
Contents

Part 1 Short Wavelength Lasers and Other Sources

Progress Towards a 44-Å X-Ray Laser by B. J. MacGowan, J. L. Bourgade, P. Combis, C. J. Keane, R. A. London, M. Louis-Jacquet, D. L. Matthews, S. Maxon, D. Naccache, M. D. Rosen, G. Thiell, and D. A. Whelan	2
Observation of Extreme Ultraviolet Amplification in 3-2 (42~46Å), 4-3 (130.5Å) and 5-4 (305Å) Transitions in Laser Produced He-like Al Plasma by H. Kuroda, K. Muroo, K. Naito, and Y. Tanaka	11
12.8 eV Laser in Neutral Cesium by C. P. J. Barty, D. A. King, G. Y. Yin, K. H. Hahn, J. E. Field, J. F. Young, and S. E. Harris	13
X-Ray Laser Experiment with Double Pass Device and Long-Recombining-Plasma Column by P. Jaegle, A. Carillon, P. Dhez, B. Gauthe, F. Gadi, G. Jamelon, and A. Klisnick	21
Short Wavelength Lasers: Something New, Something Old by P. L. Hagelstein	28
X-Ray Laser Related Experiments and Theory at Princeton by S. Suckewer	36
Amplification in Na XI H α , Mg XII H α and Al XIII H α Transitions by Y. Kato, M. Yamanaka, H. Daido, T. Tachi, H. Nishimura, H. Shiraga, E. Miura, P. R. Herman, H. Takabe, T. Jitsuno, M. Takagi, S. Nakai, C. Yamanaka, M. H. Key, G. J. Tallents, and S. J. Rose	47
Population Inversion through Charge Exchange Process in Plasmas by T. Kato, K. Masai, and T. Fujimoto	52
Prepulsing to Increase the Efficiency of Laser-Produced-Plasma Pumped Lasers by M. H. Sher and S. J. Benerofe	60

Amplification and Gain Measurement of Extreme Ultraviolet Radiation (42.4Å, 45Å and 46Å) in He-like Al Laser Plasma by K. Muroo, Y. Tanaka, and H. Kuroda	65
Population Inversions between n = 5, 4, 3 and 2 Levels of He-Like Al Plasma Observed by Spatially Resolved X-Ray Spectroscopy by H. Kuroda, M. Katsuragawa, K. Muroo, and Y. Tanaka	67
Probability of Soft X-Ray Radiation for 3p-3s Transition in Neon-Like Iron by Huimin Peng, Guoping Zhang, Jiatian Sheng, and Yunfeng Shao	69
Harmonic Generation in Laser-Free Electron Scattering Reconsidered by Anna K. Puntajer and C. Leubner	76
Gain Guided X-Ray Beams by Ernst E. Fill	78
CO ₂ Laser-Heated Plasmas for Electron-Collisionally Pumped XUV Laser Studies by G. D. Enright and N. H. Burnett	84
Ne-Like Ion X-Ray Laser Experiments in Plasmas Produced by 0.53-μm and 0.35-μm Laser Light by C. J. Keane, J. L. Bourgade, P. Combis, R. A. London, M. Louis-Jacquet, B. J. MacGowan, D. L. Matthews, D. Naccache, O. Peyrusse, M. D. Rosen, G. Thiell, and B. Whitten	93
Capillary Discharge Plasmas as Extreme Ultraviolet Laser Sources by J. J. Rocca, M. C. Marconi, M. Villagran Muniz, and D. C. Beethe	99
High Power, Short Pulse Ultra-Violet Laser for the Development of a New X-Ray Laser by L. D. Meixler, C. H. Nam, J. Robinson, W. Tighe, K. Krushelnick, S. Suckewer, J. Goldhar, J. Seely, and U. Feldman	106
Soft X-Ray Amplification in a Magnetically Confined Recombining H-like and Li-like Plasma by D. Kim, C. H. Skinner, A. Wouters, E. Valeo, D. Voorhees, and S. Suckewer	116
Calculation and Design of Ni-Like W Soft X-Ray Lasers by S. Maxon, S. Dalhed, P. Hagelstein, B. MacGowan, R. London, and M. Rosen	123
Quantum-Mechanical Interference in Four-Wave Mixing by P. B. Chapple, K. G. H. Baldwin, and H.-A. Bachor	125
Transversely Optically Pumped Ultraviolet Laser in the Range of 330-390 nm by Junhua Yu, Shangwen Sun, Yongkang Cheng, Chen Tang, and Zuguang Ma	129

