## **Contents**

Part I	Ultrashort Pulse Generation	
	Passive Mode Locking in Coupled-Cavity Lasers tt (With 8 Figures)	2
with a Nonlin By J.K. Chee	f Ultrashort Nd:YLF Pulses by cw Passive Mode Locking near External Cavity , M.N. Kong, E.C. Cheung, and J.M. Liu res)	8
in Solid State By J. Goodbe	lse Generation with Additive Pulse Modelocking Lasers: Ti:Al <sub>2</sub> O <sub>3</sub> , Diode Pumped Nd:YAG and Nd:YLF erlet, J. Jacobson, J. Wang, J.G. Fujimoto, T.Y. Fan, ulz (With 2 Figures)	11
	vely Modelocked Diode Lasers, R.S. Tucker, and E.P. Ippen (With 3 Figures)	14
with HgCdTe By C.L. Cesa	Color Center Lasers near 2.8 $\mu$ m  Multiple Quantum Well Saturable Absorber  r, M.N. Islam, C.E. Soccolich, R.D. Feldman, R.F. Austin,  man (With 3 Figures)	17
820nm Collid By W.H. Kno	ling-Pulse Modelocked Dye Laser ox and F.A. Beisser (With 3 Figures)	20
to a Linear H By P. Beaud,	osecond Pulses by Coupling Resonantly igh Loss Cavity J.Q. Bi, J. Schütz, W. Hodel, and H.P. Weber es)	23
and Q-Switch	n Effects in Gain-Switched led Semiconductor Lasers rez and C.H. Lee (With 2 Figures)	26
of Colliding-l By M.C. Nus	luction of the Amplitude Noise Pulse-Modelocking Dye Lasers s, U. Keller, G.T. Harvey, M.S. Heutmaker, th (With 2 Figures)	29



VII

Kilohertz Amplification of Femtosecond Pulses near 1.55 µm, to Microjoule Energies  By G. Sucha, M. Wegener, S. Weiss, and D.S. Chemla  (With 3 Figures)	32
A Broadly Tunable cw Femtosecond Source for Ultrafast Spectroscopy By E.S. Wachman, D.C. Edelstein, W.S. Pelouch, and C.L. Tang (With 2 Figures)	35
Passive Feedback for Stable Short Pulse Generation By A. Agnesi, JC. Diels, P. Di Trapani, V. Kubecek, J. Marek, G. Reali, and C.Y. Yeh (With 5 Figures)	38
A New Method of Ultrashort Pulse Generation:  Modified Fabry-Perot Electrooptic Modulator  By T. Kobayashi, A. Morimoto, Bong Young Lee, and T. Sueta  (With 3 Figures)	41
Subpicosecond Argon Pumped Fibre Raman Laser By R. Leonhardt and J.D. Harvey (With 3 Figures)	45
Generation and Amplification of Femtosecond Pulses at 800nm By P. Georges, F. Salin, F. Estable, G. Roger, and A. Brun (With 3 Figures)	48
Femtosecond Laser Cavity Dispersion Measurement Using Soliton Properties By F. Salin, P. Grangier, P. Georges, G. Roger, and A. Brun (With 3 Figures)	51
Physical Properties of Coupled Cavity Lasers Used for Ultrashort Pulse Generation By M. Morin, Y. Champagne, F. Martin, R. Vallée, N. McCarthy, and M. Piché (With 3 Figures)	54
Continuous Wave Diode Laser Seeding of Tunable Femtosecond Soliton Pulses By E.J. Greer, D.M. Patrick, J.I. Vukusic, P.G.J. Wigley, and J.R. Taylor (With 2 Figures)	57
Gain Compression and Recovery Dynamics in Multiple Quantum Well Optical Amplifiers By J.M. Wiesenfeld, G. Eisenstein, M. Wegener, D.S. Chemla, G. Raybon, U. Koren, and S. Weiss (With 3 Figures)	60
Generation of Blue-Green 10 fs Pulses Using an Excimer-Pumped Dye Amplifier By R.W. Schoenlein, JY. Bigot, M.T. Portella, and C.V. Shank (With 3 Figures)	63

