



*Seventy-Sixth
Annual Commencement
June 12, 1970*

CALIFORNIA INSTITUTE OF TECHNOLOGY

Seventy-Sixth
Annual
Commencement

FRIDAY MORNING AT TEN-THIRTY O'CLOCK
JUNE TWELFTH, NINETEEN SEVENTY

Academic Procession

Chief Marshal, William H. Corcoran, Ph.D.

Assistant Marshals

Donald S. Clark, Ph.D. Hardy C. Martel, Ph.D.

David C. Elliot, Ph.D. Jon Mathews, Ph.D.

David S. Wood, 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

THE CHAIRMEN OF DIVISIONS

THE DEANS

THE PROVOST

THE TRUSTEES

THE COMMENCEMENT CHAPLAIN

THE PRESIDENT

THE CHAIRMAN OF THE BOARD OF TRUSTEES

Program

CALIFORNIA INSTITUTE OF TECHNOLOGY SEVENTY-SIXTH ANNUAL COMMENCEMENT

PRESIDING Arnold O. Beckman, Ph.D., LL.D.
Chairman of the Board of Trustees

PRELUDE AND PROCESSIONAL
James H. Shearer, A.R.C.M., A.R.C.O., *Organist*

INVOCATION
Bishop Gerald Kennedy, Ph.D., LL.D., LH.D., Litt.D., S.T.D., D.D.
Resident Bishop, Los Angeles Area, The United Methodist Church

COMMENCEMENT ADDRESS "Science Is Relevant"
Philip Handler, Ph.D.
President, National Academy of Sciences

CONFERRING OF DEGREES Harold Brown, Ph.D., D.Eng., LL.D.
President, California Institute of Technology

PRESENTATION OF CANDIDATES FOR DEGREES
For the degree of Bachelor of Science David S. Wood, Ph.D.
Associate Dean of Students

For the degree of Master of Science Harold Lurie, Ph.D.
Associate Dean of Graduate Studies

For the degree of Engineer F. Bohnenblust, Ph.D.
Dean of Graduate Studies

For the degree of Doctor of Philosophy Dean Bohnenblust

CONCLUDING REMARKS President Brown

BENEDICTION Bishop Kennedy

RECESSIONAL Mr. Shearer

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

ACADEMIC DRESS

The costume of those in the academic procession has a specific symbolism which dates back to at least the 14th century. While there have been many changes in the details, the meaning of the various parts of the costume continues to be the same. Academic institutions in the United States adopted a code of academic dress in 1895 which has been revised from time to time. The dress of institutions in other countries varies considerably, but the basic elements are present in all academic costumes.

GOWNS. The bachelor's gown has long, pointed sleeves; the master's gown has an oblong sleeve open at the wrists (or some older gowns may be open near the upper part of the arm); the doctor's gown is fuller than the others with velvet panels full length on the front and three velvet crossbars on each sleeve in black or in the color distinctive of the subject to which the owner's degree pertains. The gowns are always black except for the doctor's, which in a few instances is of a color representing the institution which conferred the degree.

HOODS. The hood, draped over the shoulders and down the back, indicates the subject to which the degree pertains and the university that conferred the degree. The level of the degree is indicated by the size of the hood. The hood for the bachelor's degree is three feet long; for the master's it is three and one-half feet long; and for the doctor's it is four feet long. The binding of the hood is of colored velvet designating the subject of the degree, and it is two inches, three inches, and five inches wide for the bachelor's, master's and doctor's degrees respectively. The colors associated with some of the subjects are as follows:

Arts, Letters, Humanities, <i>White</i>	Pharmacy, <i>Olive Green</i>
Commerce, Accountancy, Business, <i>Drab</i>	Philosophy, <i>Dark Blue</i>
Economics, <i>Copper</i>	Public Administration, including Foreign Service, <i>Peacock Blue</i>
Education, <i>Light Blue</i>	Public Health, <i>Salmon Pink</i>
Engineering, <i>Orange</i>	Science, <i>Golden Yellow</i>
Fine Arts, including Architecture, <i>Brown</i>	Theology, <i>Scarlet</i>
Law, <i>Purple</i>	
Medicine, <i>Green</i>	

The lining of the hood is of the color or colors of the institution conferring the degree. When two colors are used, they are usually arranged in a single chevron. The lining of the doctor's hood is revealed more than in the master's, and much less is revealed in the bachelor's hood.

CAPS. In the United States, the black mortarboard is most commonly used. The tassel fastened to the center of the cap is normally worn in the left front quadrant of the cap and is black, although it may be of the color appropriate to the subject of the degree. The tassel for a doctor's cap may be of gold thread.

Candidates for Degrees

BACHELOR OF SCIENCE

Michael Jack Abrams, *Beachwood, Ohio*. Biology.
Robin Adler, *Saratoga, California*. Engineering.
Robert Joseph Allen, *Tollhouse, California*. Engineering.
Ivars Ambats, *Monroe, Michigan*. Physics.
William Bradford Atwood, *Auburndale, Massachusetts*. Physics.
Bruce Stafford Ault, *Palm Desert, California*. Chemistry.
Rahul Dev Basu, *Calcutta, India*. Engineering.
Stephen Charles Beach, *Torrance, California*. Physics.
Claude Alan Beagle, *Sacramento, California*. Engineering.
Thomas Jay Bicknell, *Livermore, California*. Engineering-Economics.
Mark Eliot Boulé, *Downey, California*. Geology.
Robert William Brackenbury, *Long Beach, California*. Biology.
William Guerin Bradley, Jr., *Los Angeles, California*. Chemical Engineering.
Victor Lee Bresson, *Covina, California*. Biology.
Michael David Broido, *Lakewood, California*. Mathematics.
Peter Carsley Brown, *Watsonville, California*. Mathematics.
Raymond P. Buland, *Redlands, California*. Physics.
Richard Roderick Burton, *San Diego, California*. Mathematics.
L. William Butterworth, *Hinsdale, Illinois*. Engineering.
Charles Dennis Carrie, *Sunland, California*. Mathematics.
Roger Alan Chevalier, *Hinsdale, Illinois*. Astronomy.
Alan Jeffrey Coles, *Leonia, New Jersey*. Physics.
Vernon Francis Cormier, *Santa Rosa, California*. Geophysics.
John Jerome Coyle, Jr., *Oklahoma City, Oklahoma*. Physics.
Christopher John Cunningham, *Menlo Park, California*. Engineering.
Thomas Rowlands Davis, *Denver, Colorado*. Mathematics.
Leonard Doberne, *North Hollywood, California*. Physics.
Richard Foster Doyle, *La Jolla, California*. Geology.
George Philip Drake, *Evanston, Illinois*. Economics.
Willis Kirk Drake, Jr., *Edina, Minnesota*. Engineering.
Robert James Drean, *Fairlawn, New Jersey*. Physics.
Giles Anthony Duesdieker, *Millbrae, California*. Physics.
Donald Paul Echelbarger, *Lone Pine, California*. Mathematics.
Keith Allen Edwards, *Pasadena, California*. Physics.
Allan Barry Elkowitz, *Houston, Texas*. Physics.
Donald B. Engelman, *Elberta, Alabama*. Physics.
Reuben Epstein, *Pasadena, California*. Physics.

