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TUESDAY, JUNE 18, 1985

HUBBELL AUDITORIUM

8:45 AM OPENING REMARKS
N. B. Abraham, Bryn Mawr College, Conference Cochair
C. Stroud, University of Rochester, Conference Cochair

INTRODUCTORY SESSION
H. Haken, University of Stuttgart, F. R. Germany, Presider

9:00 AM
TuA1 Single and Multimode Instabilities in Lasers, H. Risken, U. Ulm, F. R. Germany. Various types of laser instabilities are discussed, e.g., instability at threshold, of a single cw laser mode, of nonresonant modes of a ring laser, and of laser pulses.

9:30 AM
TuA2 Single- and Multimode Instabilities in Optical Systems, L. A. Lugiato, U. Milano, Italy. We overview the single- and multimode instabilities theoretically discovered for free running lasers, optical bistability, and lasers with injected signals. We demonstrate the existence of a useful general correspondence between single- and multimode instabilities, which allows both a unification of several pairs of instabilities, and the prediction of some new instabilities.

10:00 AM
TuA3 Experimental Developments in Single-Mode and Multimode Laser Instabilities, N. B. Abraham, Bryn Mawr College. An overview of laser experiments which have shown periodic and chaotic intensity fluctuations is presented. An organizing structure for classifying types of pulsations and systems is provided.

RED LOUNGE

10:30 AM-11:00 AM COFFEE BREAK

TUESDAY, JUNE 18, 1985—Continued

HUBBELL AUDITORIUM

SINGLE-MODE LASERS I
M. Sargent, University of Arizona, Presider

11:00 AM
TuB1 Recent Progress in Modeling Single-Mode Laser Instabilities, L. W. Casperson, Portland State U. The modeling of laser instabilities is becoming an increasingly rigorous science, and relevance of theory to experiment is now possible. Recent theoretical developments are reviewed and their practical consequences discussed.

11:30 AM
TuB2 The Lorenz Model, C. Sparrow, King's College, U.K. Bifurcations occurring in the Lorenz equations, including the appearance of a strange attractor, are understood in terms of bifurcations involving homoclinic orbits and heteroclinic loops between the three stationary points.

12:00 M

12:15 PM
TuB4 Single-Mode Laser Instability Induced by Phase Perturbations, J. C. Englund, U.S. Army Missile Laboratory. A new gas laser instability is described, whose threshold coincides with a bifurcation in the steady-state amplitude and frequency of a single standing-wave mode.

12:30 PM-2:00 PM LUNCH
HUBBELL AUDITORIUM

NONLINEAR SYSTEMS MODELED WITH DELAY EQUATIONS
H. J. Kimble, University of Texas, Presider

2:00 PM
TuC1 Delay-Differential Equations Modeling Nonlinear Optical Resonators, K. Ikeda, U. Kyoto, Japan. We survey the method of modeling nonlinear optical resonators by a class of delay-differential equations. Instabilities exhibited by the model equations are summarized and classified.

2:30 PM
TuC2 Instabilities of a Passive All-Optical System Subjected to cw Laser Light, H. M. Gibbs, K. Tai, J. V. Moloney, F. A. Hopf, U. Arizona; M. LeBerre, Laboratoire des Signaux et Systèmes, France; E. Ressayre, A. Tallet, Laboratoire de Photophysique Moléculaire du CNRS, France. A cavityless system consisting of off-resonance vapor and a single feedback mirror exhibits a rich instability sequence according to one- and two-transverse-dimension calculations. Experimental results, including period-two, are described.

2:45 PM
TuC3 Routes to Chaos in Passive All-Optical Resonators Containing Molecular Gases, R. G. Harrison, W. J. Firth, I. A. Al-Saidi, E. Cummins, Heriot-Watt U., U.K. Bifurcation, higher harmonics, and chaos in passive all-optical quantum systems are reported. Results are in excellent agreement with our adaptation of optical bistability theory to the time-dependent regime.