By J.D. Kafka, M.L. Watts, D.J. Roach, M.S. Keirstead, H.W. Schaaf, and T. Baer (With 4 Figures)	66
Coupled-Cavity Resonant Passive Modelocked (RPM) Ti:Sapphire Laser By U. Keller, W.H. Knox, and H. Roskos (With 5 Figures)	69
Self-Starting Additive Pulse Mode-Locking of a Nd:Glass Laser By Ch. Spielmann, F. Krausz, E. Wintner, and A.J. Schmidt (With 3 Figures)	72
Soliton-like Pulse Shaping in a cw Passively Mode-Locked Ti:Al <sub>2</sub> O <sub>3</sub> Laser By Y. Ishida, N. Sarukura, and H. Nakano (With 1 Figure)	75
Sub-picosecond 38 W Optical Pulses from a Hybrid Mode Locked Semiconductor Laser System By P.J. Delfyett, CH. Lee, L. Florez, N. Stoffel, N. Andreadakis, T. Gmitter, G.A. Alphonse, and J.C. Connolly (With 2 Figures)	78
Femtosecond Generation of Mid Infrared Pulses at 8.5 kHz via Parametric Mixing in AgGaS <sub>2</sub> By P.C. Becker, D. Gershoni, and A. Prosser (With 3 Figures)	81
Femtosecond Pulses in the Medium Infrared by Down-Conversion of a Traveling Wave Dye Laser By T. Elsaesser and M.C. Nuss (With 3 Figures)	84
Pulse Evolution in a Coupled-Cavity Mode-Locked KCl:Tl Color-Center Laser By X. Zhu, W. Sleat, D. Walker, and W. Sibbett (With 3 Figures)	87
Part II High Intensity Sources and Interactions	
Ultrahigh Peak Power Generation: Present and Future By P. Bado, J.S. Coe, J. Squier, F. Salin, CY. Chien, JP. Tapié, and G.A. Mourou (With 1 Figure)	92
Very High Order Harmonic Generation  By L.A. Lompré, A.L'Huillier, M. Ferray, and G. Mainfray  (With 2 Figures)	96
Time-Resolved Spectral Shifts of Femtosecond Pulses in Atmospheric Density Plasmas By W.M. Wood, W.C. Banyai, J.L. Trisnadi, and M.C. Downer	
(With 2 Figures)	101

Characterization of a High-Intensity, Subpicosecond XeCl Laser System By A.J. Taylor, T.R. Gosnell, J.P. Roberts, D.C. MacPherson, and C.R. Tallman (With 1 Figure)	104
Soft-X-Ray Generation from 100 fs Irradiation of Thin Film Targets By H.W.K. Tom, O.R. Wood, II, G.D. Aumiller, and M.D. Rosen (With 4 Figures)	107
Ultrafast Microscopy of Exploding Solids By D.D. Dlott (With 4 Figures)	110
Femtosecond Melting of Diamond By D.H. Reitze, H. Ahn, X. Wang, and M.C. Downer (With 2 Figures)	113
Femtosecond Photoemission and Reflectivity Measurements of High Temperature Electron Dynamics in Solid Density Plasmas By W.C. Banyai, D.C. Anacker, X.Y. Wang, D.H. Reitze, G.B. Focht, M.C. Downer, and J.L. Erskine (With 4 Figures)	116
Second Harmonic Generation in Femtosecond Laser-Produced Plasmas By T. Engers, H. Schüler, W. Fendel, H. Schulz, and D. von der Linde (With 3 Figures)	119
Enhanced Absorption and ASE Pedestal Suppression in the Generation of Ultrashort-Pulse Solid-Density Plasmas By H.C. Kapteyn, M.M. Murnane, A. Szoke, A. Hawryluk, and R.W. Falcone (With 2 Figures)	122
Proposed Source of Sub-picosecond Far Infrared Radiation By H. Hamster and R.W. Falcone (With 4 Figures)	125
Part III Spectroscopic Techniques and Nonlinear Optics	
Picosecond Stimulated Raman Measurement of Enhanced Optical Nonlinearities in a Conjugated Polymer By G.J. Blanchard and J.P. Heritage (With 3 Figures)	130
Spontaneous Emission and Ultrafast Dephasing in Front of a Mirror By K.E. Drabe, G. Cnossen, and D.A. Wiersma (With 2 Figures)	133
Polariton Effects in Transient Grating Experiments By J. Knoester	136
Atomic Wave Packets and Optical Pulses By L.D. Noordam, A. ten Wolde, H.G. Muller, A. Lagendijk, T.F. Gallagher, and H.B. van Linden van den Heuvell (With 3 Figures)	139
High Time Resolution and Coherence Effects with Incoherent Light in the Raman Fringe Decay  By M. Müller, K. Wynne, and J.D.W. van Voorst (With 2 Figures)	142