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

BACHELOR OF SCIENCE—Continued

Neal Rider Erickson, *Terre Haute, Indiana*. Physics.
Phillip Miles Erwin, *Muskogee, Oklahoma*. Physics.
Franklin Frederick Everts, *Bowie, Maryland*. Mathematics.
Jerry Mark Feinberg, *Seattle, Washington*. Mathematics.
Steven Fershtut, *Baltimore, Maryland*. Engineering.
Steven Douglas Flanagan, *Columbus, Georgia*. Biology.
Kenneth T. Fong, *Portland, Oregon*. Engineering.
Yee-Wing Fong, *Mission Viejo, California*. Biology.
Robert Alan Frohwerk, *Portland, Oregon*. Engineering.
Gene Tsuro Fujimoto, *Seabrook, New Jersey*. Chemistry.
James Leroy Gould, *Tulsa, Oklahoma*. Biology.
David Allan Grano, *Arlington, Massachusetts*. Physics.
Robert James Gray, *Canoga Park, California*. Mathematics.
Peter David Hartzman, *North Hollywood, California*. Mathematics.
Steven Ludvic Heisler, *Sacramento, California*. Chemical Engineering.
Michael Augustine Henerey, *Webster Groves, Missouri*. Biology.
David Paul Hermeyer, *Hemet, California*. Physics.
Allen Gene Hirsh, *Toms River, New Jersey*. Biology.
William Clifford Hocker, *Richmond, Virginia*. English.
Neil Conrad Holmes, *Loveland, Colorado*. Physics.
Derry Paul Hornbuckle, *St. Louis, Missouri*. Engineering.
Stephen Michael Horner, *Corpus Christi, Texas*. Economics.
Tex Lawrence Horning, *Woodland Hills, California*. Chemistry.
James Joshua Horwitz, *Waban, Massachusetts*. Mathematics.
Richard Edwin Howard, *Fresno, California*. Physics.
Kenneth Lowell Hultman, *Omaha, Nebraska*. Physics.
William Buell Inwood, *South Bend, Indiana*. Biology.
Robert Earl Jackson, Jr., *Hayward, California*. Physics.
Atul Jain, *Dehradun, U. P., India*. Engineering.
Eric Bruce Jensen, *Playa del Rey, California*. Astronomy.
Steven Andrew Johnson, *Los Angeles, California*. Mathematics.
Andrew Horace Joseph, *Riverside, California*. Economics.
Michael L. Kahn, *Santa Fe, New Mexico*. Physics.
Akihiro Kanamori, *San Francisco, California*. Mathematics.
William Paul Kells, *Wallkill, New York*. Physics.
Samuel McKennan Keys, Jr., *Lincoln, Illinois*. Economics.
Frederick William Klein, *Los Altos, California*. Astronomy.
Steven David Kraus, *New Orleans, Louisiana*. Chemistry.
Pui Kuan, *China*. Astronomy.
Man-King Lee, *Happy Valley, Hong Kong, B.C.C.* Engineering.
Stanley Phillip Levy, *Oaklyn, New Jersey*. Engineering.
David Isaac Lewin, *Philadelphia, Pennsylvania*. Biology.
Michael Joseph Lindenfeld, *Queens Village, New York*. Physics.
Alexander Constantine R. Livanos, *Athens, Greece*. Engineering.
Richard Benfer Lohman, *Danville, Pennsylvania*. Engineering.

BACHELOR OF SCIENCE—Continued

Leo Gomez Lomeli, *La Verne, California*. Physics.
James Duncan MacNair, Jr., *Chappaqua, New York*. Physics.
Isaac Majerovicz, *Bogota, Colombia*. Engineering.
Petros Zanis Mantarakis, *New York City, New York*. Astronomy.
Thomas Henry Markert, *Alliance, Ohio*. Physics.
Howard Dennis Marshall, *Twin Falls, Idaho*. Engineering.
Martin Joseph Marshall, *Pasadena, California*. Physics.
Douglas Colbourne Mason, *Winter Park, Florida*. Chemistry.
John Joseph McCarthy, Jr., *North Bergen, New Jersey*. Physics.
Mark John Meldgin, *Oak Lawn, Illinois*. Chemistry.
Thomas Edward Metke, *Seattle, Washington*. Engineering.
Thomas Dale Miller, *Portland, Oregon*. Engineering.
Kevin Michael Monahan, *Brunswick, Maine*. Physics.
Terrence Neil Moore, *Thousand Oaks, California*. Mathematics.
Armando Fernandes da Silva Moreira, *Rio de Janeiro—GB, Brazil*. Physics.
Gary Toshi Murata, *Sacramento, California*. Physics.
Vard A. Nelson, *Pasadena, California*. Physics.
Carl Richard Neu, *Arlington, Virginia*. Economics.
James Louis Nocar, *Medina, Ohio*. Astronomy.
Arthur Ogawa, *Altadena, California*. Physics.
Daniel H. Olsson, *Portland, Oregon*. Engineering.
Lesley Bennett Orr, *New Haven, Connecticut*. Economics.
Edward Allen Overman II, *Anaheim, California*. Physics.
Steven Lawrence Patt, *New Brunswick, New Jersey*. Chemistry.
Steven Robert Patterson, *Tujunga, California*. Physics.
Peter Kelley Pearson, *Orinda, California*. Chemistry.
Harry William Peterson, *Phoenix, Arizona*. Physics.
Richard Dickson Piccard, *Swarthmore, Pennsylvania*. Physics.
Dennis Emil Pocekay, *Richmond, California*. Engineering.
Dana Auburn Powers, *Coalinga, California*. Chemistry.
Glenn Downes Prestwich, *New Hartford, New York*. Chemistry.
Donald Ralph Putnick, *San Gabriel, California*. Engineering.
Carl Christopher Reed, *Rio Piedras, Puerto Rico*. Physics.
Douglas Eric Reul, *Chatsworth, California*. Physics.
Gregory Maynard Rewoldt, *Ann Arbor, Michigan*. Physics.
James Harlan Richards, *Englewood, Colorado*. Biology.
Jeffery Howard Richardson, *San Leandro, California*. Chemistry.
Stefan Conrad Riesenfeld, *Berkeley, California*. Physics.
David Philip Rossum, *San Jose, California*. Biology.
Fred Pete Roullard III, *Visalia, California*. Physics.
Michael Ruth, *Mission Viejo, California*. Biology.
Steven L. Salem, *Pasadena, California*. Physics.
Bruce Victor Samuelson, *Sherman Oaks, California*. Physics.
David Pineles Schor, *Visalia, California*. Biology.
Jeffrey Mark Schredder, *Burbank, California*. Biology.