3:00 PM
TuC4 Instabilities in Quantum Optical Systems with a Modulated Feedback, J. Tredicce, National Institute of Optics, Italy; G. Delfino, R. Meucci, Istituto di Cibernetica del CNR, Italy. We report an experimental and theoretical study of a hybrid optical bistable device with a modulated injected feedback. The appearance of subharmonics is shown in two different configurations.

3:15 PM
TuC5 Approximation of Time-Delay Differential Equations by Ordinary Equations, L. Bel, Institut H. Poincare, France. Some systems with a time delay can be approximated by ordinary differential equations. Examples include a nonlinear optical cavity and a Fabry-Perot with a mobile mirror.

RED LOUNGE

3:30 PM–4:00 PM COFFEE BREAK

HUBBELL AUDITORIUM

LASERS WITH SATURABLE ABSORBERS
P. Mandel, Université Libre de Bruxelles, Belgium, Presider

4:00 PM
TuD1 Analytic Studies of a Laser with a Saturable Absorber, T. Erneux, Northwestern U. We investigate the stability of the stationary solutions of the LSA equations and analyze the possible bifurcations to periodic and quasi-periodic solutions. We consider both static and dynamic control parameters.

4:30 PM
TuD2 Type-III Intermittency in a Simple Model of a Laser with an Intracavity Absorber, M. G. Velarde, J. C. Antoranz, UNED, Spain. Transitions from a limit cycle to chaos via type-III intermittency have been studied in a simple model of a laser with an intracavity saturable absorber. Poincare and return maps together with power spectra have been used to characterize the properties of the periodic and chaotic states.

4:45 PM
TuD3 Transient Bistability in a Laser Containing a Saturable Absorber, E. Arimondo, C. Gabbanini, E. Menchi, U. Pisa, Italy; D. Dangoisse, P. Glorieux, U. Lille, France. The transient bistability of a CO₂ laser containing SF₆ as a saturable absorber appears mainly as a dynamic broadening of the bistable region and a stabilization of the lasing and nonlasing states due to sweep-rate dependent effects. The experimental results are compared with computer simulations.

5:00 PM
TuD4 Theory of a Laser with an Inhomogeneously Broadened Saturable Absorber, R. Roy, Georgia Institute of Technology; S. Singh, U. Arkansas. Exact steady-state photon number distributions are derived. Both on- and off-resonance operations are considered for traveling- and standing-wave field modes. Our expressions reduce to the expressions derived earlier by others under various approximations.

5:15 PM
TuD5 Chaotic Pulsation of Semiconductor Lasers with a Proton-Bombarded Segment, M. Kuznetsov, D. Z. Tsang, J. N. Walpole, Z. L. Liu, E. P. Ippen, Massachusetts Institute of Technology. We report the first observation of chaotic pulsation in semiconductor lasers with a saturable absorber. Stable and chaotic regimes of operation were mapped out for the isolated laser and in external cavity. Transition between stable and chaotic regimes in external cavity is characterized by period-three pulsation.

ANTHONY HALL

5:30 PM–7:30 PM DINNER (Cash Basis)

AFTER DINNER WINE & CHEESE TASTING
George Eastman House and International Museum of Photography. Buses leave from Danforth and the Townehouse Hotel from 7:00 PM–7:30 PM. Buses will return from 9:30 PM–10:00 PM.
WEDNESDAY, JUNE 19, 1985

HUBBELL AUDITORIUM

OPTICAL BISTABILITY
H. M. Gibbs, University of Arizona, Presider

8:45 AM
WA1 Overview of the Theory of Optical Bistability, H. J. Carmichael, U. Arkansas. The semiclassical theory of bistable interferometers is described, with emphasis on the steady states and their stability and on the roles of the single-mode, mean-field, and adiabatic limits.

9:15 AM
WA2 Intrinsic Dynamical Instability in Optical Bistability with Two-Level Atoms, A. T. Rosenberger, L. A. Orozco, H. J. Kimble, U. Texas, Austin. Observation of a self-pulsing instability in the transmission of cw-excited ring and standing-wave cavities filled with homogeneously broadened two-level atoms is described and compared with theory.