Fluorescence Detection of Femtosecond Accumulated Photon Echo By K. Uchikawa, H. Ohsawa, T. Suga, A. Furusawa, and S. Saikan (With 4 Figures)	145
Analysis of Femtosecond Pulse Systems Using Ray-Pulse Matrices By A.G. Kostenbauder	148
Picosecond Universal Optical Fluctuation in Strongly Disordered Solids By M. Tomita and M. Matsuoka (With 4 Figures)	151
Wavepacket Theory of Femtosecond Dynamic Absorption Spectroscopy By W.T. Pollard and R.A. Mathies (With 2 Figures)	154
The Anti-Resonant Ring in Ultrafast Excite-Probe Spectroscopy By R. Trebino and C.C. Hayden (With 2 Figures)	157
Simultaneous Two-Photon Absorption and Second Harmonic Generation in CdSe By A. Penzkofer, M. Schäffner, and X. Bao (With 1 Figure)	160
Anomalous Dispersion of the Electronic Kerr Effect n <sub>2</sub> By D.J. Hagan, Y.Y. Wu, E. Canto, M. Sheik-bahae, A.A. Said, J. Young, T.H. Wei, M. Junnarkar, and E.W. Van Stryland (With 5 Figures)	163
Electronically Programmable Femtosecond Pulse Shaping Using a Multielement Phase Modulator By A.M. Weiner, D.E. Leaird, J.S. Patel, and J.R. Wullert (With 5 Figures)	166
Pulsed Diffusing-Wave Spectroscopy: Pathlength Specific Observation of Speckle Fluctuation Spectra from Dense Colloids By A.G. Yodh, P.D. Kaplan, and D.J. Pine (With 2 Figures)	169
Part IV Nonlinear Effects in Optical Fibers	
Ultrafast All-Optical Fiber Soliton Logic Gates By M.N. Islam, C.E. Soccolich, and D.A.B. Miller (With 4 Figures) .	174
Propagation and Amplification of Ultrashort Optical Soliton Pulses in Erbium-Doped Fibers for Very High Speed Communication By M. Nakazawa (With 6 Figures)	179
Observation of Two-Color Soliton Collisions in Optical Fiber By S.R. Friberg, W. Jiang, Y. Sakai, and R.J. Hawkins (With 3 Figures)	184
Modulational Instability for Normal Dispersion By J.E. Rothenberg (With 3 Figures)	187

Ultrafast All-Optical Switching in a Polarization-Maintaining Fiber By H. Vanherzeele and B.K. Nayar (With 2 Figures)	190
Observation of Induced Phase Modulation of Femtosecond Pulses in Glass and Organic Fibers  By M. Yamashita, K. Torizuka, and T. Uemiya (With 3 Figures)	193
Part V Optoelectronics	
Optically Induced Femtosecond Electromagnetic Radiation from Semiconductor Surfaces By XC. Zhang, B.B. Hu, J.T. Darrow, S.H. Xin, and D.H. Auston (With 5 Figures)	198
Femtosecond Excitonic Sampling in Submicron Thickness Coplanar Striplines By W.H. Knox, G.E. Doran, B. Tell, K.W. Goossen, G. Hasnain, J. Cunningham, and D.S. Chemla (With 3 Figures)	203
Picosecond Pulse Generation Circuits Using a GaAs Nonlinear Transmission Line By C.J. Madden, R.A. Marsland, D.M. Bloom, and M.J.W. Rodwell (With 3 Figures)	206
Microwave Properties of Anisotropic Materials Characterized with Picosecond Transient Radiation By G. Arjavalingam, Y. Pastol, G.V. Kopcsay, and JM. Halbout (With 3 Figures)	209
Microwave Phase Locking Using an Electro-optic Harmonic Mixer By Ming G. Li, E.A. Chauchard, Chi H. Lee, and Hing-Loi A. Hung (With 3 Figures)	212
Broadband Microwave Reflection Experiments with Picosecond Transient Radiation By W.M. Robertson, G. Arjavalingam, G.V. Kopcsay, and JM. Halbout (With 3 Figures)	215
Ultrafast Coplanar Air-Transmission Lines By D.R. Dykaar, A.F.J. Levi, and M. Anzlowar (With 1 Figure)	218
Part VI Quantum Wells; Reduced Dimensionality	
Ultrafast Studies of Resonant and Non-resonant Electron and Hole Tunneling in Quantum Well Structures By J. Shah, D.Y. Oberli, K. Leo, T.C. Damen, D.A.B. Miller, J.P. Gordon, J.E. Cunningham, J.M. Kuo, and C.W. Tu (With 8 Figures)	222

