

CALIFORNIA
INSTITUTE OF
TECHNOLOGY

Sixty-ninth Annual Commencement



June 7, 1963

CALIFORNIA INSTITUTE OF TECHNOLOGY

Sixty-ninth
Annual
Commencement

FRIDAY AFTERNOON AT FOUR-THIRTY O'CLOCK
JUNE SEVENTH, NINETEEN SIXTY-THREE

Academic Procession

Chief Marshal, Harvey Eagleson, Ph.D.

Assistant Marshals

Donald S. Clark, Ph.D. James C. Davies, Ph.D.

Rodman W. Paul, Ph.D.

MARCHING ORDER

Division I

CANDIDATES FOR THE DEGREE OF BACHELOR OF SCIENCE

CANDIDATES FOR THE DEGREE OF MASTER OF SCIENCE

CANDIDATES FOR THE DEGREE OF ENGINEER

CANDIDATES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Division II

THE FACULTY OF THE CALIFORNIA INSTITUTE

THE CHAIRMEN OF DIVISIONS

THE DIRECTORS OF LABORATORIES

THE TRUSTEES OF THE CALIFORNIA INSTITUTE

THE COMMENCEMENT CHAPLAIN

THE PRESIDENT OF THE CALIFORNIA INSTITUTE

THE COMMENCEMENT SPEAKER

THE CHAIRMAN OF THE BOARD OF TRUSTEES

Program

CALIFORNIA INSTITUTE OF TECHNOLOGY
SIXTY-NINTH
ANNUAL COMMENCEMENT



PRESIDING: ROBERT L. MINCKLER
Chairman of the Board of Trustees

PRELUDE AND PROCESSIONAL The Caltech Band

INVOCATION The Reverend N. Robert Kesler, B.A., B.D.
Holliston Avenue Methodist Church, Pasadena

COMMENCEMENT ADDRESS . John William Gardner, Ph.D., LL.D.
President, Carnegie Corporation of New York

Program—continued

CONFERRING OF DEGREES . . . Lee A. DuBridg, Ph.D., Sc.D.

President of the California Institute of Technology

PRESENTATION OF CANDIDATES FOR DEGREES

For the degree of Bachelor of Science . . . Foster Strong, M.S.

Dean of Freshmen

For the degree of Master of Science . . . Milton S. Plesset, Ph.D.

Chairman of the Curriculum Committee

For the degree of Engineer . . . Frederic Bohnenblust, Ph.D.

Dean of Graduate Studies

For the degree of Doctor of Philosophy . . . Dean Bohnenblust

CONCLUDING REMARKS President DuBridg

BENEDICTION The Reverend Mr. Kesler

RECESSIONAL . . *Organist:* James H. Shearer, A.R.C.M., A.R.C.O.

*The audience is requested to remain standing until
the end of the Recessional*

Candidates for Degrees

BACHELOR OF SCIENCE

Henry Don Isaac Abarbanel, *Beverly Hills, California*. Physics.
Daniel John Alderson, *Tujunga, California*. Astronomy.
John Caffall Alleman, *Monterey Park, California*. Mathematics.
David John Allen, *Pasadena, California*. Engineering.
Ernest Howard Anderson, *Everett, Washington*. Geology.
Kurt Steven Anderson, *Rockford, Illinois*. Astronomy.
Jack Lee Arnold, *Forest Grove, Oregon*. Engineering.
Thomas Vincent Atkinson, Jr., *Bellaire, Texas*. Chemistry.
Raymond Dean Ayers, *San Diego, California*. Physics.
David Lowell Barker, *Pasadena, California*. Chemistry.
Michael F. Behrens, *Arcadia, California*. Mathematics.
Brian Charles Belanger, *Duluth, Minnesota*. Engineering.
Edward Anton Bender, *Sacramento, California*. Mathematics.
Donald Allen Blankenship, *Seattle, Washington*. Physics.
Richard Clark Blish II, *West Covina, California*. Physics.
Joseph Thomas Bocklage, *Baltimore, Maryland*. Engineering.
Thomas Theodore Bopp, *Louisiana, Missouri*. Chemistry.
Edwin Ogilvie Buchman, *Pasadena, California*. Mathematics.
William Lionel Burke, *St. Petersburg, Florida*. Physics.
Robert Louis Causey, *South San Gabriel, California*. Mathematics.
John Millard Caywood, *Oroville, California*. Engineering.
Gregory Thomas Chalfin, *Pasadena, California*. Engineering.
Gerald David Chandler, *Hawthorne, California*. Engineering.
Bruce Wilcox Chesebro, *Los Angeles, California*. Chemistry.
David Charles Clark *Woodland, California*. Mathematics.
Ronald Keith Counsell, *Kalispell, Montana*. Chemistry.
Dennis Irwin Couzin, *Skokie, Illinois*. Mathematics.
Frank Rees Curtis, *Hollywood, California*. Engineering.
Herbert Starr Curtis, *Boulder City, Nevada*. Geology.
Dikran Damlamayan, *Istanbul, Turkey*. Engineering.
Richard Arthur D'Ari, *Auburn, California*. Biology.
Jan William Dash, *Long Beach, California*. Engineering.
Vladimir Dvornychenko, *Los Angeles, California*. Physics.
Patrick Kerwin Earley, *North Hollywood, California*. Engineering.
Sanfred Willard Elieson, Jr., *Pasadena, California*. Engineering.
Terry Eugene Ernest, *San Pedro, California*. Chemical Engineering.
Remigio Fernandez-Martin, *Santiago De Cuba, Cuba*. Chemical Engineering.
William Fisher Francis, Jr., *Yazoo City, Mississippi*. Engineering.
James Terence Geddis, *San Diego, California*. Mathematics.

Students whose names appear in boldface type are being graduated with honor in accordance with a vote of the Faculty.