9:30 AM
WA3 Modulational Instabilities in Passive Optical Resonators, J. V. Moloney, Heriot-Watt U., U.K. Transverse spatial modulation is shown to be inevitable for an external pump beam driving a passive nonlinear optical resonator. Modulational instabilities rather than period doubling cascades occur in these systems.

9:45 AM
WA4 Intrinsic Oscillations and Multistability in the Transmission of a Na Vapor-Filled Fabry-Perot in the Absence of a Buffer Gas, P. Salieri, G. Giusfredi, S. Cecchi, F. T. Arecchi, Istituto Nazionale di Ottica, Italy. By tuning the laser across the inhomogeneously broadened D1 line, we observe at zero magnetic field regions of multistability both first- and second-order polarization symmetry breaking, and intrinsic self-pulsing.

10:00 AM
WA5 Theory of an All-Optical AM-FM Modulator, P. Meystre, G. Reiner, E. M. Wright, Max-Planck Institut fur Quantenoptik, F. R. Germany. We present the theory of a phase conjugate resonator configured as an all-optical dual output device, one output beam being frequency modulated and the other amplitude modulated.

10:15 AM
WA6 Some Attempts to Understand a Very High-Dimensional Strange Attractor, K. Ikeda, K. Matsumoto, U. Kyoto, Japan. We report our recent attempts to understand the physics of a very high-dimensional strange attractor exhibited by a model of optical chaos. We show (1) how a high-dimensional attractor develops from a low-dimensional one and (2) how the interior and the exterior of the strange attractor may be observed in physical processes.

RED LOUNGE
10:30 AM–11:00 AM COFFEE BREAK

WEDNESDAY, JUNE 19, 1985—Continued

HUBBELL AUDITORIUM

CHAOTIC SYSTEMS
C. Sparrow, Kings College, U.K., Presider

11:00 AM
WB1 Overview of Classical and Quantum Hamiltonian Chaos, G. Casati, U. Milano, Italy. We describe the statistical properties of classical Hamiltonian systems and the possible manifestations of chaotic motion in quantum mechanics. The connection with recent experiments is also discussed.

11:30 AM
WB2 Universal Properties and Universal Numbers and Their Measurement in Experiments on Chaotic Dynamical Systems, I. Procaccia, U. Chicago. Universal scaling laws for the invariants that characterize chaos are reviewed. Recent results pertaining to the scenario of quasi-periodicity and period doublings are described and related to potential experiments.

12:00 M
WB3 Universal Scalings for Transitions to Chaos, P. Cvitanovic, Cornell U. and Chalmers, Sweden. Period doublings and mode lockings for circle maps are characterized by universal scalings which can be measured in a variety of nonlinear physical systems.

12:30 PM
WB4 Interaction Between Instabilities, Phase Instabilities, Phase Turbulence, P. Coullet, Laboratoire de Physique de la Matiere Condensee, Observatoire de Nice, France. We describe complex dynamical behaviors which result from the nonlinear interaction between instabilities. The cases of single-mode and many-mode interactions are both considered.

12:45 PM–2:00 PM LUNCH
2:00 PM

2:15 PM
WC2 Dynamics of Line Competition and Line Selection in Off-Resonantly Pumped Systems, M. A. Dupertuis, M. R. Siegist, Ecole Polytechnique Federale de Lausanne, Switzerland; R. R. E. Salomaa, Helsinki U. Technology, Finland. Off-resonantly pumped systems emit radiation predominantly on line center or at the Raman-shifted frequency. We discuss line competition for the lambda, vee, cascade, combined vee-lambda, and parallel configurations.

2:30 PM
WC3 Instabilities and Chaotic Emission of Far-Infrared NH₃ Lasers, W. Klische, C. O. Weiss, Physikalisch-Technische Bundesanstalt, F. R. Germany. Single-mode NH₃ FIR traveling-wave lasers show self-pulsing instabilities which can period-double to chaos. In two-counter-propagating-mode emission quasi-periodic pulsing, phase-locking at various harmonics, and period-doubling to chaos occur. Windows in the chaotic range are always observed. Instabilities occur also in homogeneously broadened conditions.