of Quasi-Zero-Dimensional Magneto-Excitons By J.B. Stark, W.H. Knox, and D.S. Chemla (With 3 Figures)	227
On the Lineshape of Time-Resolved Four-Wave Mixing By M. Wegener, G. Sucha, EO. Göbel, D.S. Chemla, S. Schmitt-Rink, and W. Schäfer (With 2 Figures)	230
Stimulated Photon Echoes and Free Polarization Decay in GaAs Multiple Quantum Well Structures: Evidence for Localized and Delocalized Excitons By M.D. Webb, S.T. Cundiff, and D.G. Steel (With 3 Figures)	233
$\Gamma$ -X Intervalley Electron Transfer Rates in Type-II $Al_xGa_{1-x}As/AlAs$ Superlattices By J. Nunnenkamp, J. Kuhl, K. Ploog, J. Feldmann, E.O. Göbel, P. Dawson, and C.T. Foxon (With 3 Figures)	236
Two-Dimensional Carrier-Carrier Screening Studied with Femtosecond Photon Echoes By JY. Bigot, M.T. Portella, R.W. Schoenlein, C.V. Shank, and J.E. Cunningham (With 3 Figures)	239
Femtosecond Spectroscopy of Highly Excited Cu <sub>2</sub> O By A. Mysyrowicz, D. Hulin, and E. Hanamura (With 2 Figures)	244
Dynamics of Excitons in Conjugated Polymers By M. Yoshizawa, M. Taiji, and T. Kobayashi (With 3 Figures)	247
Femtosecond Transient-Grating Experiments in Quantum Wells By K. Leo, E.O. Göbel, T.C. Damen, J. Shah, S. Schmitt-Rink, W. Schäfer, J.F. Müller, K. Köhler, and P. Ganser (With 4 Figures)	250
Femtosecond Quantum Beats in Excitons of a Layered Semiconductor BiI <sub>3</sub> By T. Tokizaki, A. Nakamura, Y. Ishida, T. Yajima, I. Akai, and T. Karasawa (With 3 Figures)	253
Picosecond Photoluminescence of AlGaAs/GaAs Quasi-Quantum Wires and Boxes By H.Z. Wang, X.G. Hwang, W.Z. Lin, and Z.X. Yu (With 2 Figures)	256
Absorption Saturation Dynamics in Capped CdSe Microcrystallites Exhibiting Quantum Confinement By W.L. Wilson, M.G. Bawendi, L. Rothberg, P.J. Carrol, T. Jedju, L. Brus, and M.L. Steigerwald (With 5 Figures)	259
Picosecond Imaging of Photoexcited-Carrier Transport in GaAs/AlGaAs Multiple Quantum Wells By D.R. Wake, H.W. Yoon, J.S. Preston, H. Morkoç, and J.P. Wolfe (With 3 Figures)	262

Fast Recovery of Excitonic Absorption Peaks in Tunneling Bi-Quantum-Well Structures By A. Tackeuchi, S. Muto, T. Inata, and T. Fujii (With 4 Figures)	265
Degenerate Four Wave Mixing in Staggered Type-II $Al_xGa_{1-x}As/AlAs$ Multiple Quantum Well Structures By T. Mishina, F. Sasaki, and Y. Masumoto (With 2 Figures)	268
B-Exciton Bleaching in Bulk CdSe By D. Braun, W.W. Rühle, and J. Collet (With 3 Figures)	271
Femtosecond Room Temperature Measurements of Transport over Nanometer Dimensions in Quantum-Confined Heterostructures By D.P. Norwood, HE. Swoboda, M.D. Dawson, T.F. Boggess, A.L. Smirl, and T.C. Hasenberg (With 1 Figure)	274
Femtosecond Nonlinear Optical Properties of GaAs/AlAs Type-II Superlattices By G.R. Olbright, W.S. Fu, J.F. Klem, T.E. Zipperian, R. Binder, and S.W. Koch (With 1 Figure)	277
Part VII Semiconductors; Solid-State Physics	
Ultrafast Scattering Times in Amorphous Silicon By D. Hulin, A. Mourchid, R. Vanderhaghen, and P.M. Fauchet (With 3 Figures)	282
k-Space Carrier Dynamics in GaAs By M.T. Portella, JY. Bigot, R.W. Schoenlein, C.V. Shank, and J.E. Cunningham (With 1 Figure)	285
Time-Resolved Picosecond Photon Echo Studies of Phase Relaxation in CdSSe Mixed Crystals By U. Siegner, G. Noll, S.G. Shevel, and E.O. Göbel (With 2 Figures)	288
Direct Observation of the Electron and Hole Contributions in the Impulse Response of a Metal-Semiconductor-Metal Schottky Diode By M. Lambsdorff, J. Kuhl, M. Klingenstein, C. Moglestue, J. Rosenzweig, A. Axmann, J. Schneider, H. Leier, and A. Forchel (With 2 Figures)	291
Ultrafast Recombination in Ion-Damaged InP Studied by Femtosecond Luminescence By K.F. Lamprecht, R.A. Höpfel, and L. Palmetshofer (With 2 Figures)	294
Subpicosecond Photoconductivity in III-V Compound Semiconductors Using Low Temperature MBE Growth Techniques By S. Gupta, J. Pamulapati, J. Chwalek, P.K. Bhattacharya,	
and G. Mourou (With 2 Figures)	297

