low light levels	229
<i>L. M. R. Gartside, G. J. Tallents and D. Neely</i>	
Automated image diagnostic system	231
<i>J. Baxter and A. K. Kidd</i>	
Vulcan computer control developments	234
<i>D. A. Pepler, C. J. Reason, A. K. Kidd and D. J. Canny</i>	
The Argus/Cerberus interlock system used throughout the CLF	236
<i>C. J. Reason, W. J. Lester, D. A. Pepler and P. Holligan</i>	
Combined imaging and energy monitoring system for the Vulcan laser	240
<i>J. Baxter and A. K. Kidd</i>	
 Target Fabrication	
Target Fabrication operational statistics	242
<i>C. Spindloe and M. Tolley</i>	
Fabrication of laser x-pinch targets	244
<i>D. Wyatt, C. Spindloe and M. Tolley</i>	
White light interferometric profiling of ultra-thin foil high power laser targets	247
<i>C. Spindloe and H. F. Lowe</i>	
White light interferometric profilometry of surface structured glass for high power laser microtargets	249
<i>H. F. Lowe and C. Spindloe</i>	
The application of ultra-precision CNC machining to enable high-volume direct manufacture of complex geometry x-ray backlights	253
<i>P. Hiscock, J. Spencer and M. Tolley</i>	
The production of multi-element opacity targets for x-ray laser experiments	256
<i>C. Spindloe</i>	

8 Appendices

Schedules and Operational Statistics

	Page
Astra Operational Statistics 06/07	261

S. J. Hawkes

LSF Operational Statistics	262
-----------------------------------	-----

E. L. Belcher, S. M. Tavender, M. Towrie and A. W. Parker

Vulcan Operational Statistics	266
--------------------------------------	-----

A. K. Kidd, T. B. Winstone and C. Hernandez-Gomez

Publications	269
---------------------	-----

Panel Membership and CLF Structure	281
---	-----

Author Index	285
---------------------	-----