2:45 PM
WC4 Sideband Instabilities in a Homogeneously Broadened Distributed Feedback CH₂F Laser, N. M. Lawandy, W. S. Rabinovich, Brown U. We have examined the oscillation condition for DFB modes in an optically pumped CH₂F laser. The complicated susceptibility structure and mode coupling result in multiple sidebands being above threshold.

3:00 PM
WC5 Regular and Chaotic Dynamics of a Single- or Multimode Ruby NMR Laser, E. Brun, U. Zurich, Switzerland. New experimental observations concerning the regular and chaotic response of an rf-driven ruby NMR laser are presented and discussed within the framework of Bloch-type NMR laser equations.

3:15 PM
WC6 Instabilities of Self-Pumped Phase-Conjugate Lasers, C. Pare, M. Piche, P. A. Belanger, U. Laval, Canada. The stability of self-pumped phase-conjugate lasers with a saturated gain medium is investigated through the exact nonlinear theory of degenerate four-wave mixing. Instabilities and chaos are predicted.
WEDNESDAY, JUNE 19, 1985—Continued

WD15 Phase Diagrams for a CO₂ Laser with an Intracavity Saturable Absorber, E. Arimondo, C. Gabbbanini, E. Menchil, U. Pisa, Italy. The operation of a CO₂ laser with different gaseous intracavity saturable absorbers has been investigated experimentally. The coexistence of bistability and modulated output operation has been explored for SF₆, CF₃Br, and CH₃OH gases.

WD16 Evidence of Mode Splitting in a Single-Mode Homogeneously Broadened Laser, D. J. Biswas, R. G. Harrison, Heriot-Watt U., U.K. Oscillatory instabilities observed in the 12.8μm emission from a single-mode homogeneously broadened two-photon Raman laser are identified as providing evidence of mode splitting in this system.


WD18 Search for Deterministic Chaos in the Mode Switching Instability of the Dye Ring Laser, T. H. Chyba, W. Christian, E. Gage, P. Lett, L. Mandel, U. Rochester. The succession of time intervals in which the dye ring laser switches between counter-propagating modes has been measured and analyzed for evidence of deterministic chaos. No evidence was found.

WD19 Resonatorless Optical Bistability, C. M. Bowden, U.S. Army Missile Laboratory. Five models are presented and discussed which characterize four generalized categories of intrinsic (resonatorless) optical bistability. Two are shown to be prototypes which describe the phenomenon in simple physical terms.

WD20 Squeezed State Experiments Using Four-Wave Mixing in a Cavity, R. E. Slusher, B. Yurke, L. Hollberg, J. C. Mertz, AT&T Bell Laboratories. Four-wave-mixing experiments in an optical cavity at frequencies near the sodium atomic resonance are described including studies of spontaneous emission noise, stimulated processes, and squeezed-state generation.

WD21 Squeezed-Coherent State Generation via Wideband Four-Wave Mixers, B. Yurke, AT&T Bell Laboratories. Wideband calculations of the output of cavity four-wave mixers are presented. The response of wideband homodyne detectors to squeezed-coherent radiation generated by such devices is also described.

WD22 Dynamics of Atomic Excitations by Chirped Pulses, C. E. Carroll, F. T. Hioe, St. John Fisher College. We present new analytic results involving an infinite variety of both amplitude-and frequency-modulated laser pulses for inverting or restoring, partially or completely, the atomic population.
WD23 Macroscopic Quantum Fluctuations of Stimulated Raman Scattering from a Partially Coherent Source. M. G. Raymer, I. A. Walmsley, U. Rochester. A pencil-shaped region of a Raman-active medium forms a source for Stokes-shifted light via stimulated Raman scattering when driven by an intense laser pulse. Stokes photons are scattered spontaneously at first and then amplified during propagation through the medium.

WD24 Quantum Beat Superfluorescence, J. W. Haus, Rensselaer Polytechnic Institute; R. J. Glauber, Harvard U.; W. Woger, H. King, Physikalisch-Technische Bundesanstalt, F. R. Germany. Two models are presented which describe the cooperative emission of electromagnetic radiation from two slightly detuned species of inverted atoms. For both models, the statistical properties of the radiated photons are discussed.