BACHELOR OF SCIENCE—Continued

Edward A. Schroeder IV, *Basking Ridge, New Jersey*. Economics.
Adrian Charles Smith, Jr., *San Luis Obispo, California*. Engineering-Physics-English.
Emilio Temoche Sovero, *Lima, Peru*. Engineering.
Michael Robert Sperry, *Loveland, Colorado*. Engineering.
Michael Scott Stefanko, *Santa Clara, California*. Economics.
Arden Lynn Steinbach, *San Diego, California*. Physics.
John Alfred Stevenson, *Phoenix, Arizona*. Physics.
Howard H. Stover, *Hammond, Indiana*. Engineering.
Richard Allan Strelitz, *Hewlett Harbor, New York*. Geophysics.
Peter Szolovits, *Los Angeles, California*. Physics.
James Joseph Taylor, *Phoenix, Arizona*. Chemical Engineering.
Trinh Xuan Thuan, *Saigon, South Vietnam*. Physics.
Craig Campbell Todd, *Solvang, California*. Physics.
Sze-Hoi Henry Tye, *Hong Kong, B.C.C.* Physics.
Craig Edwin Tyner, *Anchorage, Alaska*. Chemical Engineering.
William Mabry Tyson, *Houston, Texas*. Mathematics.
Joseph Robert Vance III, *Albany, Georgia*. Geophysics.
Richard Craig Vincent, *Richmond, California*. Chemical Engineering.
Alan Woodrow Walker, *North Caldwell, New Jersey*. Physics.
Larry R. Waterland, *Junction City, Kansas*. Chemical Engineering.
Paul Howard White, *Hanford, California*. Mathematics.
Steven Warren Wierenga, *Loveland, Colorado*. Engineering.
Peter Michael Wilzbach, *Evergreen Park, Illinois*. Engineering.
Paul Alan Winter, *Pasadena, California*. Engineering.
Rayman Young Wong, *Los Angeles, California*. Chemistry.
John Peter Wronowski, *Uncasville, Connecticut*. Engineering.
Peter Ernest Youtz, *San Rafael, California*. Engineering.
Hans Peter Zassenhaus, *Worthington, Ohio*. Biology.

MASTER OF SCIENCE

- George Efstratios Apostolakis (*Engineering Science*). Dipl., National Technical University of Athens, 1969.
- Luiz Telmo Auler (*Physics*). B.S., Universidade da Guanabara, 1962.
- Robert Charles Balcer (*Aeronautics*). B.S.M.E., Worcester Polytechnic Institute, 1969.
- Warren Scott Baldrige (*Geology*). A.B., Hamilton College, 1967.
- Mark Louis Bartelt (*Mathematics*). B.S., California Institute of Technology, 1969.
- Karl Ammon Bell (*Chemical Engineering*). B.S., Lehigh University, 1969.
- Karl Richard Blasius (*Planetary Science*). B.S., Michigan State University, 1969.
- Kwasi Kete Bofah (*Aeronautics*). B.S., Purdue University, 1969.
- Lawrence Leo Bogemann (*Aeronautics*). B.S., Purdue University, 1961.
- John Robert Born (*Civil Engineering*). B.S., Yale University, 1967; B.A., Cambridge University, 1969.
- David Boss (*Mathematics*). B.S., Clarkson College of Technology, 1967.
- Richard Frederick Boyce (*Materials Science*). B.S., Tulane University, 1969.
- Kenneth Alan Braly (*Astronomy*). A.B., Princeton University, 1969.
- Keith Howard Burrell (*Physics*). B.S., Stanford University, 1968.
- Fredrick Morey Cady (*Electrical Engineering*). B.S., Pennsylvania State University, 1966.
- Elizabeth Denise Campbell (*Biology*). B.A., Radcliffe College, 1968.
- Pierre Rene Charles (*Mechanical Engineering*). Math. Sup., Lycee Technique d'Etat de Reims, 1965; Math. Spec., 1966; Ing., Ecole Nationale Supérieure d'Electricite et de Mecanique, 1969.
- Duck Soo Choo (*Electrical Engineering*). B.S., Seoul National University, 1969.
- Ronald Lee Christenson (*Aeronautics*). B.S., United States Naval Academy, 1969.
- Kwong Wah Chu (*Astronomy*). S.B., Massachusetts Institute of Technology, 1967.
- Robert Edward Cohen (*Chemical Engineering*). B.S., Cornell University, 1968.
- James Albert Conte (*Engineering Science*). B.S., University of Rhode Island, 1969.
- Jean Francis Coudert (*Environmental Engineering Science*). Ing., Universite de Toulouse, 1968; Ing. Math., Institut Polytechnique de Grenoble, 1969.
- John Chester Cummings (*Aeronautics*). B.S., California Institute of Technology, 1969.
- Daniel Michael Curtis (*Mechanical Engineering*). B.S., Lehigh University, 1969.
- Uma Rasiklal Dalal (*Engineering Science*). B.S., Institute of Science, 1967.
- John Alan Derrmon (*Electrical Engineering*). B.S., Duke University, 1969.
- Jean-Pierre Dolait (*Aeronautics*). Diploma in Mechanical Engineering, Ecole Nationale D'Ingenieurs Arts et Metiers, 1969.
- Kevin Gerard Donohoe (*Chemical Engineering*). B.S., Newark College of Engineering, 1969.

MASTER OF SCIENCE—*continued*

- Tommy Charles Douglas (*Biology*). A.B., Princeton University, 1969.
- Robert Alexander Dukelow (*Electrical Engineering*). B.S., California Institute of Technology, 1969.
- James M. Ehlbeck (*Mechanical Engineering*). B.S., University of Washington, 1969.
- Moises Eisenberg-Grunberg (*Biology*). B.A., University de Chile, Faculty of Medicine, 1962; University de Chile, Faculty of Science, 1967.
- Margaret Cosgrove Everett (*Engineering Science*). B.A., Harpur College, 1968.
- Helio Fagundes (*Physics*). B.S., Universidade de Sao Paulo, 1963.
- Abdol Reza Faiz (*Mechanical Engineering*). B.S., University of Rhode Island, 1969.
- Bunsen Fan (*Electrical Engineering*). B.S., The University of Kansas, 1969.
- Thierry Dominique Faure (*Environmental Engineering Science*). Maitrise et Mecanique, Faculte des Sciences de Toulouse, 1968; Ing., Ecole Nationale Supérieure d'Informatique et d'Hydraulique, 1969.
- Marty Jon Fegley (*Aeronautics*). B.S., University of Colorado, 1969.
- Samuel Paul Feinstein (*Mechanical Engineering*). B.M.E., The Cooper Union, 1969.
- Robert Elliot Frank (*Chemistry*). A.B., Harvard College, 1965.
- George Richard Frost (*Aeronautics*). B.A.E., University of Minnesota, 1969.
- Jean-Noel Giraudbit (*Aeronautics*). Mecanique des Milieux Deformables, Faculte des Sciences, 1968.
- Atef Isaac Girguis (*Civil Engineering*). B.Sc., Cairo University, 1967.
- Walter Christian Gish (*Physics*). B.S., California Institute of Technology, 1968.
- Richard Ira Gomberg (*Engineering Science*). B.S., University of Puerto Rico, 1967.
- William Jerry Grabner (*Civil Engineering*). B.S., United States Military Academy, 1963.
- Edward George Groff (*Mechanical Engineering*). B.S., Pennsylvania State University, 1969.
- Esin Gulari (*Chemical Engineering*). B.S., Robert College, School of Engineering, 1969.
- Narendra Kumar Gupta (*Aeronautics*). B. Tech., Indian Institute of Technology, Delhi, 1969.
- John Henry Hall (*Geochemistry*). B.A., Reed College, 1967.
- George Hyland Hayes (*Mechanical Engineering*). B.S.M.E., Howard University, 1969.
- Craig Peter Helberg (*Aeronautics*). B.S., California Institute of Technology, 1969.
- Daniel Francis Higgins (*Physics*). B.S., University of Illinois, 1968.
- Todd King Hinkley (*Geology*). A.B., Occidental College, 1964.
- Robin David Alexander Hirschfeld (*Applied Mechanics*). B.Sc., University of Newcastle-Upon-Tyne, 1967.
- Bruce Hoeneisen (*Electrical Engineering*). Eng. Civil-Electrical, University of Chile, 1968.
- Gordon Henry Holze (*Mechanical Engineering*). B.S., University of Illinois, 1969.