Nonequilibrium Carrier Dynamics in GaAs Semiconductors Induced by Energetic Ions By D. McMorrow, A.R. Knudson, and A.B. Campbell (With 3 Figures)	300
Ultrafast Relaxation Processes of Hot Carriers in Graphite By K. Seibert, G.C. Cho, W. Kütt, H. Kurz, D.H. Reitze, M.C. Downer, and A.M. Malvezzi (With 2 Figures)	303
Femtosecond Dynamics of Photo-Generated Carriers in Amorphous Hydrogenated Germanium  By M. Wraback, J. Tauc, D. Pang, W. Paul, and Z. Vardeny (With 2 Figures)	306
Ultrafast Pump-Probe X-Valley Absorption Spectroscopy in GaAs By W.B. Wang, N. Ockman, M.A. Cavicchia, M. Yan, and R.R. Alfano (With 4 Figures)	309
Subpicosecond Nonlinearities of Semiconductor Near Infrared Bragg Reflectors By G. Le Saux, J.P. Pocholle, P. Georges, J.P. Schnell, F. Salin, M. Papuchon, and A. Brun (With 4 Figures)	312
Femtosecond Thermomodulation of Single-Crystalline and Polycrystalline Gold Films By H.E. Elsayed-Ali, T. Juhasz, G.O. Smith, and W.E. Bron (With 3 Figures)	315
Vibrational Exciton Decay in Uranyl Crystals by Picosecond Coherent Raman Scattering: Energy Bottlenecks and High Order Relaxation Mechanisms By E.L. Chronister and R.A. Crowell (With 3 Figures)	318
Second-Harmonic Efficiency and Reflectivity of GaAs During Femtosecond Melting By JK. Wang, P. Saeta, Y. Siegal, E. Mazur, and N. Bloembergen (With 2 Figures)	321
Picosecond Time-Resolved Measurements of Photorefractive Grating Dynamics in Zincblende Semiconductors By A.L. Smirl, M.D. Dawson, W.A. Schroeder, T.S. Stark, T.F. Boggess, and G.C. Valley (With 2 Figures)	324
Part VIII Coherent Phonons	
Hot Phonon Spectra of Polar Semiconductors Studied via Picosecond Free Carrier Absorption Between 5 and 10 μm By T. Elsaesser, R.J. Bäuerle, R. Klann, and W. Kaiser (With 1 Figure)	328

