

Contents

I. Fundamental Physical Applications of Laser Spectroscopy

Present Status of the Laser Revolution in Spectroscopy By B.P. Stoicheff	1
Experimental Study of a Highly Forbidden Magnetic Transition. Search for Parity Violation. By M.A. Bouchiat and L. Pottier	9
Search for Optical Rotation Induced by the Weak Neutral Current. By P.G.H. Sandars	21
Infrared Heterodyne Spectroscopy in Astronomy By A.L. Betz, E.C. Sutton, and R.A. McLaren	31
Precision Measurement of the Ground State Lamb Shift in Hydrogen and Deuterium. By C. Wieman and T.W. Hänsch	39
Selective Single Atom Detection in a 10^{19} Atom Background By G.S. Hurst, M.H. Nayfeh, J.P. Young, M.G. Payne, and L.W. Grossman	44
Laser Frequency Measurements: A Review, Limitations, Extension to 197 THz (1.5 μm). By K.M. Evenson, D.A. Jennings, F.R. Petersen, and J.S. Wells	56
Laser Spectroscopy of the Hydrogen Molecular Ion HD^+ By W. H. Wing	69

II. Multiple Photon Dissociation

Selective Dissociation of Polyatomic Molecules by Two Infrared Pulses. By R.V. Ambartsumian, G.N. Makarov, and A.A. Puretzky	76
Collisionless Multiphoton Dissociation of SF_6 : A Statistical Thermodynamic Process. By N. Bloembergen and E. Yablonovitch	86
Multiphoton Dissociation of Polyatomic Molecules Studied with a Molecular Beam. By E.R. Grant, P.A. Schulz, Aa.S. Sudbo, M.J. Coggiola, Y.T. Lee, and Y.R. Shen	94
Laser Diode Spectra of Spherical-Top Molecules By R.S. McDowell	102

Coherent versus Stochastic Theories of Collisionless Multiple-Photon Excitation of Polyatomic Molecules. By C.D. Cantrell 109

Multiphoton Dissociation of Polyatomic Molecules: Quantum or Classical? By W.E. Lamb, Jr. 116

III. New Sub-Doppler Interaction Techniques

Progress in Understanding Sub-Doppler Line Shapes
By C.J. Bordé 121

Optical Ramsey Fringes in Two-Photon Spectroscopy
By M.M. Salour 135

Ramsey Fringes in Saturation Spectroscopy. By J.C. Bergquist,
S.A. Lee, and J.L. Hall 142

Multiple Coherent Interactions. By T.W. Hänsch 149

Doppler-Free Laser-Induced Dichroism and Birefringence
By C. Delsart and J.-C. Keller 154

IV. Highly Excited States, Ionization, and High Intensity Interactions

Identification of Rydberg States in the Atomic Lanthanides and Actinides. By J.A. Paisner, R.W. Solarz, E.F. Worden, and J.G. Conway 160

Multiphoton Ionization Spectroscopy of the Alkaline Earths
By P. Esherick, J.J. Wynne, and J.A. Armstrong 170

Measurement and Calculation of Excited Alkali Hyperfine and Stark Parameters. By S. Svanberg 183

Spontaneous Raman Effect in Intense Laser Fields
By C. Cohen-Tannoudji and S. Reynaud 195

Collisional and Radiative Effects in Three-Level Systems
By J.L. Carlsten and M.G. Raymer 205

V. Optical Transients

Superfluorescence in Cesium: Comparison with Theory and Application to Quantum Beat Spectroscopy. By H.M. Gibbs, Q.H.F. Vrethen, and H.M.J. Hiksboers 213

Coherent Transients and Pulse Fourier Transform Spectroscopy
By R.G. Brewer, A.Z. Genack, and S.B. Grossman 220

High Resolution Studies in Fast Ion Beams. By M. Dufay and M.L. Gaillard 231

Laser Saturation Spectroscopy in the Time-Delayed Mode By M. Ducloy and M.S. Feld	243
Optical Transients in Doppler-Free Two-Photon Excitation By B. Cagnac, M. Bassini, F. Biraben, and G. Grynberg	258
Coherent Optical Spectroscopy of Molecules Undergoing Resonance Scattering and Radiationless Transitions: The Right-Angle Photon Echo. By A.H. Zewail	268

VI. High Resolution and Double Resonance

Infrared-Microwave Double Resonance. By K. Shimoda	279
RF Spectroscopy in a Laser Cavity: "Pure" Nuclear Quadrupole Spectra. By E. Arimondo, P. Glorieux, and T. Oka	287
Investigation of the Fine Structure Splitting of Rydberg States. By G. Leuchs and H. Walther	299
Laser-Induced Line Shifts and Double-Quantum Lamb Dips By R. Keil and P.E. Toschek	306

VII. Laser Spectroscopic Applications

Coherent Anti-Stokes Raman Spectroscopy. By J.-P. Taran	315
Laser Spectroscopy Relevant to Stratospheric Photochemistry By R.T. Menzies	325
Long Range Interaction Between cw Laser Beams in an Atomic Vapor. By W. Happer and A.C. Tam	333
Phase Matching of 2-Photon Resonant 4-Wave Mixing Processes By G.C. Bjorklund, J.E. Bjorkholm, R.R. Freeman, and P.F. Liao	344
Laser Spectroscopy of Bound NaNe and Related Atomic Physics By D.E. Pritchard, R. Ahmad-Bitar, and W.P. Lapatovich	355