MASTER OF SCIENCE—continued

- James David Hutchinson (*Mechanical Engineering*). B.A.Sc., University of Toronto, 1969.
- Nicole Imbert (*Engineering Science*). Cert. Maitrise in Information Science, Faculte de Sciences, 1969; Diplome d'Ingenieur, Ecole Nationale Superieure de l'Aeronautique, 1969.
- George Iverson, Jr. (*Aeronautics*). B.S., University of Washington, 1952.
- George Anthony Jackson (*Environmental Engineering Science*). B.S., California Institute of Technology, 1969.
- Atul Jain (*Electrical Engineering*). B.S., California Institute of Technology, 1969.
- John Berkeley Jamieson (*Biology*). B.A., University of California, Berkeley, 1967.
- Ernest Yuh Nung Jan (*Physics*). B.S., National Taiwan University, 1967.
- Javier Jiminez-Sendin (*Aeronautics*). Ingeniero Aeronautico, Escuela Technica Superior de Ingenieros Aeronauticos, 1969.
- Thomas Hillman Jordan (*Geology*). B.S., California Institute of Technology, 1969.
- Michael Jon Kaiserman (*Aeronautics*). B.S.A.E., University of Arizona, 1967.
- Gregory Nicolas Kourilsky (*Mathematics*). B.S., California Institute of Technology, 1968.
- Arun Narayan Kulkarni (*Aeronautics*). B.E. Mech., College of Engineering, Poona, 1969.
- Vijay Anand Kulkarny (*Aeronautics*). B. Tech., Indian Institute of Technology, 1969.
- Dwight Anthony Landis (*Mechanical Engineering*). B.S., Loyola University, 1969.
- Juan Eduardo Leon (*Mechanical Engineering*). Ingeniero Mecanico, Universidad Central Facultad de Ingenieria, 1966.
- Thomas William Logsdon (*Engineering Science*). B.A., Washington State University, 1969.
- William Carl Lyford (*Mathematics*). B.S., Clarkson College, 1966.
- Pierce Allen Lynne (*Electrical Engineering*). B.S., Purdue University, 1969.
- Ray William MacDonald (*Engineering Science*). B.S., United States Military Academy, West Point, 1968.
- David Rodgers MacQuigg (*Electrical Engineering*). B.S., California Institute of Technology, 1969.
- Anupam Madhukar (*Physics*). B.Sc., University of Lucknow, 1967; M.S., Indian Institute of Technology, 1968.
- Hisatoshi Maeda (*Electrical Engineering*). B.E., Tokyo University, 1967; M.E., Graduate School of Tokyo University, 1969.
- Narayan Krishna Mahale (*Aeronautics*). B. Tech., Indian Institute of Technology, Bombay, 1969.
- James Kenneth Mardian (*Physics*). B.S., Cornell University, 1968.
- Gerald Rhodney Martin (*Mathematics*). B.A., Macalester College, 1968.
- William Linus Martin III (*Aeronautics*). B.S., California Institute of Technology, 1969.

MASTER OF SCIENCE—*continued*

- David Richard Martinez (*Applied Mechanics*). B.S.M.E., University of New Mexico, 1969.
- Carl Frederick Melius (*Chemistry*). B. Chem., University of Minnesota, 1968.
- Gabriel Menkes (*Civil Engineering*). B.Sc., Technion, Israel Institute of Technology, 1967.
- Jovka Michova (*Electrical Engineering*). B.S.E.E., State's Polytechnic Institute, Sofia, Bulgaria, 1952.
- Gavien Nobuyuki Miyata (*Aeronautics*). B.S., California Institute of Technology, 1969.
- Vivek Caesar Monteiro (*Physics*). B.Sc., St. Xaviers College, 1968.
- Albert Patrick Mortola (*Chemistry*). B.S., Fordham University, 1968.
- Stanley Joseph Mark Mozda (*Mechanical Engineering*). B.S.M.E., Newark College of Engineering, 1969.
- Clyde Dave Newman (*Chemical Engineering*). B.E., The Cooper Union, 1969.
- Richard Walter Noren (*Chemistry*). B.S., University of Notre Dame, 1968.
- Thomas James Noyes (*Mathematics*). B.A., Oakland University, 1967.
- Augustus Oemler, Jr. (*Astronomy*). A.B., Princeton University, 1969.
- Thales Michael Papazoglou (*Mechanical Engineering*). Dipl., National Technical University of Athens, 1968.
- Richard Dana Pashley (*Electrical Engineering*). B.A., University of Colorado, 1969.
- Barry Stephen Poland (*Electrical Engineering*). B.S., Rensselaer Polytechnic Institute, 1969.
- Robert Edward Powell (*Geology*). A.B., Middlebury College, 1969.
- Harold Byrd Ray (*Mechanical Engineering*). B.S., University of California, Los Angeles, 1963.
- Douglas Kent Reece (*Engineering Science*). B.S., California Institute of Technology, 1969.
- Joseph Murray Riddell III (*Mathematics*). B.S., University of Texas, 1968.
- Donald Dean Rintala (*Electrical Engineering*). B.S., California Institute of Technology, 1969.
- Magdi Rizk (*Aeronautics*). B.S., Columbia University, 1969.
- Gerald Forrest Robertson (*Mechanical Engineering*). B.S., Pennsylvania State University, 1969.
- Thomas Samuel Robin (*Chemical Engineering*). B.S., University of California, Berkeley, 1968.
- Denis Robert Henryevich Rydjeski (*Biology*). B.S., Columbia University, 1966.
- August Lee Schultz (*Mechanical Engineering*). B.S., California Institute of Technology, 1969.
- Abraham Seiden (*Physics*). B.S., Columbia University, 1967.
- John Martin Sherfinski (*Physics*). B.A., University of Wisconsin, 1968.
- Henry Longfellow Shipman (*Astronomy*). B.A., Harvard College, 1969.