Spectra of Lead, Bismuth, Thorium and Uranium Relevant to a Neodymium-Like Soft X-Ray Lasing Scheme by W. L. Hodge, P. C. Filbert, D. A. Kohler, C. L. Navoda, J. D. Perez, P. L. Hagelstein, S. Maxon, J. H. Scofield, and J. M. Peek	133
Soft X-Ray Lasing of Li-like Ions in Laser-Produced Plasmas by Yim T. Lee and W. M. Howard	135
Time Development of Amplification in Na XI H α -Line at 54.19 Å by H. Nishimura, H. Shiraga, H. Daido, T. Tachi, P. R. Herman, E. Miura, H. Takabe, M. Yamanaka, Y. Kato, G. J. Tallents, and M. H. Key	137
Gain Measurement on a 18.2-nm Carbon Recombination Laser Produced by an Intense CO ₂ Laser by H. Daido, E. Miura, Y. Kitagawa, K. Nishihara, Y. Kato, C. Yamanaka, and S. Nakai	141
Narrow Line X-Ray Transition Radiation by Electron Beam Traversing a Solid-State Superlattice by A. E. Kaplan and C. T. Law	145
VUV Amplification of Neon-Like Titanium Ion by Hidehiko Yashiro, Tamio Hara, Kozo Ando, Yoshinobu Aoyagi, Toshihiko Dote, and Susumu Namba	154
X-Ray Laser Research at Physics International by C. Deeney, J. Levine, T. Nash, P. D. LePell, and M. Krishnan	157
Continuous Anti-Stokes Raman Laser Operation by A. Feitisch and B. Wellegehausen	163
Ultrahigh Peak Power Pulses Produced by Chirped Pulse Amplification by P. Maine, D. Strickland, B. Bado, and G. Mourou	165
Multiterawatt Excimer Laser System by S. Watanabe, A. Endoh, M. Watanabe, and N. Sarukura	167
Narrowband Tunable VUV/XUV Radiation Generated by Frequency Mixing of Pulsed and CW Laser Radiation by G. Hilber, A. Lago, and R. Wallenstein	175
High Efficiency, Scalable, 130 nm Coherent Source by Four-Wave Mixing in Hg Vapor by C. H. Muller, III, C. E. Hamilton, D. D. Lowenthal, and A. V. Smith	177
Intense Coherent Radiation in the VUV and XUV Region with Electron Beam Pumped Rare Gas Excimer Lasers by Wataru Sasaki, Kou Kurosawa, Peter R. Herman, Kunio Yoshida, and Yoshiaki Kato	184

X-Ray Emission Studies of Sub-Picosecond Laser Produced Plasmas by M. M. Murnane, H. C. Kapteyn, and R. W. Falcone	189
Observations of High Density Plasmas Produced with a Picosecond High Power KrF Laser by O. Willi, G. Kiehn, J. Edwards, V. Barrow, and R. Smith	194
Current Prospects for Free-Electron Lasers in the Extreme Ultraviolet by Brian E. Newnam	200
Compact X-Ray Free-Electron Laser by W. Barletta, M. Atac, A. Bhowmik, B. Bobbs, D. B. Cline, R. A. Cover, F. P. Dixon, J. Gallardo, J. Kolonko, C. Pellegrini, G. Rakowsky, X. Wang, and G. Westenskow	202
Targets for Efficient Femtosecond-Time-Scale X-Ray Generation by J. D. Kmetec and S. E. Harris	209

Part 2 High Intensity Laser Interaction with Matter

The Stark Effect in Atoms at Extremely High Intensities: Ponderomotive Potentials and All That by Richard R. Freeman	214
Strong-Field Processes in the Ultraviolet Region by K. Boyer, G. Gibson, H. Jara, T. S. Luk, I. A. McIntyre, A. McPherson, R. Rosman, J. C. Solem, and C. K. Rhodes	220
Multiphoton Ionization for the Production of X-Ray Laser Plasmas by P. B. Corkum and N. H. Burnett	225
Charge-Displacement Self-Channeling as a Method for Energy Concentration by K. Boyer, T. S. Luk, J. C. Solem, and C. K. Rhodes	233
Stimulated Compton Backscattering and the High Intensity Kapitza-Dirac Effect by D. W. Schumacher, P. H. Bucksbaum, and M. Bashkansky	236
Search for X-Rays Generated by Collisionless Multiphoton Processes by Peter H. Y. Lee, Donald E. Casperson, and Gottfried T. Schappert	242
Characteristics of a Non-Equilibrium Picosecond Laser Plasma by G. Gibson, R. Rosman, T. S. Luk, I. A. McIntyre, A. McPherson, G. Wendum, K. Boyer, and C. K. Rhodes	246
Investigations of Multiphoton Excitation and Ionization in a Short Range Potential by S. M. Susskind, S. C. Cowley, and E. J. Valeo	251

Multiphoton Spectroscopy of Multielectron Atoms and the Quest for Direct Two-Electron Ejection by P. Lambropoulos	256
Symmetries and Asymmetries in Above-Threshold Ionization by P. H. Bucksbaum, M. Bashkansky, and D. W. Schumacher	258
Multiphoton Ionization with Femtosecond Laser Pulses by H. G. Muller	265
High-Order Harmonics in Light Scattering by Atomic Electrons Above Threshold by J. H. Eberly, Q. Su, and J. Javanainen	266