WD25 Four-Wave Mixing Processes in Multiple-Pump Multiphonon Systems: Effects of Coherence Length, J. T. Lin, Jaycor. Equations of motion for parametric processes including Raman and four-wave-mix coupling are developed in a multiple-pump multiphonon nonlinear medium. Analytical and numerical results are presented for the effects of the coherence length on the high-order Stokes.

WD26 Degenerate Four-Wave Mixing of Picosecond Light Pulses in Soluble Polydiacetylenes, W. M. Dennis, W. Blau, D. J. Bradley, Trinity College, Ireland; R. C. Schulz, N. O. Rau, C. Plachetta, U. Mainz, F. R. Germany. Optical phase conjugation by degenerate four-wave mixing of picosecond light pulses in polydiacetylene solutions has been observed with reflectivities up to 600%. The coupling mechanisms are ultrafast Kerr-like nonlinear susceptibility and thermally induced refractive-index changes.

WD27 Parametric Bistable Resonance in the Four-Wave Interaction in Molecular Systems, B. Ratajska-Gadomska, W. Gadomski, Istituto Nazionale di Ottica, Italy. It is shown that resonant bistable enhancement of the square of the crystal vibration amplitude occurs because the external biharmonic field with a difference frequency is equal to twice the vibration frequency.

WD28 Large Signal Analysis of Phase Variations and Bistability in Degenerate Four-Wave Mixing, K. Tajima, H. Hsu, Ohio State U. Inherent phase variations of interacting waves can deteriorate the ideal phase conjugation properties at high pump levels, leading eventually to hysteresis and bistability in the interaction.

ANTHONY HALL
6:00 PM–7:30 PM DINNER (Cash Basis)

WILSON COMMON/LECTURE ROOM & LOUNGE
8:00 PM DISCUSSION SESSIONS
THURSDAY, JUNE 20, 1985—Continued

HUBBELL AUDITORIUM

MULTIMODE LASERS II
G. H. C. New, Imperial College, U.K., Presider

11:00 AM
ThB1 Unstable Modes of an Inhomogeneously Broadened Multimode Ring Laser, P. Mandel, U. Libre de Bruxelles, Belgium. We determine the domain of unstable modes for a unidirectional multimode ring laser with inhomogeneous width either much smaller than, equal to, or much larger than the homogeneous width.

11:15 AM
ThB2 Statistical Behavior of Mode Amplitudes and Phases in Multimode Dye Lasers, M. G. Raymer, L. A. Westling, U. Rochester. Measurements of mode intensity cross correlations and total intensity autocorrelation have been made on continuous and pulsed dye lasers. Various types of statistical behavior have been found.

11:30 AM
ThB3 Longitudinal Mode Competition in Semiconductor Injection Lasers, N. Ogasawara, R. Ito, U. Tokyo, Japan. A peculiar laser power change, associated with longitudinal mode hopping in laser diodes, has been observed. The results have been interpreted in terms of strong coupling with asymmetric cross saturation.

11:45 AM
ThB4 Steady-State and Stability Properties of a Multimode Inhomogeneously Broadened Laser, L. M. Narducci, J. R. Tredicce, Drexel U.; D. K. Bandy, Bryn Mawr College; L. A. Lugiato, U. Milano, Italy. We analyze the multiple steady states of a multimode inhomogeneously broadened ring laser and their linear stability. From these results, we predict hysteresis and pulsations for appropriate control parameters.

12:00 M
ThB5 Chaotic Emission of Solid-State Lasers in Multitransversal Mode Operation, C. Jung, F. Hollinger, H. Weber, U. Kaiserslautern, F. R. Germany. Build-up of laser emission is approximated by a gain-rate equation and the Kirchhoff integral, which includes the intensity-dependent saturable gain. This discretized dynamic system delivers bifurcations and chaotic emission. The results are checked experimentally.