MASTER OF SCIENCE—continued

- Laurent Bernard Sidor (*Aeronautics*). B.E.S., Johns Hopkins University, 1969.
- Charles Oneal Slater (*Engineering Science*). B.S., Florida Agricultural and Mechanical University, 1968.
- Douglas Charles Smith (*Electrical Engineering*). B.E., Vanderbilt University, 1969.
- Sasson Roger Somekh (*Electrical Engineering*). B.S., University of Tel-Aviv, 1969.
- Peter Stavroulakis (*Electrical Engineering*). B.S., New York University, 1969.
- Juan Luis Steimle (*Chemical Engineering*). Ingeniero Quimico, National University of Mexico, 1968.
- Donald James Sterba (*Physics*). B.S., University of Wisconsin, 1966.
- John Daniel Stricklin (*Mechanical Engineering*). B.S., Oklahoma State University, 1969.
- Tsung-chow Joe Su (*Aeronautics*). B.Sc., National Taiwan University, 1968.
- James Edwin Swindell (*Mechanical Engineering*). B.S., Southern Methodist University, 1969.
- Donald Hiroshi Tanaka (*Aeronautics*). B.Sc., United States Naval Academy, 1969.
- Andrew U. Tenne-Sens (*Electrical Engineering*). B.Eng., McGill University, 1969.
- Edward Michael Trujillo (*Chemical Engineering*). B.S., University of Arizona, 1969.
- Kin Hing Tsang (*Aeronautics*). B.S., California Institute of Technology, 1969.
- Bobby Lee Ulich (*Electrical Engineering*). B.S., Texas A & M University, 1969.
- John L. Ullmann (*Physics*). B.S., University of Wisconsin, 1968.
- George Zino Voyiadjis (*Civil Engineering*). B.Sc., Ain Shams University, 1969.
- Chi-Shin Wang (*Physics*). B.Sc., National Taiwan University, 1967.
- Allan E. Williams (*Chemistry*). B.S., University of Redlands, 1965.
- Spencer Hoffman Wood (*Geophysics*). B.S., Colorado School of Mines, 1964.
- Guillaume Worms (*Aeronautics*). Ing. Civil de l'Aeronautique, Ecole Nationale Supérieure de l'Aeronautique, 1969.
- Mashio Yatsuzuka (*Civil Engineering*). B.S., Kobe University, 1966; M.S., 1968.
- Kung Chung Lily Yeh (*Physics*). B.S., National Taiwan University, 1968.
- Linda Diane Yurk (*Electrical Engineering*). B.S.E., University of Michigan, 1969.
- Sheldon Howard Zemell (*Applied Mathematics*). B.Sc., University of Toronto, 1967; M.Sc., University of Toronto, 1968.

ENGINEER

- John Edwin O'Pray (*Aeronautical Engineer*). B.S., California Institute of Technology, 1967; M.S., 1968.
- Hermanus Snel (*Aeronautical Engineer*). Ing., Delft Technological University, 1967.

DOCTOR OF PHILOSOPHY

- Michael I. Baskes (*Materials Science, Physics and Economics*). B.S., California Institute of Technology, 1965.
Thesis: A Generalized Treatment of the Order-Disorder Transformation in Alloys and its Effect on their Magnetic Properties.
- Henry Joel Bilow (*Electrical Engineering*). B.S.E.E., Illinois Institute of Technology, 1965; M.S.E.E., 1966.
Thesis: Electromagnetic Wave Propagation and Scattering in a Randomly-Inhomogeneous Dielectric Sphere.
- James Edwin Blakemore (*Chemical Engineering*). B.S., The University of Tennessee, 1966.
Thesis: The Pyrolysis and Partial Oxidation of N-Butane.
- Donald Lawrence Blumenthal (*Aeronautics*). B.S., California Institute of Technology, 1965.
Thesis: Experimental Study of Satellite Wakes in a Simulated Ionospheric Plasma.
- Donald Maxwell Burland (*Chemistry and Physics*). A.B., Dartmouth College, 1965.
Thesis: Spectroscopic Investigations of Inter- and Intramolecular Processes in Crystalline Benzene.
- Philip Earl Cassidy (*Aeronautics*). S.B., Massachusetts Institute of Technology, 1963; S.M., 1963.
Thesis: An Investigation of Non-Equilibrium Phenomena in an Argon Free-Jet Plasma.
- Richard Guy Casten (*Applied Mathematics*). A.B., Temple University, 1965.
Thesis: Methods for Deriving Conservation Laws.
- Richard Bruce Chapman (*Engineering Science*). B.S., Purdue University, 1965; M.S., California Institute of Technology, 1966.
Thesis: Nonspherical Vapor Bubble Collapse.
- Yu-Ssu Chen (*Physics*). B.S., National Taiwan University, 1963; M.A., Rice University, 1966.
Thesis: A Study of the Decay Modes of the ${}^9\text{Li}$ Nucleus.
- Shui-uh Cheng (*Physics*). B.S., National Taiwan University, 1963; M.S., Tufts University, 1966.
Thesis: Measurement of Recoil Proton Polarization in π^0 Photoproduction at 60° and 90° , Using a Wire Chamber System.
- Kwang-nan Chow (*Mathematics*). B.S., National Taiwan University, 1964.
Thesis: Representing Measures on the Royden Boundary for Solutions of $\Delta u = Pu$ on a Riemannian Manifold.
- Billie Mae Chu (*Aeronautics*). B.A., Agnes Scott College, 1968; M.A., Emory University, 1949.
Thesis: Rheological Properties of Soft Extensible Animal Tissue in Both Living and Excised States.

DOCTOR OF PHILOSOPHY—*continued*

- David Alvin Clayton (*Biophysics and Chemistry*). B.S., Northern Illinois University, 1965.
Thesis: I. Occurrence and Structure of Complex Mitochondrial DNA in Human Leukemic Leukocytes and Normal Mammalian Tissues.
II. Use of Alkali Metal Salts of Trichloroacetic Acid as Buoyant Denaturing Solvents for DNA.
- Robert Sanderson Cooke (*Chemistry*). A.B., Wesleyan University, 1966.
Thesis: The Naphthalene Sensitized Photoracemization of Sulfoxides.
- Sydney Pollock Craig III (*Developmental Biology and Genetics*). B.S., Purdue University, 1966.
Thesis: Mitochondria and the Development of Sea Urchin Embryos.
- Dikran Damlamayan (*Electrical Engineering and Physics*). B.S., California Institute of Technology, 1963; M.S., 1964.
Thesis: Analysis of Aperture Antennas in Inhomogeneous Media.
- Theodore Herbert Davey (*Electrical Engineering*). B.S., California Institute of Technology, 1962; M.S., 1963.
Thesis: The Conjugate Representation of Signal Envelope.
- Ronald Wayne Davis (*Chemistry*). B.S., Eastern Illinois University, 1964.
Thesis: A Study of the Base Sequence Arrangements in DNA by Electron Microscopy.
- Peter William Day (*Mathematics*). B.S., Emory University, 1966.
Thesis: Rearrangements of Measurable Functions.
- Richard John Defouw (*Astronomy*). A.B., Harvard University, 1966.
Thesis: Thermal Instability and the Convective Stability of Stellar Chromospheres.
- John Cedric Dill (*Engineering Science*). B.A.Sc., University of British Columbia, 1962; M.S., North Carolina State College of Agriculture and Engineering, 1964.
Thesis: A Computer-Aided Investigation of Motion Detection Units in the Fly.
- Thomas Harold Dunning, Jr. (*Chemistry*). B.S., University of Missouri, 1965.
Thesis: The Excitation Operator Method and the Valence Excited States of Ethylene.
- Benjamin Nathaniel Early (*Electrical Engineering and Mathematics*). B.S., Howard University, 1966; M.S., California Institute of Technology, 1967.
Thesis: Stochastic Optimal Control.
- Michel Sadek El Raheb (*Aeronautics and Applied Mathematics*). B.Sc., Cairo University, 1964; M.S., California Institute of Technology, 1966.
Thesis: Some Approximations in the Dynamic Shell Equations.
- Christopher England (*Chemical Engineering*). B.S., University of Southern California, 1965; M.S., California Institute of Technology, 1967.
Thesis: I. The Rate and Mechanism of the Vapor-Phase Reaction Between Water and Parts-Per Million Concentrations of Nitrogen Dioxide.
II. The Rate and Mechanism of the Air Oxidation of Parts Per-Million Concentrations of Nitric Oxide in the Presence of Water Vapor.