by Femtosecond Multiple-Pulse Impulsive Stimulated Raman Scattering By A.M. Weiner, D.E. Leaird, G.P. Wiederrecht, and K.A. Nelson (With 3 Figures)	331
Impulsive Phase Coherent Femtosecond Spectroscopy of Atomic and Molecular Transients with Phase-Locked Pulse Pairs By A.J. Ruggiero, N.F. Scherer, M. Du, and G.R. Fleming (With 2 Figures)	334
Direct Time-Resolved Observation of Coherent-Phonon Oscillations in III-V Compounds By G.C. Cho, W. Kütt, M. Strahnen, A. Esser, U. Lemmer, and H. Kurz (With 1 Figure)	337
Excitation of Low Frequency Polaritons in PbTiO <sub>3</sub> with Femtosecond Pulses By J. Etchepare, G. Grillon, A. Antonetti, J.C. Loulergue, M.D. Fontana, and G.E. Kugel (With 3 Figures)	340
Time-Resolved Electron-Hole Plasma and Optical Phonon Interaction in GaP By G.O. Smith, T. Juhasz, and W.E. Bron (With 2 Figures)	343
Part IX Superconductors	
Far-Infrared Spectroscopy of High Temperature Superconductors with Terahertz Electrical Pulses By M.C. Nuss, K.W. Goossen, P.M. Mankiewich, M.L. O'Malley, J.L. Marshall, and R.E. Howard (With 3 Figures)	348
Femtosecond Absorption Studies of Nonequilibrium Electronic Processes in High-T <sub>c</sub> Superconductors By J. Chwalek, C. Uher, S. Gupta, J. Whitaker, G. Mourou, J. Agostinelli, and M. Lelental (With 2 Figures)	351
Femtosecond Thermomodulation Study of Conventional and High-T <sub>c</sub> Superconductors By S.D. Brorson, A. Kazeroonian, J.S. Moodera, D.W. Face, T.K. Cheng, E.P. Ippen, M.S. Dresselhaus, G. Dresselhaus, G.L. Doll, T. Venkatesan, X.D. Wu, and A. Inam (With 3 Figures)	354
Rate of Electron-Phonon Relaxation in Niobium By K.M. Yoo, X.M. Zhao, M. Siddique, R.R. Alfano, D.P. Osterman, M. Radparvar, and J. Cunniff (With 2 Figures)	357

Part X Interfaces and Surfaces	
Surface Vibrational Energy Relaxation: c(2 × 2)-CO/Cu(100) By S.F. Shane, L. Rothberg, L.H. Dubois, N.J. Levinos, M. Morir and A.L. Harris (With 1 Figure)	ı, 362
Femtosecond Laser-Induced Structural Changes in Gallium Arseni By H. Schulz, J. Bialkowski, K. Sokolowski-Tinten, and D. von der Linde (With 3 Figures)	de 365
Ultrafast Relaxation of Electrons Probed by Surface Plasmons at a Thin Silver Film By R.H.M. Groeneveld, R. Sprik, M. Wittebrood, and A. Lagendij (With 3 Figures)	k 368
Picosecond Transient Surface Temperature Measurement by Reflection High-Energy Electron Diffraction By H.E. Elsayed-Ali and J.W. Herman (With 2 Figures)	371
Lifetime of an Adsorbate Substrate Vibration: H on Si(111) By P. Guyot-Sionnest, P. Dumas, Y.J. Chabal, and G.S. Higashi (With 2 Figures)	374
Pump-Probe Investigation of Femtosecond Desorption By F. Budde, T.F. Heinz, M.M.T. Loy, J.A. Misewich, and B.D. S (With 1 Figure)	
Part XI Electron or Proton Transfer and Solvation	· · ·
Femtosecond Dynamics of Single Electron Transfer in Aqueous M By Y. Gauduel, S. Pommeret, N. Yamada, A. Migus, and A. Anto (With 4 Figures)	netti
Femtosecond Studies of Electrons in Water By F.H. Long, Hong Lu, and K.B. Eisenthal (With 2 Figures)	387
Femtosecond Optical Spectroscopies of Solvated Polyatomic Molece By S. Mukamel and Y.J. Yan (With 1 Figure)	
Ultrafast Studies on Intramolecular Charge Transfer and Solvation By P.F. Barbara (With 2 Figures)	393
Dynamics of Intramolecular Electron Transfer in Polar Solvents By T. Okada, S. Nishikawa, K. Kanaji, and N. Mataga (With 3 Figures)	397
Femtosecond Proton Transfer Reactions in Electronically Excited Aromatic Molecules By T. Elsaesser, F. Laermer, W. Frey, W. Kaiser, M. Wiechmann,	
and H. Port (With 1 Figure)	402