BACHELOR OF SCIENCE—*continued*

- Lawrence Kenneth Gershwin**, *Bayside, New York*. Physics.
William Cannon Giauque, *Monrovia, California*. Geology.
Frederic Andrews Gibbs, Jr., *Chicago, Illinois*. Biology.
Jerrold Ralph Goodwin, *Newport Beach, California*. Mathematics.
Richard William Griffith, *Los Angeles, California*. Engineering.
Harold Roger Harrison, *Arlington, Virginia*. Physics.
Harold Jay Haskins, *Lincoln, Nebraska*. Engineering.
Roger Calvert Hill, *Pasadena, California*. Physics.
Martin Robert Hoffman, *Glencoe, Illinois*. Mathematics.
John Michael Hosack, *La Mesa, California*. Mathematics.
Sigmund John Hoverson, *Seattle, Washington*. Physics.
Alan Frank Huber, *Mountain View, California*. Biology.
Wayne Charles Huber, *Hawthorne, California*. Engineering.
Jackson Isamu Ito, *Sacramento, California*. Engineering.
Robert Lee Jernigan, *Santa Fe, New Mexico*. Chemistry.
Carlos S. Johnson, Jr., *San Diego, California*. Mathematics.
Harry Edward Keller III, *Pasadena, California*. Chemistry.
John Richard Kessler, *Glencoe, Illinois*. Mathematics.
John Andrew Kiger, Jr., *Pasadena, California*. Biology.
Allan R. King, *San Diego, California*. Engineering.
John Louis Kleiderer, *Indianapolis, Indiana*. Engineering.
Ronald Lee Koretz, *Los Angeles, California*. Biology.
Michael Marvin Krieger, *Los Angeles, California*. Mathematics.
Nishan Kay Krikorian, *Pasadena, California*. Mathematics.
David James Large, *Mount Vernon, Washington*. Engineering.
Anthony Shui-Yee Lau, *Kowloon, Hong Kong*. Physics.
Don Howard Lee, *Portland, Oregon*. Engineering.
Stephen Howard Leppa, *Palos Verdes Estates, California*. Biology.
John Seymour Letcher, Jr., *Lexington, Virginia*. Physics.
John Hathaway Lindsey II, *Southport, Connecticut*. Mathematics.
Stephen Ludwig Lowe, *San Francisco, California*. Chemistry.
Hayden Bryant Macurda, *Pleasantville, New York*. Engineering.
John Patrick Manning, *Torrance, California*. Chemistry.
Stephen Howard Mastin, *Skokie, Illinois*. Chemistry.
John Michael May, *Malibu, California*. Mathematics.
Barry Malcolm McCoy, *Tucson, Arizona*. Physics.
James Ernest McCoy, *Dallas, Texas*. Physics.
Cyrus Mead IV, *Highland Park, Illinois*. Chemistry.
Aram Z. Mekjian, *Westbury, New York*. Physics.
Wendell Willkie Mendell, *Houston, Texas*. Physics.
Charles Vincent Minichiello, Jr., *Winthrop, Massachusetts*. Chemistry.
Lee Marvin Molho, *Glendale, California*. Engineering.
Barry Kyler Moritz, *Linden, New Jersey*. Physics.
James Allen Morrow, Jr., *Dallas, Texas*. Mathematics.
Richard John O'Connell, *Helena, Montana*. Physics.
Terence O'Leary, *Los Angeles, California*. Physics.
David Frederick Ollis, *Los Gatos, California*. Chemical Engineering.

BACHELOR OF SCIENCE—continued

- David Ross Owen**, *Sherman Oaks, California*. Mathematics.
Michael David Perlman, *Chicago, Illinois*. Mathematics.
Richard Emil Peterson, *Lenexa, Kansas*. Physics.
Allen Michael Pfeffer, *Portland, Connecticut*. Mathematics.
Raymond Herman Plaut, *Los Angeles, California*. Engineering.
Stephen William Prata, *Sacramento, California*. Astronomy.
Larry Rabinowitz, *Los Angeles, California*. Mathematics.
John Rayner, *Ridgewood, New Jersey*. Physics.
Richard Stuart Robertson, *Bainbridge Island, Washington*. Mathematics.
Arthur Brouhard Robinson, *Houston, Texas*. Chemistry.
N. Paul Rosenthal, *Beverly Hills, California*. Chemistry.
Bruce Lee Rothschild, *Los Angeles, California*. Mathematics.
Larry Edward Ruff, *Sacramento, California*. Physics.
Joseph Edward Russo, *Boston, Massachusetts*. Mathematics.
Charles Albert Ryavec, *Santa Monica, California*. Mathematics.
William Frederick Saam, *Butte, Montana*. Physics.
James Mamoru Sagawa, *Phoenix, Arizona*. Engineering.
Stanley Walter Sajdera, *Chicago, Illinois*. Biology.
Robert William Schmieder, *Phoenix, Arizona*. Physics.
Robert Jay Schmulian, *San Francisco, California*. Engineering.
Franklin Alfred Schultz, *Corona del Mar, California*. Chemistry.
Richard Eugene Sears, *Palo Alto, California*. Chemical Engineering.
Truman Leo Seely, *Forest Grove, Oregon*. Chemical Engineering.
Albert Julius Semtner, *Dallas, Texas*. Mathematics.
James Franklin Shaw, *San Marino, California*. Engineering.
David S. Siegel, *Chicago, Illinois*. Mathematics.
Jack Raymond Slager, *Seattle, Washington*. Engineering.
George Fredrick Soule, *Arcadia, California*. Engineering.
Willard Gibbs Spiegelman, *Champaign, Illinois*. Mathematics.
Howard Alan Stewart, *Chattanooga, Tennessee*. Physics.
Kenneth Barry Stolarsky, *San Diego, California*. Mathematics.
David Ross Stoutemyer, *Pacific Palisades, California*. Engineering.
Karvel Kuhn Thornber, *Portland, Oregon*. Engineering.
Ivar Harald Tombach, *Palos Verdes Estates, California*. Engineering.
Leslie Jens Tomley, *Hayward, California*. Physics.
Charles Robert Trimble, *Pitman, New Jersey*. Engineering.
Howard H. Wang, *Seattle, Washington*. Biology.
Randle William Ware, *Phoenix, Arizona*. Engineering.
Michael Kenneth Wells, *Beverly Hills, California*. Engineering.
Warren Humphreys White, *East Norwich, New York*. Mathematics.
James Gerard Williams, *Los Angeles, California*. Astronomy.
David Franklin Windsor, *Whittier, California*. Engineering.
Ying-Bun Woo, *Hong Kong*. Engineering.
Alan Cameron Wright, *Houston, Texas*. Chemistry.
Steven Joseph Yellin, *Los Angeles, California*. Physics.
Joel William Young, *Berea, Kentucky*. Engineering.
Albert Yeou-Cherng Yu, *Hong Kong*. Engineering.