12:15 PM
ThB6 Instabilities Associated with Hopf Bifurcations in Semiconductor Lasers, K. A. Shore, T. E. Rozzi, U. Bath, U.K. The properties of oscillations arising at Hopf bifurcations in semiconductor lasers have been analyzed. Numerical examples utilizing typical GaAs laser parameters show that both unstable and stable oscillations may occur.

12:30 PM-1:45 PM LUNCH

THURSDAY, JUNE 20, 1985—Continued

HUBBELL AUDITORIUM

EFFECTS OF NOISE I
L. A. Lugiato, Universita di Milano, Italy, Presider

1:45 PM
ThC1 Quantized Chaotic Systems, R. Graham, U. Essen, F. R. Germany. An overview is presented of quantized systems exhibiting chaos in the classical limit. Autonomous and periodically forced conservative and dissipative systems are considered and applications to quantum optics are stressed.

2:15 PM

2:30 PM
ThC3 Dwell Times and Average First Passage Times in the Dye Ring Laser, P. Lett, L. Mandel, U. Rochester. By solving numerically the coupled Langevin equations of motion for the ring laser we have determined the average dwell time between switches, and compared the results with several first passage time calculations.

2:45 PM
ThC4 Dye Laser Model with Multiplicative Colored Noise, P. Jung, H. Risken, U. Ulm, F. R. Germany. Stationary distributions, correlation functions, and correlation times of a dye laser model with multiplicative colored noise are obtained by using matrix continued fractions.

3:00 PM
ThC5 Quantum Fluctuations and the Lorenz Equations, S. Sarkar, J. S. Satchell, H. J. Carmichael, Royal Signals & Radar Establishment, U.K. The quantization of the Lorenz equations is shown to take the form of two complex and one real stochastic differential equations with multiplicative noise. Quantities such as the probability of the modulus of the variables are unchanged from those in the classical Lorenz equations and a unique fractal dimension can be associated with the stochastic process.

3:15 PM
ThC6 Semiclassical Limit of Chaos and Quantum Noise in Second Harmonic Generation, M. Dorfle, R. Graham, U. Essen, F. R. Germany. Quantum noise in second harmonic generation in the semiclassical limit is described by a Fokker-Planck equation. The influence of quantum noise on coexisting chaotic and periodic attractors is studied numerically.

RED LOUNGE

3:30 PM-4:00 PM COFFEE BREAK
HUBBELL AUDITORIUM

EFFECTS OF NOISE II
L. Mandel, University of Rochester, Presider

4:00 PM
ThD1 Effect of Noise on the Bifurcations to Chaos in a Modulated Diode Laser, H. G. Winful, Y. C. Chen, GTE Laboratories, Inc. The effect of quantum noise on deterministic instabilities in modulated diode lasers has been studied by solving the rate equations driven by Langevin noise sources.

4:15 PM
ThD2 The Effects of Time-Varying Parameter on a Period Doubling Cascade, R. Kapral, U. Toronto, Canada, P. Mandel, U. Libre, Belgium. The change in the bifurcation structure of a quadratic map due to the introduction of linear time dependence of the bifurcation parameter will be discussed. Since studies of bifurcation points are often carried out by such variations, the results provide guides for interpretation of experimental data.

4:30 PM
ThD3 Gain and Loss Fluctuations in Nonlinear Optical Systems, A. Schenzle, U. Essen, F. R. Germany. Recent experiments revealed that temporal fluctuations close to threshold of either gain or loss can be the dominant source of noise. These different mechanisms are compared using analytically solvable models.

4:45 PM
ThD4 Experimental Studies of Transient Noise-Induced Bistability, W. Lange, F. Mitschke, R. Deserno, J. Mlynek, U. Hannover, F. R. Germany. The phenomenon of transient bistability induced by external noise is investigated in an all-optical device and complementarily in a bistable electronic circuit.

5:00 PM
ThD5 Bistable Two-Mode Lasers and Most Probable Tunneling Paths, X. W. Wang, D. L. Lin, SUNY-Buffalo; F. T. Hioe, St. John Fisher College. New analytic results for the mode-switching characteristics of bistable two-mode lasers, obtained by a potentially powerful technique utilizing curved (nonstraight) most probable tunneling paths, are presented.