Solvent/Solute Interactions Probed by Transient Absorption and Transient Raman Spectroscopy  By T.L. Gustafson, K. Iwata, and W.L. Weaver (With 3 Figures)	405
Solvation and Barrierless Electron Transfer: How Different Are the Dynamics? By B. Bagchi, A. Chandra, and G.R. Fleming (With 2 Figures)	408
Low Temperature Ultrafast Charge Separation: Rate Versus Free Energy By M.P. O'Neil, G.L. Gaines, III, W.A. Svec, M.P. Niemczyk, and M.R. Wasielewski (With 2 Figures)	411
Solvent Dynamics by Transient Holeburning: Nonpolar Versus Polar Solutes By Tai Jong Kang, Jongwan Yu, and M. Berg (With 2 Figures)	414
Part XII Chemical Dynamics	
Femtosecond Dynamics from c.w. Spectroscopy By E.J. Heller (With 3 Figures)	418
Ultrafast Molecular Dynamics of Liquid Carbon Disulfide Observed at High Pressure in a Diamond Anvil Cell By B. Kohler and K.A. Nelson (With 2 Figures)	423
Femtosecond Transition-State Absorption Spectroscopy of Bi Atoms Produced by Bi <sub>2</sub> Photodissociation By J.A. Misewich, J.H. Glownia, R.E. Walkup, and P.P. Sorokin (With 2 Figures)	426
Femtosecond Infrared Spectroscopy of Complex Molecules Using CW IR Lasers By R.M. Hochstrasser, P.A. Anfinrud, R. Diller, C. Han, M. Iannone, T. Lian, and B. Locke (With 4 Figures)	429
The Observation of Vibrational Relaxation and Solvent Reorientation Following Ultrafast Photodissociation of Cr(CO) <sub>6</sub> By Soo-Chang Yu, Xiaobing Xu, R. Lingle, Jr., and J.B. Hopkins	
(With 2 Figures)  Ultrafast Rotational Dynamics of Electronically Excited Aniline Molecules in Solution By M.A. Pereira, P.E. Share, M.J. Sarisky, and R.M. Hochstrasser (With 2 Figures)	434
Dynamics of cis-Stilbene Isomerization in Solution By J.M. Jean, D.C. Todd, S.J. Rosenthal, A.J. Ruggiero, and G.R. Fleming (With 1 Figure)	441

Isomerization of cis-Stilbene in Ar and Kr Clusters: Direct Measurements of trans-Stilbene Formation Rates on a Picosecond Time Scale By H.Petek, K. Yoshihara, Y. Fujiwara, and J.G. Frey (With 2 Figures)	444
Rotational Dynamics in Simple and Nematogenic Liquids: Transient Grating Optical Kerr Effect Investigations By F.W. Deeg and M.D. Fayer (With 2 Figures)	447
Rotational Diffusion of Phenoxazine Dyes: Characterization of Molecular Friction By D.S. Alavi, R.S. Hartman, and D.H. Waldeck (With 2 Figures)	450
Linear Electron-Phonon Interaction in Dye-Doped Polymers Studied by Femtosecond Accumulated Photon Echo By S. Saikan (With 2 Figures)	453
Time-Resolved Decay of Absorption Anisotropy due to Rotation of Free Molecules in the Gas Phase By N.A. Borisevich, E.V. Khoroshilov, I.V. Kryukov, P.G. Kryukov, G.B. Tolstorozhev, M.Yu. Shakhbazyan, and A.V. Sharkov (With 1 Figure)	456
Ultrafast Predissociation Dynamics of Isolated Small Molecules from UV Resonance Raman Depolarization Ratios By A.B. Myers and Bulang Li (With 2 Figures)	459
Vibrational Dynamics of Chloroform, Bromoform and Iodoform By H.J. Bakker, P.C.M. Planken, L. Kuipers, and A. Lagendijk (With 2 Figures)	462
Photoisomerization Dynamics of Methylstilbenes By N.S. Park and D.H. Waldeck (With 2 Figures)	465
Ultrafast Energy Trapping in Mercuric Iodide By L.R. Williams, R.J. Anderson, and M.J. Banet (With 2 Figures)	468
Non-Markovian Dynamics of Azulene in Solution By E.T.J. Nibbering, K. Duppen, and D.A. Wiersma (With 3 Figures)	471
Resonance Raman Scattering as a Probe of Ultrafast Electronic Surface Hopping and Nuclear Vibrational Motion By J.Z. Zhang, E.J. Heller, and D.G. Imre (With 2 Figures)	474
Nickel(II) Octaethylporphyrin: Conformational Dynamics, Ligand Binding and Release By S.H. Courtney, T.M. Jedju, J.M. Friedman, L. Rothberg, R.G. Alden, M.S. Park, and M.R. Ondrias (With 4 Figures)	<i>177</i>