MASTER OF SCIENCE IN SCIENCE

Chemistry

Dinshaw Jehangir Patel. *B.Sc., Jai Hind College, Bombay, 1961.*

Chemical Engineering

Harvie Andre. *B.Sc., University of Alberta, 1962.*

John Henry Arndt, Jr. *B.S., California Institute of Technology, 1962.*

Terry Randolph Galloway. *B.S., University of California (Berkeley), 1962.*

David Kauffman. *B.S., California Institute of Technology, 1962.*

John Cheairs Porter. *B.S., University of Tennessee, 1961.*

Edmund Eugene Spaeth. *B.S., Stanford University, 1962.*

Geology

Michael Timberlake Field. *S.B., Massachusetts Institute of Technology, 1961.*

Geophysics

Héctor M. Alvarez. *Ing.Civ., University of Chile, 1958.*

John Edward Beitzel. *B.S., Michigan College of Mining and Technology, 1961.*

Abou-Bakr Khalil Ibrahim. *B.S., A'in Shams University, Cairo, Egypt, 1958;*

M.S., New Mexico Institute of Mining and Technology, 1962.

Arthur Francis McGarr III. *B.S., California Institute of Technology, 1962.*

Mathematics

Robert Allister MacLeod. *B.Sc., University of Alberta, 1961.*

Physics

John W. Davies. *B.A., State University of Iowa, 1961.*

Robert Winston Gammon. *B.A., The Johns Hopkins University, 1961.*

Henry Hunter Hill. *B.A., Rice University, 1960.*

Evan Eugene Hughes, Jr. *B.S., California Institute of Technology, 1962.*

Ben Edward Lynch. *B.E.P., Cornell University, 1960.*

Calvin Elroy Moss. *B.S., University of Virginia, 1961.*

Park S. Nobel. *B.E., Cornell University, 1961.*

Clyde Stewart Zaidins. *B.S., California Institute of Technology, 1961.*

MASTER OF SCIENCE IN ENGINEERING

Aeronautics

- Ahmad K. Abu-Shumays. B.S., *California Institute of Technology*, 1962.
William Henry Bettes, Jr. B.S., *Northrop Institute of Technology*, 1961.
Steven Collins Crow. B.S., *California Institute of Technology*, 1962.
Everett Leon DeLano, Jr. B.S., *Northrop Institute of Technology*, 1959.
David Franklin Gates. B.S., *Maryville College*, 1954.
Robert Theodore Herzog. B.S., *California Institute of Technology*, 1956.
Jark Chong Lau. Dipl., *Royal Melbourne Technical College*, 1957.
Jen-shih Lee. B.S., *National Taiwan University*, 1961.
John Eldon Lewis. B.S., *University of California (Berkeley)*, 1962.
Mervyn Daniel Olson. B.S.Sc., *University of British Columbia*, 1962.
John Merrill Rosen. B.S., *University of Minnesota*, 1956.
Charles Joseph Ruger. B.Ae., *Polytechnic Institute of Brooklyn*, 1962.
Jerome Allan Smith. B.S.E., *University of Michigan*, 1962.
Pin Tong. B.S., *National Taiwan University*, 1960.
Charles Chang-Ping Wang. B.S., *National Taiwan University*, 1959;
M.S., *National Tsing Hua University*, 1961.

Applied Mechanics

- Klaus Victor Bury. B.A.Sc., *University of Toronto*, 1959;
B.A., *Sir George Williams University*, 1962.
David Chapman Cartwright. B.S., *Hamline University*, 1962.
Jacques Godin. B.Sc.A., *Universite de Montreal*, 1954.
Leo Horowitz. B.S., *Drexel Institute*, 1962.
Donald Frederick Jensen. B.S., *Virginia Polytechnic Institute*, 1962.
Logan Keith Kuiper. B.A., *State University of Iowa*, 1962.
Donald Joseph Mokski. B.S., *University of Buffalo*, 1954.
Frederick Reyes Norwood. B.S., *University of California (Los Angeles)*, 1962.
Jay Smith III. B.S., *Virginia Polytechnic Institute*, 1963.
Christopher Kwong Wah Tam. Dipl., *Hong Kong Technical College*, 1959;
B.E., *McGill University*, 1962.

Civil Engineering

- Percy Max Augustus. B.S., *University of Kentucky*, 1962.
Ralph Eric Bredehorst. B.S., *California Institute of Technology*, 1961.
Hugo Breed Fischer. B.S., *California Institute of Technology*, 1958.
Michael John Anthony Hannon. B.E., *University College, Cork, Ireland*, 1960.
Hon-Yim Ko. B.Sc., *University of Hong Kong*, 1962.
Jay C. Pyle. B.S., *Agricultural and Mechanical College of Texas*, 1962.
Dwight Clare Schroeder. B.S., *California Institute of Technology*, 1950.
Boris Simpsen-Dubovoy. C.E., *University of Mexico*, 1961.
Eliot Francis Tucker. B.S., *Northeastern University*, 1962.