5:15 PM
FRIDAY, JUNE 21, 1985

HUBBELL AUDITORIUM

LASERS WITH EXTERNAL DRIVING
M. G. Velarde, UNED, Spain, Presider

8:45 AM
FA1  Low Dimensional Chaos in Simple Forced Laser Systems, F. T. Arecchi, Istituto Nazionale di Ottica, Italy. The single mode, homogeneously broadened laser offers the best correspondence between chaos in a physical system and its theoretical model. We classify lasers by their time scales and review different types of behavior.

9:15 AM
FA2  Laser with Modulated Loss: a Complete Description of Its Periodic and Aperiodic Behavior, A. Poggi, G. P. Puccioni, W. Gadomski, F. T. Arecchi, J. R. Tredicce, National Institute of Optics, Italy. We present measurements which form the most complete description given up to now of a deterministically chaotic experimental system and find good agreement with theoretical models.

9:30 AM
FA3  Nonlinear dynamics for a Semiconductor Laser with Optical Feedback, H. Olesen, B. Tromborg, Telecommunication Research Laboratory, Denmark; J. H. Osmundsen, Technical U. Denmark, Denmark. We report on computer simulations of the noise-driven rate equations for an external cavity semiconductor laser. FM noise spectra and time evolution of coherent and chaotic states are presented.

9:45 AM
FA4  Dynamic Effects and Instabilities in Semiconductor Lasers in External Cavities, K. Tatah, E. Garmire, U. Southern California. Bifurcations have been observed in rf-modulated lasers both at relaxation oscillation and cavity round trip frequencies. Measurements of self-sustained relaxation oscillations have been explained by an excitation-dependent cavity decay time.

10:00 AM
FA5  Subharmonic Oscillations and Chaos in a Laser Diode Coupled to an External Cavity, K. Otsuka, T. Mukai, NTT Musashino Electrical Communication Laboratory, Japan. The first clear evidence of oscillatory instabilities leading to optical chaos is found in a compound cavity laser diode. The intermode interaction through a third-order nonlinear process provides an adequate explanation.

10:15 AM
FA6  Observation of Chaos in a Frequency-Modulated CO₂ Laser, D. Dangoisse, P. Glorieux, U. Lille, France. A fully developed sequence of chaos occurring via period-doubling bifurcations and including periodic windows was observed in a frequency-modulated CO₂ laser in the quasi-static regime and with fast variations of the control parameter.

FRIDAY, JUNE 21, 1985—Continued

RED LOUNGE

10:30 AM-11:00 AM  COFFEE BREAK

HUBBELL AUDITORIUM

LASERS WITH EXTERNAL DRIVING, Continued
M. G. Velarde, UNED, Spain, Presider

11:00 AM
FA7  Conservative-Dissipative Behavior of a CO₂ Laser with Injected Signal, A. Politi, G. L. Oppo, Istituto Nazionale di Ottica, Italy; R. Badii, Physik Institut, Switzerland. A reversible model is derived by suitably approximating an externally injected CO₂ laser. The coexistence of conservative and dissipative structures is found. Occurrence of symmetry breaking bifurcations explains the appearance of very stable periodic solutions.

11:15 AM
FA8  Chaotic Behavior in Experiments with a CO₂ Ring Laser with Injected Signal, A. V. Lerberghe, P. Cottin, J.-L. Boulnois Quantel, France; F. T. Arecchi, G. P. Puccioni, Istituto Nazionale di Ottica, Italy. Theoretically predicted chaotic behavior in a homogeneously broadened CO₂ ring laser under injection has been observed in the neighborhood of the frequency-locking zone. The first experimental data are presented as functions of detuning and injected power.
FRIDAY, JUNE 21, 1985—Continued

HUBBELL AUDITORIUM

DYNAMICS OF NONLINEAR OPTICAL SYSTEMS
M. Rayner, University of Rochester, Presider

11:30 AM
FB1 Instabilities in the Propagation of Laser Beams through Atomic Vapors, R. W. Boyd, D. J. Gauthier, M. S. Malcuit, University of Rochester. We have observed that in intense laser beam passing through an atomic vapor is unstable to the growth of new frequency components, due to phase-matched four-wave mixing processes. The new frequencies are emitted either on-axis or in a cone surrounding the transmitted laser beam.