Application of Ultrafast Broadband Infrared Spectroscopy to Measurement of Metal-Carbonyl Dynamics By S.A. Angel, P.A. Hansen, E.J. Heilweil, and J.C. Stephenson (With 5 Figures)	480
Broadband Ultrafast Absorption Spectroscopy in the Hard Ultraviolet: Evolution of the CF <sub>2</sub> Radical upon Photodissociation of CF <sub>2</sub> Br <sub>2</sub> By T.R. Gosnell, A.J. Taylor, and J.L. Lyman (With 2 Figures)	483
Femtosecond Transient Absorption Spectroscopy of Photochemical Reactions in Solution By A.G. Joly and K.A. Nelson (With 2 Figures)	486
Subpicosecond Infrared Spectroscopy: The Condensed Phase Photochemistry of Iron Carbonyls By P.A. Anfinrud, C. Han, T. Lian, and R.M. Hochstrasser (With 3 Figures)	489
Excited State Dynamics of Jet-Cooled Substituted Indoles: The Role of Polar Interactions in ${}^1L_a - {}^1L_b$ State Coupling By D.R. Demmer, G.W. Leach, and S.C. Wallace (With 3 Figures)	492
Molecular Alignment in the Photoisomerization of Stilbene By S.T. Repinec, R.J. Sension, S.A. Abrash, and R.M. Hochstrasser (With 4 Figures)	495
Femtosecond and Picosecond Laser Photolysis Studies of Photoreduction Processes of Excited Benzophenone and Its Derivatives in Solution By H. Miyasaka, K. Morita, M. Kiri, and N. Mataga (With 2 Figures)	498
Femtosecond Laser Photolysis Studies on the Conformation Change of Benzil in Solutions  By H. Miyasaka and N. Mataga (With 3 Figures)	501
Fast Change in the Excited State Absorption Spectrum of TPM Dye Solutions By M.M. Martin, P. Plaza, Nguyen Dai Hung, and Y.H. Meyer (With 2 Figures)	504
Temperature Dependent Superradiant Decay in Molecular Aggregates By F.C. Spano, J.R. Kuklinski, and S. Mukamel (With 2 Figures)	507
Studies of Diffusion-Influenced Fluorescence Quenching By D.D. Eads, B.G. Dismer, and G.R. Fleming (With 2 Figures)	510
Zero-Phonon Line and Ultrafast Dephasing in Nile Blue Doped Polymer Film By S. Nakanishi, H. Ohta, and H. Itoh (With 4 Figures)	513

The Impact Approximation in Transition-State Absorption Spectroscopy: On the Possibility of Obtaining Difference Potentials Directly from the Transient Spectra By R.E. Walkup, J.A. Misewich, J.H. Glownia, and P.P. Sorokin (With 2 Figures)		
Part XIII Biology		
Primary Charge Separation in the Photosynthesis of Bacterial Reaction Centers By W. Zinth, W. Holzapfel, U. Finkele, C. Lauterwasser, K. Dressler, and P. Hamm (With 2 Figures)	520	
Primary Charge Separation Process in Reaction Centers from Chloroflexus aurantiacus Bacterium By J.L. Martin, J.C. Lambry, M. Ashokkumar, M.E. Michel-Beyerle, R. Feick, and J. Breton (With 3 Figures)	524	
Picosecond Transient Phase Grating Studies of the Energetics and Structure Dynamics of Heme Proteins By L. Genberg, L. Richard, G. McLendon, and R.J.D. Miller (With 3 Figures)	529	
Polarized Pump-Probe Spectroscopy of the $Q_y$ Band of BChl a-Protein from $Prosthecochloris\ aestuarii$ : Evidence for Ultrafast Exciton Localization By P.A. Lyle and W.S. Struve (With 2 Figures)	532	
Picosecond Transient Absorption and Dichroism Studies on Excitation Transfer in Allophycocyanin  By W.F. Beck, M. Debreczeny, Xinwei Yan, and K. Sauer (With 1 Figure)	535	
Vibrational Temperatures of Photoexcited Deoxy-Hemoglobin By S.H. Courtney, J.M. Friedman, R.G. Alden, M.D. Chavez, and M.R. Ondrias (With 3 Figures)	538	
Sub-picosecond Resonance Raman Spectroscopy of Some Biological Systems By R. van den Berg and M.A. El-Sayed (With 3 Figures)	541	
Picosecond Polarization Studies of Protein Relaxation By Xiaoliang Xie and J.D. Simon (With 1 Figure)	544	
Subpicosecond Fluorescence Anisotropy Measurements of Tryptophanyl Residues in Proteins By J.E. Hansen, S.J. Rosenthal, and G.R. Fleming (With 3 Figures)	548	
Index of Contributors	551	