MASTER OF SCIENCE IN ENGINEERING—continued

Electrical Engineering

- Carl Edward Baum. B.S., *California Institute of Technology*, 1962.
David Bernard Benson. B.S., *California Institute of Technology*, 1962.
Ronald David Boettcher. B.S., *California Institute of Technology*, 1962;
B.A., *Occidental College*, 1962.
Robert William Bower. B.A., *University of California (Berkeley)*, 1962.
Bruce Leroy Conroy. S.B., *Massachusetts Institute of Technology*, 1962.
James Edward Cordes. B.S., *California Institute of Technology*, 1962;
B.A., *Occidental College*, 1962.
Ted H. Davey. B.S., *California Institute of Technology*, 1962.
Andrew Dienes. B.E., *McGill University*, 1962.
Michael John Ferguson. B.A.Sc., *University of Toronto*, 1962.
Lavelle Roger Gibson. B.S., *University of Oklahoma*, 1962.
Malcolm Lee Heimer. B.S., *Bucknell University*, 1962.
Arnold Richard Jones. B.S., *California Institute of Technology*, 1961, 1962.
Algis John Juodikis. B.S., *University of Illinois*, 1961.
Robert Kenneth Keenan. B.S., *University of California (Los Angeles)*, 1962.
Richard Michael Leichus. B.E., *Stevens Institute of Technology*, 1962.
Anastasios Gerasimos Livitsanos. B.E., *Stevens Institute of Technology*, 1962.
Wayne A. Massey. B.S., *California Institute of Technology*, 1961.
John Wallace Matthews. B.S., *University of California (Los Angeles)*, 1962.
Patrick Anthony McGovern. B.E., *University of Queensland*, 1961; B.Sc., 1962.
Lauren Vail Merritt. B.S., *California Institute of Technology*, 1962.
Fernando Mexia-Algar. Ae.E., *Aeronautical Engineering Technical University, Madrid*, 1955.
Paul Joel Nahin. B.S., *Stanford University*, 1962.
Robert Ronald Natale. B.E.S., *The Johns Hopkins University*, 1962.
Howard Oringer. B.E., *Stevens Institute of Technology*, 1962.
Raymond Félix Poggi. Dipl., *Faculte des Sciences de Marseille*, 1962.
George Robert Root, Jr. B.S., *California Institute of Technology*, 1962.
Robert James Schneider. B.S., *Washington University*, 1961.
Gaetan Joseph St-Cyr. B.S., *California Institute of Technology*, 1962.
Byron Fletcher Summers, Jr. B.S., *California Institute of Technology*, 1961.
Richard Franklin Webber. B.S., *California Institute of Technology*, 1955.
Clarence G. Winternheimer. B.A., *Evansville College*, 1957; B.S., 1958.
James Yoh. B.S., *California Institute of Technology*, 1962.

MASTER OF SCIENCE IN ENGINEERING—*continued*

Engineering Science

- David Storer Burnett. *B.E.P., Cornell University, 1962.*
David G. Carta. *B.S., California Institute of Technology, 1962.*
James Edward Lancaster. *B.S., Seattle Pacific College, 1961.*
Joseph Po-keung Lau. *B.Sc., Purdue University, 1962.*
Laurence Bei-Yu Zung. *B.Sc., Purdue University, 1962.*

Materials Science

- Samuel Theodore Furr. *B.S., California Institute of Technology, 1962;*
B.A., Occidental College, 1962.
Edmond Remy Iagolnitzer. *Dipl. d'Ingenieur, Ecole des Mines de Nancy, 1962.*
Miguel Enrique Levy. *B.S., California Institute of Technology, 1962.*
John Christian Russ. *B.S., California Institute of Technology, 1962.*
Chang-chyi Tsuei. *B.S., National Taiwan University, 1960.*

Mechanical Engineering

- Irwin Emanuel Alber. *B.S., University of California (Los Angeles), 1962.*
John Theodore Armstrong, Jr. *B.S., California Institute of Technology, 1962.*
Lon Edward Bell. *B.S., California Institute of Technology, 1962.*
Jacob Brentjes. *B.S., University of California (Berkeley), 1960.*
William Winston Evans. *B.Sc., University of Alberta, 1962.*
Pierre Facon. *M.E., Université de Nancy, 1962.*
William Paul Gruber. *B.S., University of Washington, 1962.*
Dwight Harwood Harrison. *B.S., University of Kansas, 1955.*
William Lynderman Hendry. *B.S., University of California (Los Angeles), 1962.*
David Fielding James. *B.Sc., Queen's University, 1962.*
Keishi Kawamo. *B.E., Waseda University, 1959.*
C. Robert Klotz. *B.M.E., Fenn College, 1962.*
Alan Lippert. *B.M.E., Cornell University, 1961.*
Franklin Lester Marshall. *B.S., California Institute of Technology, 1962.*
Rex Bredesen Peters. *B.S., California Institute of Technology, 1956.*
Frank Ridolphi. *B.S., California Institute of Technology, 1962.*
Alvin Kenneth Yedlin. *B.M.E., Polytechnic Institute of Brooklyn, 1962.*

ENGINEER

Aeronautical Engineer

Harry Spencer Blackiston, Jr. B.S., *Purdue University, 1957; M.S., 1959.*

Amable Liñan-Martinez. *Ae.E., University of Madrid, 1962.*

James Howard Mauldin, Lt., U.S.N.R. B.S., *Georgia Institute of Technology, 1953; M.S., 1956; M.S., California Institute of Technology, 1960.*

Richard Earl Parks, Lt. U.S.N. B.S., *United States Naval Academy, 1954; B.S., United States Naval Postgraduate School, 1962.*

Viviane Claude Rupert. *Ing. d'Aéronautique, Ecole Nationale Supérieure de l'Aéronautique (Paris), 1961; M.S., California Institute of Technology, 1962.*

Erik Jaak Slachmuylders. *B.W.E.ir, University of Ghent, 1958; Electromech.Eng., 1960; M.S. California Institute of Technology, 1961.*

Charles Fleming Stebbins, Lt., U.S.A.F. B.S., *United States Air Force Academy, 1961; M.S., California Institute of Technology, 1962.*

Floyd Ronald Stuart, Lt., U.S.A.F. B.S., *United States Naval Academy, 1957; M.S. California Institute of Technology, 1962.*

Thomas Ross Thompson. *B.S.A.E., Purdue University, 1955; M.S.A.E., 1957.*

Mechanical Engineer

Philip Mwangi Githinji. *B.S.M.E., Purdue University, 1960; M.S., California Institute of Technology, 1961.*

Louis C. Roesch. *C.E., Ecole Nationale Supérieure des Mines (Paris), 1960; M.S., California Institute of Technology, 1961.*

André-Jacques Tesnière. *Dipl. Ing., Institut Polytechnique (Grenoble), 1959; M.S., California Institute of Technology, 1961.*

Joseph Richard Wrobel. *B.S., Carnegie Institute of Technology, 1958; M.S., Cornell University, 1960.*

DOCTOR OF PHILOSOPHY

Harlow Garth Ahlstrom (*Aeronautics*). B.S., University of Washington, 1959;
M.S., 1959.