DOCTOR OF PHILOSOPHY—*continued*

- Paul Lee Fehder (*Chemistry*). S.B., Massachusetts Institute of Technology, 1964.
Thesis: A Molecular Dynamics Study of the Microscopic Properties of Simple Dense Fluids.
- John Lionel Firkins (*Chemistry and Business Economics*). B.Sc. (Hons), University of Victoria, 1965.
Thesis: Norbornenyl- and Nortricyclyl-Free Radicals.
- Raymond Kurt Fisher (*Physics and Aeronautics*). S.B., Massachusetts Institute of Technology, 1965.
Thesis: Resonance Cones in the Field Pattern of a Short Radio Frequency Probe in a Warm Anisotropic Plasma.
- Jonathan Akin French (*Civil Engineering and Economics*). A.B., Harvard College, 1961; M.S., California Institute of Technology, 1964.
Thesis: Wave Uplift Pressures on Horizontal Platforms.
- Ernest William Goodell (*Biophysics and Chemistry*). B.S., Colorado State University, 1964.
Thesis: Processes Affecting Growth of *Phycomyces* Sporangiophores.
- Seymour Evan Goodman (*Applied Mathematics*). B.S., Columbia University, 1965; M.S., 1966.
Thesis: The Hydro-Kinetic Theory of Liquid Helium II.
- Shakkottai P. Govindaraju (*Aeronautics*). B.E., University College of Engineering, 1962; M.E., Indian Institute of Science, 1964.
Thesis: I. An Analysis of Reiner's Centripetal Pump.
II. A Study of Some Turbulent Flows Using a Model for Inhomogeneous Turbulence.
- Robert Lee Gran (*Mechanical Engineering*). B.S., University of Washington, 1965; M.S., California Institute of Technology, 1966.
Thesis: Step Induced Separation of a Turbulent Boundary Layer.
Part I. Experiments in Supersonic Flow.
Part II. A Model for Incompressible Flow in a Channel.
- Jack Denney Griffith (*Biophysics*). B.A., Occidental College, 1964.
Thesis: High Resolution Electron Microscope Studies of Chromosomal Fibers.
- Edwin John Hamilton, Jr. (*Chemistry*). B.A., New York University, 1963.
Thesis: I. Free Radical Reaction Rates by Electron Paramagnetic Resonance.
II. Termination Rates of Substituted Benzophenone Ketyl Radicals in Alkanes.
- Loren Endicott Hatlen (*Biochemistry and Chemistry*). B.A., University of California, Santa Barbara, 1962.
Thesis: I. Structural Studies on HeLa 5s RNA.
II. Hybridization Studies with HeLa 4s and 5s RNA.
- Theodore William Hilgeman (*Physics*). S.B., Massachusetts Institute of Technology, 1964.
Thesis: Infrared Observations of H II Regions.

DOCTOR OF PHILOSOPHY—*continued*

- Donald Richard Hoffman (*Chemistry*). A.B., Harvard College, 1965.
Thesis: Model Systems for the Study of Drug Hypersensitivity.
- Hwei-kwan Hong (*Chemistry and Physics*). B.S., National Taiwan University, 1963; M.S., National Tsing Hua University, 1965.
Thesis: The Electronic States of Heavily-doped Molecular Crystals—Naphthalene and the Electronic Spectra of Pyrazine.
- Cornelius Oliver Horgan (*Applied Mechanics*). B.Sc., University College, Cork, 1964; M.S., 1965.
Thesis: Eigenvalue Problems Associated With Korn's Inequalities in the Theory of Elasticity.
- Richard Walter Hyman (*Chemistry*). B.S., University of California, Berkeley, 1962; M.S., Cornell University, 1964.
Thesis: On the Interaction of Actinomycin and DNA.
- Richard Norman Jacobson (*Chemical Engineering and Business Economics*). B.S., Michigan State University, 1965.
Thesis: Forced Convection Film Boiling of Subcooled Water around a Sphere.
- Kenneth Mark Jassby (*Materials Science*). B.Eng., McGill University, 1965; M.Eng., 1966.
Thesis: An Experimental Study of the Mobility of Edge Dislocations in Pure Copper Single Crystals.
- Torrence Vaino Johnson (*Planetary Science*). B.S., Washington University, 1966.
Thesis: Albedo and Spectral Reflectivity of the Galilean Satellites of Jupiter.
- Richard Douglas Kerr Josslin (*Cell Biology and Developmental Biology*). S.B., Massachusetts Institute of Technology, 1965.
Thesis: The Lysis Mechanism of Phage T4.
- Bruce Rene Julian (*Geophysics*). B.S., California Institute of Technology, 1964; M.S., 1966.
Thesis: Regional Variations in Upper Mantle Structure Beneath North America.
- Douglas Allan Keeley (*Astronomy and Physics*). B.Sc. (Hons), University of Manitoba, 1964.
Thesis: Static and Dynamical Models of Long-Period Variable Stars.
- Ronald Lee Kerber (*Engineering Science*). B.S., Purdue University, 1965; M.S., California Institute of Technology, 1966.
Thesis: Phase Transitions from the Solid State of Monatomic Elements.
- John Kent Koester (*Applied Mechanics and Physics*). B.S., University of Notre Dame, 1964; M.S., California Institute of Technology, 1965.
Thesis: Analytical and Experimental Study of Thermionically Emitting Electrodes in Contact with Dense, Seeded Plasmas.
- David Louis Kreinick (*Physics and Economics*). B.A., Brandeis University, 1963; M.S., California Institute of Technology, 1965.
Thesis: High Energy Photoproduction of Neutral Mesons.