11:45 AM
FB2 Stability of Counter-Propagating Waves in a Nonlinear Kerr Medium, Y. Silberberg, Bell Communications Research, Inc.; I. Bar-Joseph, Weizmann Institute of Science, Israel. Instabilities of counter-propagating waves in an optical Kerr medium are explained as parametric oscillations in a distributed feedback resonator generated in the nonlinear medium.

12:00 M
FB3 Multiple Isolated Branches in Four-Wave-Mixing Optical Bistability, A. E. Kaplan, C. T. Law, Purdue U. Optical bistability based on the cross-interaction of two counter-propagating plane waves in a Kerrlike medium exhibits nonhysteretic input-output characteristics with multiple isolated branches in addition to conventional hysteretic behavior.

12:15 PM
FB4 Bistability in Intracavity Nearly Degenerate Four-Wave Mixing, H. Nakajima, Ecole Nationale Superieure des Telecommunications, France; R. Frey, Ecole Polytechnique, France. Bistable behavior in the pump, probe, and conjugated signals obtained through intracavity nearly degenerate four-wave mixing is reported when using a GaAlAs diode-laser amplifier as the nonlinear interferometer.

12:30 PM-2:00 PM LUNCH

FRIDAY, JUNE 21, 1985—Continued

HUBBELL AUDITORIUM

SHORT PULSE FORMATION
C. L. Tang, Cornell University, Presider

2:00 PM
FC1 Perturbations and Instabilities in Laser Mode-Locking Dynamics, G. H. C. New, J. M. Catherall, Imperial College of Science and Technology, U.K. Stochastic background radiation can induce severe perturbations in mode-locked pulses, particularly in mode locking by synchronous pumping. Fundamental instabilities in hybrid (active-passive) mode locking are also discussed.

2:30 PM
FC2 Laser Pulse Formation by Balanced Self-Phase Modulation, Group Velocity Dispersion, Saturable Absorption, and Saturable Gain, R. L. Fork, J. P. Gordon, J. A. Valdmanis, AT&T Bell Laboratories. We examine, both experimentally and theoretically, shaping of pulses as short as 27 fsec in lasers by the balanced action of saturable gain, saturable absorption, self-phase modulation, and group velocity dispersion.

2:45 PM
FC3 Stabilization and Passive-Mode Locking of cw Alexandrite Lasers, D. J. Harter, Y. B. Band, H. Samelson, E. P. Ippen, Allied Corporation. We present data on noise in cw alexandrite lasers and theoretical work in stabilizing and passively mode locking an alexandrite laser with a reverse saturable absorber.

3:00 PM
FC4 Role of Transiency in the Formation of Solitons in Stimulated Raman Scattering, J. L. Carlsten, D. C. MacPherson, Montana State U. Although solitons in stimulated Raman scattering were predicted a decade ago, the recent experimental observations appear to be unexpectedly linked to collisional dephasing and the degree of transiency.

3:15 PM
FC5 Solitons in Four-Wave Mixing, J. R. Ackerhalt, Los Alamos National Laboratory. We have extended previous work on solitons in stimulated Raman scattering to include four-wave mixing phenomena. We have found that CARS exhibits a solitonlike structure, whereas second Stokes generation exhibits a real soliton.

3:30 PM
FC6 Soliton Structures in the Excitation due to Induced Absorption, H. Haug, S. W. Koch, H. E. Schmidt, M. Lindberg, U. Frankfurt, F. R. Germany. A soliton structure in the excitation density can occur in a nonlinear optical medium whose absorption coefficient increases with the excitation density (e.g., free-carrier concentration in a semiconductor).

4:15 PM DISCUSSION SESSION