Thesis: Experiments on the Upstream Wake in Magneto-Fluid Dynamics.

Shelton Setzer Alexander (*Geophysics and Mathematics*). B.S., University of North Carolina, 1956; M.S., California Institute of Technology, 1959.

Thesis: Surface Wave Propagation in the Western United States:

I. Crustal Structure in the Western United States from Multimode Surface Wave Dispersion.

II. The Effects of the Continental Margin in Southern California on Rayleigh Wave Propagation.

William Judson Anderson (*Aeronautics and Mathematics*). B.S., Iowa State University, 1957; M.S., 1958.

Thesis: Studies in Panel Flutter:

I. Flat and Slightly Curved Panels;

II. Cylindrical Shells with Boundary Layer.

John Edwin Baldwin (*Chemistry and Physics*). A.B., Dartmouth College, 1959.

Thesis: I. Mechanism of the Thermal Isomerization of 2-Norbornene-5,6-*endo*-dicarboxylic Anhydride.

II. The Aldoketene Dimer Rearrangement.

Philip Oren Banks (*Geochemistry*). S.B., Massachusetts Institute of Technology, 1958.

Thesis: Systematics of the Distribution of Uranium and Lead in Relation to the Petrology of the Mt. Rubidoux Granites, Riverside County, California.

Dennis Barrett (*Biochemistry*). A.B., University of Pennsylvania, 1957.

Thesis: The Parallel Accumulation and Distribution of Two Purine-Oxidizing Enzymes During Frog Development.

Frank Bliss Booth (*Chemistry and Physics*). B.S., University of California (Los Angeles), 1953; M.S. 1954.

Thesis: I. Electron Magnetic Resonance Studies on Irradiated Single Crystals of Sebacic Acid.

II. Rate of Electron Exchange Between Di-*p*-Anisyl Nitrogen Oxide Molecules by Electron Paramagnetic Resonance.

William Charles Boyle (*Civil Engineering*). C.E., University of Cincinnati, 1959; M.S., 1960.

Thesis: Studies on the Biochemistry of Disinfection by Monochloramine.

James Stanley Clovis (*Chemistry and Economics*). B.S., Waynesburg College, 1959.

Thesis: The Mechanism of the Benzidine Rearrangement.

DOCTOR OF PHILOSOPHY—*continued*

- Thomas Alan Cole (*Biochemistry*). B.A., Wabash College, 1958.
Thesis: Peptidyl Acylating Agents in the Pupae of *Drosophila melanogaster* and Their Possible Relationship to Protein Synthesis.
- Jacques de Barbeyrac Saint-Maurice (*Electrical Engineering*). Dipl.C.A.E., Ecole Nationale Supérieure de l'Aéronautique (Paris), 1959; M.S., California Institute of Technology, 1960.
Thesis: Minimal Time Deadbeat Regulation and Control of Linear, Stationary, Sampled-Data Systems.
- Clarence Forbes Dewey, Jr. (*Aeronautics*). B.E., Yale University, 1956; M.S., Stanford University, 1957.
Thesis: Measurements in Highly Dissipative Regions of Hypersonic Flows:
I. Hot-Wire Measurements in Low Reynolds Number Hypersonic Flows.
II. The Near Wake of a Blunt Body at Hypersonic Speeds.
- Robert Ernest Diebold (*Physics*). B.S., University of New Mexico, 1958; M.S., California Institute of Technology, 1960.
Thesis: Photoproduction of Neutral Pions from Protons at Center of Mass Angles of 60° , 90° , and 120° from .6 to 1.2 BeV.
- John Jacob Domingo (*Physics*). B.S., California Institute of Technology, 1955.
Thesis: A Study of the Effect of the 3.10 -MeV State of F^{17} on the $O^{16}(p,\gamma)F^{17}$ Reaction.
- Michael B. Duke (*Geochemistry*). B.S., California Institute of Technology, 1957; M.S., Pennsylvania State University, 1958; M.S., California Institute of Technology, 1961.
Thesis: Petrology of the Basaltic Achondrite Meteorites.
- Thornton Roberts Fisher (*Physics*). B.S., Wesleyan University, 1958.
Thesis: I. A Study of the $Na^{23}(p,\alpha)Ne^{20}$ Reaction for Proton Bombarding Energies from 100 to 450 keV.
II. A Measurement of the Half-lives of N^{12} and B^{12} .
- Robert Paul Foss. (*Chemistry*). B.A. Northwestern University, 1958.
Thesis: The Mechanism of Triplet-Energy Transfer in Solution: the Quenching of Excited-State Benzophenone by Transition-Metal Chelates.
- Michael Eugene Fourney (*Aeronautics*). B.S.A.E., West Virginia University, 1958; M.S., California Institute of Technology, 1959.
Thesis: I. On the Application of a Laser to High Speed Photography.
II. Torsional Magnetoelastic Waves in a Circular Cylinder.