VIII. Laser Sources

Optically Pumped Continuous Alkali Dimer Lasers. By H. Welling and B. Wellegehausen	365
Tunable Infrared Lasers Using Color Centers. By H. Welling, G. Litfin, and R. Beigang	370
IR Spectroscopy via Difference-Frequency Generation By A.S. Pine	376

X

Pulsed and cw Optically Pumped Lasers for Novel Applications in Spectroscopy and Kinetics. By J.B. Koffend, R.W. Field, D.R. Guyer, and S.R. Leone	382
Generation and Applications of 16 GHz Tunable Sidebands from a CO ₂ Laser. By P.K. Cheo	394
The Free Electron Laser. By D.A.G. Deacon, L.R. Elias, J.M.J. Madey, H.A. Schwettman, and T.I. Smith	402

IX. Laser Wavelength Measurements

Laser Wavelength Measurements, Why? How? and How Accurate? By P. Giacomo	410
Digital Wavemeter for cw Lasers. By F.V. Kowalski, W. Demtröder, and A.L. Schawlow	412
A Wavelength Meter. By R.L. Byer, J. Paul, and M.D. Duncan	414
Motionless Michelson for High Precision Laser Frequency Measurements: The Sigmameter. By P. Jacquinot, P. Juncar, and J. Pinard	417
Fizeau Wavelength Meter. By J.J. Snyder	419
A Traveling Michelson Interferometer with Phase-Locked Fringe Interpolation. By S.A. Lee and J.L. Hall	421
A Self-Calibrating Grating. By T.W. Hänsch	423
A Simple Moving-Carriage Interferometer for 1 in 10 ⁷ Wavelength Intercomparison, and a Servo-controlled Fabry-Perot System for 3 in 10 ¹¹ Accuracy. By W.R.C. Rowley, K.C. Shotton, and P.T. Woods	425

X. Postdeadline Papers

Tunable Laser Infrared Photochemistry at Cryogenic Temperatures By J.K. Burdett, P.G. Buckley, B. Davies, J.H. Carpenter, A. McNeish, M. Poliakoff, J.J. Turner, D.H. Whiffen, R.L. Allwood, J.D. Muse, S.D. Smith, H. MacKenzie, and T. Scragg	427
Measurement of a Diamagnetic Shift in Atomic Hyperfine Structure By N.P. Economou, S.J. Lipson, and D.J. Larson	429
Light-Assisted Collisional Energy Transfer. By Ph. Cahuzac and P.E. Toschek	431
Two-Photon Optical Free-Induction Decay in Atomic Sodium Vapor By P.F. Liao, J.E. Bjorkholm, and J.P. Gordon	433

Doppler-Free Coherent Two-Photon Transients by Stark Switching. By M.M.T. Loy	435
Sub-Doppler Spectroscopy of NO ₂ . By I.R. Bonilla, W. Demtröder, F. Paech, and R. Schriedl	437
Dissociation of Matrix-Isolated Molecules by Infrared Laser Radiation. By R.V. Ambartzumian, Yu.A. Gorokhov, G.N. Makarov, A.A. Puretzky, and N.P. Furzikov	439
Infrared Spectroscopy of Molecular Beams. By T.E. Gough, R.E. Miller, and G. Scoles	443
Observation of Infrared Lamb Dips in Separated Optical Isomers By E. Arimondo, P. Glorieux, and T. Oka	444
High-Resolution Spectroscopy in Fast Atomic Beams By R. Neugart, S.L. Kaufman, W. Klempt, G. Moruzzi, E.-W. Otten, and B. Schinzler	446
High Performance Spectrometer for Doppler-Free Spectroscopy: Study of the Hyperfine Predissociation in Iodine Molecules By B. Couillaud and A. Ducasse	448
Polarization Spectroscopy of Condensed Phases. By J.J. Song, J.H. Lee, and M.D. Levenson	450
Quantitative Analysis of Resonant Third Harmonic Generation in Sr-Xe Mixtures. By H. Scheingraber, H. Puehl, and C.R. Vidal	452
New Spectral Information by Lamb-Dip Spectroscopy By W. Radloff, V. Stert, and H.-H. Ritze	454
Detection of Very Weak Absorption Lines with the Aid of Neodymium-Glass and Dye Lasers. By V.M. Baev, T.P. Belikova, E.A. Svizidenkov, and A.F. Sutchkov	455
Polarization Dependence and Franck-Condon Factors of a Velocity-Tuned Na ₂ Two-Photon Transition. By J.P. Woerdman	456
Double and Triple Resonance Studies of Rotational Relaxations in NH ₃ -He and NH ₃ -H ₂ Collisions. By N. Morita, S. Kano, and T. Shimizu	457
Time Resolved Spectroscopy of the 2p-1s Transition in Neon By L.A. Christian, C.G. Carrington, W.J. Sandle, and J.N. Dodd	459
<u>List of Participants</u>	461