DOCTOR OF PHILOSOPHY—continued

- Mark Howard Kryder (*Electrical Engineering and Physics*). B.S., Stanford University, 1965; M.S., California Institute of Technology, 1966.
Thesis: Flux Reversal in Ferromagnetic Thin Films.
- Harold Theodore Larson (*Physics and Business Economics*). B.A., Los Angeles State College, 1963; M.S., California Institute of Technology, 1965.
Thesis: Neutron-Neutron Scattering Parameters from the $^3\text{He}(d,t)2p$ and $^3\text{H}(d,^3\text{He})2n$ Reactions.
- James Robert Lawrence (*Geochemistry*). B.S., Union College, 1964; M.S., California Institute of Technology, 1966.
Thesis: $\text{o}^{18}/\text{o}^{16}$ and D/H Ratios of Soils, Weathering Zones, and Clay Deposits.
- Chong Sung Lee (*Chemistry*). B.S., Seoul National University, 1964.
Thesis: I. Studies on Bacteriophage DNA's and Minicircular DNA's in *M. lysodeikticus* and *E. coli* 15.
II. Flow Dichroism of DNA Solutions.
- Jiin-jen Lee (*Civil Engineering*). B.S., National Taiwan University, 1962; M.S., Utah State University, 1966.
Thesis: Wave Induced Oscillations in Harbors of Arbitrary Shape.
- Jo Woong Lee (*Chemistry and Physics*). B.S., Seoul National University, 1964; M.S., 1966.
Thesis: Spin-Internal-Rotation Interaction and Nuclear Spin Relaxation in the Presence of Internal Rotation.
- Menachem Levanoni (*Physics*). B.Sc., Hebrew University, Jerusalem, 1964.
Thesis: Hyperfine Interactions and Nuclear Structure.
- Jerre Levy (*Psychobiology*). B.A., University of Miami, 1962; M.S., 1965.
Thesis: Information Processing and Higher Psychological Functions in the Disconnected Hemispheres of Human Commissurotomy Patients.
- Robert Gary Lindgren (*Chemical Engineering and Applied Mathematics*). B.S., University of Minnesota, 1965.
Thesis: Theory of the Positive Column.
- Glenn Richard Luecke (*Mathematics*). B.S., Michigan State University, 1966.
Thesis: Paranormal Operators on a Hilbert Space.
- Gary Luxton (*Physics*). B.Sc., McGill University, 1964; M.S., California Institute of Technology, 1966.
Thesis: The Complex Angular Momentum Theory of the Production of Three Particles in Collisions of Two Strongly Interacting Particles at High Energy.
- Lahmer Lynds (*Physical Chemistry*). B.A., University of California, Berkeley, 1954.
Thesis: I. Electron Spin Relaxation Studies of Manganese (II) Complexes in Acetonitrile.
II. Nuclear Spin Relaxation Studies of Manganese (II) Complexes in Acetonitrile.

DOCTOR OF PHILOSOPHY—continued

- Joyce Bennett Maxwell (*Genetics and Biochemistry*). A.B., University of California, Los Angeles, 1963.
Thesis: I. Synthesis of L-Amino Acid Oxidase by a Serine- or Glycine-Requiring Strain of *Neurospora*.
II. Studies Concerning Multiple Electrophoretic Forms of Tyrosinase in *Neurospora*.
- Arthur Bruce McDonald (*Physics*). B.Sc., Dalhousie University, 1964; M.Sc., 1965.
Thesis: Excitation Energies and Decay Properties of $T=3/2$ States in ^{17}O , ^{17}F and ^{21}Na .
- Robert Thomas Menzies (*Physics*). S.B., Massachusetts Institute of Technology, 1965; M.S., California Institute of Technology, 1967.
Thesis: Magnetic Field and Pressure Effects in a Saturated Gas Laser Amplifier.
- Georges Joseph Michaud (*Astronomy*). B.A., Universite Laval, Quebec, 1961; B.Ph., 1961; B.Sc., 1965.
Thesis: I. Diffusion Processes in A-Pec Stars.
II. Nucleosynthesis in Si Burning.
- David Michael Mog (*Chemistry*). B.S., Case Institute of Technology, 1964.
Thesis: Mechanistic Studies of a Model Reaction for Enzymatic Hydroxylation.
- Thomas Andrew Nagylaki (*Physics*). B.Sc. (Hons), McGill University, 1964.
Thesis: I. Current Commutators in Quantum Electrodynamics.
II. Electromagnetic Mass Differences of the Pseudoscalar Meson and Baryon Octets.
- John Edward Newbold (*Biophysics and Genetics*). B.Sc., Birmingham University, 1962.
Thesis: I. The Abortive Infection of Bacteriophage ϕX174 at Low Temperatures.
II. The Early Stages in the Process of Infection by Bacteriophage ϕX174 .
- Lawrence Ronald Newkirk (*Materials Science*). B.S., California Institute of Technology, 1966; M.S., 1967.
Thesis: Band Structure and Transport Properties of Simple Cubic Tellurium-Base Alloys.
- Robert West O'Connell (*Astronomy and Physics*). A.B., University of California, Berkeley, 1964.
Thesis: The Stellar Content of M82.
- Charles Douglas Orth (*Physics*). B.S., University of Washington, 1964.
Thesis: A Search for Fractionally Charged Particles in Cosmic Rays and a Theoretical Interpretation of the Results.
- Patrick Stewart Osmer (*Astronomy*). B.S., Case Institute of Technology, 1965.
Thesis: The Atmospheres of the F Supergiants.
- Dimitri Anastassios Papanastassiou (*Physics*). B.S., California Institute of Technology, 1965.
Thesis: The Determination of Small Time Differences in the Formation of Planetary Objects.

DOCTOR OF PHILOSOPHY—continued

- Gerhard Hans Parker (*Electrical Engineering*). B.S., California Institute of Technology, 1965; M.S., 1966.
Thesis: Tunneling in Schottky Barriers.
- John Stansfield Parkinson, Jr. (*Genetics and Biophysics*). B.A., Haverford College, 1965.
Thesis: Organization and Function of the Phage Lambda Chromosome.
- Edward John Patula (*Applied Mechanics*). B.S., Carnegie Institute of Technology, 1966; M.S., California Institute of Technology, 1967.
Thesis: Equivalent Differential Equations for Nonlinear Dynamical Systems.
- Thomas Lorne Penner (*Chemistry*). B.Sc., University of Manitoba, 1965.
M.Sc., 1966.
Thesis: Ions and Excitations in Organic Radiation Chemistry:
I. The Gamma Radiation Induced Reactions of 1,3-Cyclohexadiene.
II. The Radiation Induced Isomerization of 1,2-Diphenylpropene in Cyclohexane.
- Edward Harris Perry (*Mechanical Engineering*). B.S., California Institute of Technology, 1966; M.S., 1967.
Thesis: Experimental Investigations of the T-burner and its Role in Combustion Instability Studies.
- Arsine Victoria Peterson (*Astronomy and Physics*). S.B., Massachusetts Institute of Technology, 1963; M.S., California Institute of Technology, 1966.
Thesis: A Spectroscopic Investigation of Four O-Type Subdwarfs.
- George Arthur Petersson (*Chemistry*). B.S., City College of New York, 1964.
Thesis: Filtering Nuclear Magnetic Resonance Spectra.
- Ronald James Pogorzelski (*Electrical Engineering and Physics*). B.S., Wayne State University, 1964; M.S., 1965.
Thesis: Investigations in the Theory of Electromagnetic Scattering from Expanding Dielectric Obstacles.
- James Randolph Preer (*Chemistry*). B.A., Swarthmore College, 1965.
Thesis: Electronic Structure in Five-Coordinate Complexes of Nickel (II) with Heavy Donor Ligands.
- Daniel Adam Prelewicz (*Applied Mechanics*). B.S., State University of New York, Buffalo, 1965; M.S., 1966.
Thesis: Range of Validity of the Method of Averaging.
- Eldon Bruce Priestley (*Chemistry and Physics*). B.Sc. (Hons), University of Alberta, 1965.
Thesis: I. A study of the Dynamics of Triplet Excitons in Molecular Crystals.
II. An Investigation of Delayed Emission from *Chlorella Pyrenoidosa*.
- Edmund Andrew Prych (*Civil Engineering and Geology*). B.S., University of Massachusetts, 1961; S.M., Massachusetts Institute of Technology, 1963.
Thesis: Effects of Density Differences on Lateral Mixing in Open-Channel Flows.