DOCTOR OF PHILOSOPHY—*continued*

- Charles Julius Fritchie, Jr. (*Chemistry*). B.S., Tulane University, 1958.
Thesis: The Molecular and Crystal Structures of a Dimer of a Cyclobutadiene Derivative; the Crystal Structure of Bis-(2-bromopyridine)-dodecahydrodeca borane.
- Harris Gold (*Aeronautics*). B.M.E., Polytechnic Institute of Brooklyn, 1958;
M.S.M.E., Columbia University, 1959.
Thesis: Stability of Laminar Wakes.
- Louise Dillon Gray (*Engineering Science*). B.S., University of California (Los Angeles), 1957; M.S., 1959.
Thesis: I. Theoretical Calculations of Equilibrium Infrared Gas Emissivities from Spectroscopic Data.
II. Representative Radiative Energy Transfer Calculations for Transparent and Optically Dense Media.
- David Eiben Groce (*Physics and Electrical Engineering*). B.S., California Institute of Technology, 1958.
Thesis: Magnetic Analysis of Reactions Leading to Excited States in Li^6 and B^{11} .
- David Warren Hall (*Chemistry*). B.S., University of Arizona, 1957.
Thesis: I. Electrophilic Substitution Reactions of Some Substituted Ferrocenes.
II. The Effects of Heteroannular Substituents on the Rates of Solvolyses of Methylferrocenylcarbonyl Acetates; a Comparison with Substituent Effects in Other Reactions of Ferrocene.
- Carole Lois Hamilton (*Chemistry*). B.S., Colorado State University, 1958.
Thesis: I. An Investigation of Rearrangement in 2-Phenylethyl Organometallic Compounds.
II. Skeletal Interconversion in Allylcarbonyl, Cyclopropylcarbonyl and Cyclobutyl Grignard Reagents.
- David Garrison Harkrider (*Geophysics*). B.S., Rice University, 1953; M.A., 1957.
Thesis: I. Propagation of Acoustical Gravity Waves from an Explosive Source in the Atmosphere.
II. Rayleigh and Love Waves from Sources in a Multilayered Elastic Halfspace.
- Kenneth Edwin Harwell (*Aeronautics*). B.S., University of Alabama, 1958; M.S., California Institute of Technology, 1960.
Thesis: Initial Ionization of Shock-Heated Argon, Krypton, and Xenon.
- Thomas McCalfree Helliwell (*Physics*). B.A., Pomona College, 1958.
Thesis: The Nodal Boundary Condition Method: Wave Functions and Transition Probabilities for Atoms with Two Valence Electrons.

DOCTOR OF PHILOSOPHY—*continued*

Robert Hickling (*Engineering Science*). M.A., University of St. Andrews, 1954.

Thesis: I. Acoustic Radiation and Reflection from Spheres.

II. Some Effects of Thermal Conduction and Compressibility in the Collapse of a Cavity in a Liquid.

Richard O'Neil Hundley (*Physics*). B.S. California Institute of Technology, 1957;
M.S., 1959.

Thesis: Direct Pair Production by Electrons.

Marcos Intaglietta (*Applied Mechanics*). B.S., University of California, 1957;
M.S., California Institute of Technology, 1958.

Thesis: Streaming Birefringence Study of the Interactions of Submicroscopic Particles.

Paul Christian Jennings (*Civil Engineering*). B.S., Colorado State University, 1959;
M.S., California Institute of Technology, 1960.

Thesis: Response of Simple Yielding Structures to Earthquake Excitation.

Kenneth Irwin Kellermann (*Physics and Astronomy*). S.B., Massachusetts Institute
of Technology, 1959.

Thesis: The Spectra of Galactic and Extragalactic Radio Sources.

James W. Kessel (*Chemistry*). B.S., University of Michigan, 1958.

Thesis: I. The Isolation and Structure of Two Alkaloids from *Tabernaemontana
rupicola*.

II. The Structure of Necrosamine.

Joseph R. Kilner (*Physics*). B.S., Case Institute of Technology, 1957.

Thesis: The Photoproduction of Positive Pions from Hydrogen at Energies of 1.1
to 1.4 GeV.

Donald Menford King (*Chemistry*). B.S., State College of Washington, 1957.

Thesis: I. A Kinetic Study of the Reaction Between Thioacetamide and Hydrazine.

II. The Iodometric Determination of Peroxydisulfate.

III. Effect of Surface Oxidation and Platinization on the Behavior of Platinum
Electrodes.

Wolfgang Gustav Knauss (*Aeronautics*). B.S., California Institute of Technology,
1958; M.S., 1959.

Thesis: Rupture Phenomena in Viscoelastic Materials.

Donald Ervin Knuth (*Mathematics*). B.S., Case Institute of Technology, 1960.

Thesis: Finite Semifields and Projective Planes.

DOCTOR OF PHILOSOPHY—*continued*

- William L. Ko (*Aeronautics*). B.S., National Taiwan University, 1950; M.S., California Institute of Technology, 1959.
Thesis: Application of Finite Elastic Theory to the Behavior of Rubber-Like Materials.
- Alvin L. Kwiram (*Chemistry*). B.S., Walla Walla College, 1958.
Thesis: I. A Chemical Application of Electron-Nuclear Double Resonance.
II. Auxiliary Equipment.
- George Melvin Lawrence (*Physics*). B.S., University of Utah, 1959.
Thesis: Experimental Absolute f -Values for Lines of Ni, Co, Au, and Ag.
- Michael Jerry Levine (*Physics*). B.S., University of Illinois, 1958.
Thesis: Neutrino Processes of Significance in Stars.
- Paul Hersh Levine (*Physics*). S.B., Massachusetts Institute of Technology, 1956; M.S., California Institute of Technology, 1957.
Thesis: Phase Space Formulation of the Quantum Many-Body Problem.
- John Kailin Link (*Physics*). B.S., Antioch College, 1959.
Thesis: Measurement of Absolute f -Values for Selected Metals with an Atomic Beam Method.
- Robert Lee Luttermoser (*Physics and Astronomy*). B.S., University of Michigan, 1948; M.S., 1950.
Thesis: Nuclear Interactions in a High Energy Multiplate Cloud Chamber.
- Egon Marx-Oberländer (*Physics*). E.E., University of Chile, 1959.
Thesis: On Pion Nucleon Resonances.
- Francis Clay McMichael (*Civil Engineering and Geophysics*). B.S., Lehigh University, 1958; M.S., California Institute of Technology, 1959.
Thesis: Suspensions of Particles Generated by an Upward Flow.
- Chiang Chung Mei (*Engineering Science*). B.S.C.E., National Taiwan University, 1955; M.S., Stanford University, 1958.
Thesis: I. On the Initial Value Problems of Radiation and Scattering of Water Waves by Immersed Obstacles.
II. Gravity Waves Due to a Point Disturbance in a Stratified Flow.
- James Eardley Midgley (*Physics*). B.S.E., University of Michigan, 1956.
Thesis: Calculation by a Moment Technique of the Perturbation of the Geomagnetic Field by the Solar Wind.