Part 3 Microscopy and Holography

X-Ray Microscopy for the Life and Physical Sciences by D. Attwood, Y. Vladimirska, D. Kern, W. Meyer-Ilse, J. Kirz, S. Rothman, H. Rarback, N. Iskander, K. McQuaid, H. Ade, and T. H. P. Chang	274
Contact Microscopy with a Soft X-Ray Laser by D. S. DiCicco, D. Kim, R. J. Rosser, C. H. Skinner, S. Suckewer, A. P. Gupta, and J. G. Hirschberg	277
X-Ray Fourier-Transform Holographic Microscope by W. S. Haddad, D. Cullen, J. C. Solem, K. Boyer, and C. K. Rhodes	284
First Images from the Stanford Tabletop Scanning Soft X-Ray Microscope by J. A. Trail and R. L. Byer	290
Progress in Optical Reconstruction of Submicron X-Ray Holograms by D. Joyeux and F. Polack	295
X-Ray Holographic Microscopy: Improved Images of Zymogen Granules by Chris Jacobsen, Malcolm Howells, Janos Kirz, Kenneth McQuaid, and Stephen Rothman	303
Amplitude- and Phase-Contrast Microscopy by G. Schmahl	309
X-Ray Holography: X-Ray Interactions and Their Effects by Richard A. London, James E. Trebes, and Mordecai D. Rosen	310

Part 4 Optics and Detectors

Recent Advances and Prospects of Bragg-Fresnel Optics by V. V. Aristov	318
Reflectance of Aluminum Reflectors in the Extreme Ultraviolet by Marion L. Scott	322
Soft X-Ray Lenses with 400 Å Outer Zone Width by Y. Vladimirska, D. Kern, T. H. P. Chang, W. Meyer-Ilse, P. Guttmann, B. Greinke, and D. Attwood	325
Soft X-Ray Spectroscopy of Laser-Produced Plasma by Shi-sheng Chen, Zhi-zhan Xu, and Zheng-quan Zhang	326
Large Holographic Diffraction Gratings Made by a Multiple Exposure Technique by L. Wosinski and M. Breidne	327
Effectiveness of Metal-Coated Diffraction Gratings at Grazing and Near Normal Incidence as Harmonic Scrubbers by P. J. Wantuck, Q. D. Appert, K. Tong, and D. J. Pistoresi	329
Saddle Toroid Arrays: Novel Grazing Incidence Optics for Synchrotron X-Ray Lithography by R. J. Rosser and P. M. J. H. Wormell	339
Diffraction Contrast of a Bragg-Fresnel Lens in White and Monochromatic Radiation by V. V. Aristov, Yu. A. Basov, R. Frahm, W. Graeff, G. Materlik, and A. A. Snigirev	347
Proposed Method for the Measurement of the Spatial Coherence of Laboratory X-Ray Lasers by James Trebes, Troy Barbee, Howard Nathel, and Abraham Szoke	350
Coplanar Vacuum Photodiode for Measurement of Short-Wavelength Picosecond Pulses by J. Bokor, A. M. Johnson, W. M. Simpson, and R. H. Storz	355
X-Ray Optics for X-Ray Laser Research Applications by N. M. Ceglio	357
Sub-Nanosecond, Photon Counting, Imaging, X-Ray Camera by D. A. Whelan, M. R. Carter, D. F. Price, and R. E. Stewart	371
Parabolic Mirror Electron Energy Analyzer for Multiphoton Photoemission Spectroscopy by L. D. Van Woerkom, D. J. Trevor, and R. R. Freeman	378

Part 5 Spectroscopy and Other Applications

Vacuum Ultraviolet Laser Spectroscopy of Molecular Autoionizing States by D. Milburn, D. J. Hart, and J. W. Hepburn	384
Time-Resolved Study of Surface Recombination at Si(111) Surfaces by N. J. Halas and J. Bokor	392
Coherent Excitations of Nuclei in Crystals by Synchrotron Radiation Pulses by G. T. Trammell and J. P. Hannon	394
Nuclear Bragg Diffraction Using Synchrotron Radiation by Rudolf Ruffer	400
The Production of Long Coherence-Length Hard X-Rays Using Nuclear Bragg Scattering of Synchrotron Radiation by D. P. Siddons	401
Measurement of the Quenching of Spontaneous Emission Coefficients in Laser-Produced Plasmas by Y. Chung, H. Hirose, and S. Suckewer	402
Ultra-High Resolution VUV-XUV Laser: Application to the Hyperfine Study of Krypton by A. H. Kung, T. Trickl, E. Cromwell, M. J. J. Vrakking, and Y. T. Lee	411
Non-Reciprocity of Autoionizing Interferences: Lasers Without Inversion by S. E. Harris	414
Studies of Hot, Solid Materials Produced by an Ultrashort Pulse Laser by H. M. Milchberg and R. R. Freeman	418
All Short Pulse Multiphoton Ionization is Resonant Ionization by W. Cooke, R. R. Freeman, and T. J. McIlrath	422
Index of Authors	425