DOCTOR OF PHILOSOPHY—*continued*

- Ralph Fraley Miles, Jr. (*Physics*). B.S., California Institute of Technology, 1955; M.S., 1960.
Thesis: The Density of Cosmic-Ray Neutrons in the Atmosphere.
- Norton Leonard Moise (*Physics and Aeronautics*). B.S., University of Illinois, 1948; M.A., University of California (Los Angeles), 1954; M.S., California Institute of Technology, 1959.
Thesis: A Study of Atomic Transition Probabilities; the Correlation of Oscillator Strengths and Vapor Pressures.
- Fernando B. Morinigo (*Physics*). B.S., University of Southern California, 1957.
Thesis: A Study of Excited Levels in Be^8 via the Reaction $\text{Li}^6 (\text{He}^3, p) \text{Be}^{8*}$.
- D. James F. Morré (*Biochemistry and Plant Physiology*). B.S., University of Missouri, 1957; M.S., Purdue University, 1958.
Thesis: Biochemistry of Cell Extension.
- Robert George Mortimer (*Chemistry and Physics*). B.S., Utah State University, 1958; M.S., 1959.
Thesis: I. Irreversible Thermodynamics of Photochemistry.
II. Approximations to Ensemble Averages.
- Robert Canute Neuman, Jr. (*Chemistry*). B.S., University of California (Los Angeles), 1959.
Thesis: I. A Nuclear Magnetic Resonance Study on Amidinium Ions in Solution.
II. The Kinetics of the Thermal Decomposition of Azo-bis-isobutyramidines and Their Salts in Solution.
- Robert Wilson Noyes (*Physics*). B.A., Haverford College, 1957.
Thesis: Observations of Oscillatory Motions in the Solar Atmosphere.
- Peter Donald MacDougall Parker (*Physics*). B.A., Amherst College, 1958.
Thesis: Investigation of the Direct-Capture Reaction, $\text{He}^3(\alpha, \gamma)\text{Be}^7$.
- Robert Allan Ridley Parker (*Astronomy and Physics*). B.A., Amherst College, 1958.
Thesis: The Physical Conditions Pertaining to Some Possible Supernova Remnants.
- John Davie Pearson (*Physics*). B.Sc., Brown University, 1956.
Thesis: A Study of the Gamma Radiation Produced in the Alpha-Particle Bombardment of O^{16} .
- James Macon Peterson (*Chemistry and Physics*). B.S., Wake Forest College, 1958.
Thesis: I. Remarks on the Archibald Technique for Determining Molecular Weights in the Ultracentrifuge.
II. The Hydrodynamic Alignment of Rod-like Molecules in Centrifugal Fields.

DOCTOR OF PHILOSOPHY—*continued*

James Sibley Petty (*Aeronautics*). B.S. California Institute of Technology, 1959; M.S., 1960.

Thesis: Linearized Transonic Flow About Symmetric Non-Lifting Airfoils.

Alfred Cyril Pinchak (*Mechanical Engineering and Physics*). B.S.E.E., Case Institute of Technology, 1957; M.S.E., Purdue University, 1959.

Thesis: Experimental Investigation of Gas Phase and Surface Phenomena in a Seeded Plasma.

John William Porter, Jr. (*Engineering Science*). B.A., Rice University, 1959; M.S., California Institute of Technology, 1960.

Thesis: I. Chemical Reactions During Flow in Rocket Nozzles.

II. Gas Discharge Rates Through De Laval Nozzles and the Experimental Determination of Desorption Rates.

James Howard Renken (*Physics*). B.S., Ohio State University, 1957; M.S., 1958.

Thesis: The Elastic Scattering of Deuterons by Beryllium.

Charles Dyer Russell (*Chemistry*). S.B., Massachusetts Institute of Technology, 1957.

Thesis: Chronopotentiometry in Acetonitrile; Oxidation of Substituted Acetates and Substituted Ferrocenes at Platinum Electrodes.

Louis Vincent Schmidt (*Aeronautics*). B.S., California Institute of Technology, 1946; M.S., 1948; Ae.E., 1950.

Thesis: Air Loads on a Circular Cylinder.

Philip Anthony Seeger (*Physics*). B.A., Rice University, 1958.

Thesis: Electromagnetic Decay of the Second Excited State of C^{12} .

George Andrew Seielstad (*Physics*). A.B., Dartmouth College, 1959.

Thesis: Measurements of the Linear Polarization of Radio Sources at Decimeter Wave Lengths.

Yun-Yuan Shi. (*Aeronautics*). B.S., National Taiwan University, 1955; M.S., Brown University, 1958.

Thesis: Low Reynolds Number Flow Past Finite Cylinders of Large Aspect Ratio.

Jon Hardy Shirley (*Physics and Mathematics*). A.B., Middlebury College, 1957.

Thesis: Interaction of a Quantum System with a Strong Oscillating Field.

George Warren Simon (*Physics*). A.B., Grinnell College, 1955; M.S., California Institute of Technology, 1961.

Thesis: Correlations Between Large-Scale Solar Photospheric and Chromospheric Motions, Ca II (k) Emission, and Magnetic Fields.

DOCTOR OF PHILOSOPHY—*continued*

- Himan Sternlicht (*Chemistry and Physics*). B.S., Columbia University, 1958.
Thesis: I. The Electron Spin Resonance Line Shape of a Polycrystalline Radical.
II. Paramagnetic Excitons in Molecular Crystals.
- Robert Farrell Stewart (*Chemistry*). B.A., Carleton College, 1958.
Thesis: Polarized Absorption Spectra of Purines and Pyrimidines.
- Frederick William Studier (*Biophysics and Chemistry*). B.S., Yale University, 1958.
Thesis: Studies on the DNA of Bacteriophage T7.
- Donald Gary Swanson (*Physics*). B.Th., Northwest Christian College, 1958; B.S.,
University of Oregon, 1958; M.S., California Institute of Technology, 1961.
Thesis: An Experimental Study of Compressional Hydromagnetic Waves.
- Richard Michael Talman (*Physics*). B.A., University of Western Ontario, 1956;
M.A., 1957.
Thesis: Photoproduction of π^0 's from Protons in the Forward Direction in the Region
of the Second and Third Resonances.
- Robert Clem Titsworth (*Electrical Engineering and Mathematics*). B.S., New Mexico
College of Agriculture and Mechanic Arts, 1957; M.S., California Institute of
Technology, 1958.
Thesis: Correlation Properties of Cyclic Sequences.
- M. Nafi Toksöz (*Geophysics and Electrical Engineering*). Geoph.Eng., Colorado School
of Mines, 1958; M.S., California Institute of Technology, 1960.
Thesis: Velocities of Long Period Surface Waves and Microseisms and Their Use in
Structural Studies:
I. Mantle Love and Mantle Rayleigh Waves and the Structure of the Earth's Upper
Mantle.
II. Microseisms and Their Application to Seismic Exploration.
- Nicholas John Turro, Jr. (*Chemistry*). B.A., Wesleyan University, 1960.
Thesis: Energy Transfer in Organic Photochemistry.
I. Photosensitized cis-trans Isomerization.
II. Photosensitized Dimerization of Conjugated Dienes.
- Harris E. Ulery (*Chemistry*). B.A., Grinnell College, 1959.
Thesis: I. Acid Catalyzed Reactions of 1,5-Epoxyolefins.
II. The Alkylative Cyclization of 1,5-Hexadiene.
III. The Acid Catalyzed Cyclizations of cis,cis- and trans,trans-2,6-Octadiene.
IV. The Infrared Spectra of Cyclobutane Compounds.
- Janis Vasilevskis (*Chemistry*). B.S., University of California, 1958.
Thesis: Studies of the Metal Ion Complexes of Purines and Pyrimidines by
Electrophoresis and Other Methods.

DOCTOR OF PHILOSOPHY—*continued*

George Charpentier Vlases (*Aeronautics*). B.S., The Johns Hopkins University, 1958;
M.S., California Institute of Technology, 1959.

Thesis: Experiments in a Cylindrical Magnetic Shock Tube.

Joseph L. Vogl (*Physics*). A.B., Columbia College (New York), 1957; M.S.,
California Institute of Technology, 1959.

Thesis: Radiative Capture of Protons by C^{12} and C^{13} Below 700 KeV.

Yui-Loong Wang (*Chemical Engineering*). B.S., Taiwan College of Engineering,
1956; California Institute of Technology, 1958.

Thesis: I. Thermal Decomposition of n-Butane.
II. Flow in Entrance Section of Parallel Plates.

Ronald Watson (*Mechanical Engineering*). B.S.(M.E.), Illinois Institute of Technology,
1952; M.S., California Institute of Technology, 1953.

Thesis: I. Experimental Spectroscopic Temperature Measurements in the Reflected
Wave Region of a Shock Tube Using the $OH^2\Sigma \rightarrow ^2\pi$ Band System.
II. Shock Tube Measurements of the Absorption Oscillator Strength for the $^2\Sigma \rightarrow ^2\pi$
Band System of OH.

Ned Conder Webb (*Chemistry and Physics*). B.A., Vanderbilt University, 1959.

Thesis: Determinations of the Crystal Structures of Bis-indenylruthenium and of Two
So-Called Gamma-Brass Type Compounds:

I. Bis-indenylruthenium.

II. " Ni_5Cd_{21} ".

III. " Ni_5Zn_{21} ".

Robert Avrum Weisberg (*Virology*). A.B., Harvard College, 1958.

Thesis: Studies on Mouse Embryo Cultures Infected with Polyoma Virus.

Douglas Warren Willett (*Mathematics*). B.S., South Dakota School of Mines and
Technology, 1959.

Thesis: Solutions of Nonlinear Integral Equations and Their Application to Singular
Perturbation Problems.

Ying-Chu Lin Wu (*Aeronautics*). B.E., National Taiwan University, 1955; M.S.,
Ohio State University, 1959.

Thesis: Flow Generated by Suddenly Heated Flat Plate.

Robert Eugene Zartman (*Geology*). B.S., Pennsylvania State University, 1957;
M.S., California Institute of Technology, 1959.

Thesis: A Geochronological Study of the Lone Grove Pluton from the Llano Uplift,
Texas.

Jonas Stasys Zmuidzinis (*Physics and Mathematics*). B.S., Indiana Technical College,
1958; M.S., California Institute of Technology, 1959.

Thesis: High-Energy Nucleon Compton Scattering.

Prizes and Awards

AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS AWARD

Awarded to the student member of the AIAA attaining the best scholastic record in engineering or the physical sciences.

IVAR HARALD TOMBACH

DON BAXTER, INC. PRIZES

Awarded to the undergraduate students who during the year have carried out the best original researches in chemistry.

First Prize: ALAN C. WRIGHT

Second Prize: DAVID L. BARKER

Honorable Mention: JESSE L. BEAUCHAMP
ROBERT D. BRUNER

E. T. BELL MATHEMATICS PRIZE

Awarded annually to one or more juniors or seniors for outstanding original research in mathematics.

EDWARD A. BENDER

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CONGER PEACE PRIZES

Established in 1912 by the late Everett D. Conger, D.D., for the promotion of interest in the movement toward universal peace, and for the furtherance of public speaking.

First Prize: STEVEN MORSE

Second Prize: ROGER C. DAVISSON

Prizes and Awards

EASTMAN KODAK SCIENTIFIC AWARDS

Awarded to doctoral students on the basis of outstanding contributions and progress either in graduate studies and research or in teaching.

Chemistry: NICHOLAS J. TURRO, JR.

GEORGE M. WHITESIDES

Physics: KENNETH I. KELLERMANN

DAVID JOSEPH MACPHERSON PRIZE

Awarded annually to the graduating senior in engineering who best exemplifies excellent in scholarship.

KARVEL K. THORNER

MARY A. EARLE MCKINNEY PRIZES

Established in 1946 by the late Samuel P. McKinney, M.D., as a memorial to his mother, to cultivate proficiency in writing.

First Prize: VOLKER M. VOGT

Second Prize: LARRY RABINOWITZ

Third Prize: PHILIP H. BOWLES

Fourth Prize: MICHAEL J. COSGROVE

DON SHEPARD AWARDS

Awarded annually to one or more outstanding residents of the Student Houses in order to pursue cultural opportunities which they might otherwise not be able to enjoy.

CARTER G. NAYLOR

GERALD H. THOMAS