DOCTOR OF PHILOSOPHY—continued

- David Lawrence Randall (*Engineering Science and Electrical Engineering*). B.S.E. (EE), University of Michigan, 1963; B.S.E. (Ma), 1963; M.S., California Institute of Technology, 1965.
Thesis: Formal Methods in the Foundations of Science.
- Prabhat Kumar Rastogi (*Materials Science*). B.Tech., Indian Institute of Technology, 1965; M.S., State University of New York, Stony Brook, 1967.
Thesis: I. Kinetics of Coarsening of the Gamma-Prime Precipitate in Ni-Si Alloys.
II. Rate of Crystallisation of an Amorphous Fe-P-C Alloy.
- Donald Sherwood Remer (*Chemical Engineering and Business Economics*). B.S.E., University of Michigan, 1965; M.S., California Institute of Technology, 1966.
Thesis: The Separation of Atomic and Molecular Gases from Helium by Cataphoresis.
- Carl James Rice (*Physics*). B.A., University of Utah, 1964.
Thesis: Primary Cosmic-Ray Positrons and Negatrons in 1968 at Energies Between 11 and 204 MeV.
- Paul Granston Richards (*Geophysics*). B.A., Cambridge University, 1965; M.S., California Institute of Technology, 1966.
Thesis: A Contribution to the Theory of High Frequency Elastic Waves, with Applications to the Shadow Boundary of the Earth's Core.
- Phillip Howard Roberts, Jr. (*Physics*). B.S., University of Kansas, 1963; M.S., California Institute of Technology, 1965.
Thesis: Velocity Fields in Magnetically Disturbed Regions of the H α Chromosphere.
- Stephen Dell Rockwood (*Physics*). B.A., Grinnell College, 1965; M.S., California Institute of Technology, 1967.
Thesis: Dilution Refrigeration and a Calorimetric Measurement of the Quadrupole Coupling Constant in Rhenium Metal.
- Louis James Sharp IV (*Chemistry*). B.S., University of Notre Dame, 1966.
Thesis: The Photoreactions of N-Methyl-2-Pyridone.
- John Edward Smart (*Biochemistry and Chemistry*). B.S., Ohio State University, 1965.
Thesis: Studies on the Role of Histones in the Structure and Function of Chromatin.
- Ronald Lee Smith (*Chemical Engineering*). B.E., Vanderbilt University, 1958; M.S., Rice University, 1965.
Thesis: Joule-Thomson Coefficients of Propane and N-Butane.
- Laurence Albert Soderblom (*Planetary Science and Geophysics*). B.S., New Mexico Institute of Mining and Technology, 1966.
Thesis: The Distribution and Ages of Regional Lithologies in the Lunar Maria.
- Richard Anthony Sramek (*Astronomy and Physics*). S.B., Massachusetts Institute of Technology, 1965.
Thesis: The Brightness Distribution of Core-Halo Radio Sources.
- James Herbert Starnes, Jr. (*Aeronautics*). B.S., Georgia Institute of Technology, 1961; M.S., 1963.
Thesis: The Effect of a Circular Hole on the Buckling of Cylindrical Shells.

DOCTOR OF PHILOSOPHY—continued

- Reiner Ludwig Stenzel (*Electrical Engineering and Economics*). Dipl., Technische Hochschule, Braunschweig, 1965; M.S., California Institute of Technology, 1966.
Thesis: Microwave Absorption and Emission from Magnetized Afterglow Plasmas.
- Joseph Dean Taynai (*Electrical Engineering*). B.S., California Institute of Technology, 1964; M.S., 1966.
Thesis: Properties of α -Monoclinic Selenium.
- James Waldo Toevs (*Physics*). B.Sc., University of Colorado, 1964.
Thesis: The $^{16}\text{O}(\alpha, \gamma)^{20}\text{Ne}$ and $^{28}\text{Si}(\alpha, \gamma)^{32}\text{S}$ Reactions at Low Energy.
- Lois Schloemer Toevs (*Neurophysiology and Developmental Biology*). B.A., University of Colorado, 1964.
Thesis: Identification and Characterization of the Egg-Laying Hormone from the Neurosecretory Bag Cells of *Aplysia*.
- John Burgess Trenholme (*Materials Science*). B.S., California Institute of Technology, 1961; M.S., 1962.
Thesis: Superconducting Proximity Effect Currents in Indium Above its Transition Temperature.
- Natalia Pisker Trifunac (*Chemistry*). Dipl., University of Belgrade, 1965.
Thesis: Photochemical *Cis-Trans* Isomerization of β -Styrylferrocene.
- Donald Gene Truhlar (*Chemistry*). B.A., Saint Mary's College, 1965.
Thesis: Quantum Mechanical Calculations for Rearrangement Collisions of Electrons, Atoms, and Molecules.
- Shui Pong Van (*Chemistry*). B.Sc., Chung Chi College, Hong Kong, 1965.
Thesis: Exciplexes in Fluorescence Quenching of Aromatic Hydrocarbons by Tertiary Aliphatic Amines.
- Quat Thuong Vu (*Electrical Engineering and Applied Mathematics*). B.S., University of Kentucky, 1965; M.S., California Institute of Technology, 1967.
Thesis: Space-Charge-Limited Current in Fast Neutron Irradiated Silicon.
- Carl Christian Wamser (*Chemistry*). Sc.B., Brown University, 1966.
Thesis: I. Photochemical Studies on Phenoxy Radical.
II. The Photoreaction of Michler's Ketone with Benzophenone.
- John Clinton Webber (*Astronomy, Physics and English*). B.S., California Institute of Technology, 1964.
Thesis: The Molecular Spectrum of Sunspots.
- Kurt Walter Weiler (*Physics*). B.S., University of Arizona, 1964.
Thesis: Synthesis of the Polarization Properties of 3C_{10} and 3C_{58} at 1420 and 2880 Megahertz.
- David Clinton Wilcox (*Aeronautics*). S.B., Massachusetts Institute of Technology, 1966.
Thesis: The Motion of a Disc at Angle of Attack in a Rapidly Rotating Fluid.
- Charles Woodrow Wilson, Jr. (*Chemistry*). B.A., Temple University, 1966.
Thesis: Molecular Stability and the $\text{H}_2 + \text{D}_2 \rightleftharpoons 2\text{HD}$ Four Center Exchange Reaction Surface.

DOCTOR OF PHILOSOPHY—*continued*

- Bruce Darrell Winstein (*Physics*). B.S., University of California, Los Angeles, 1965.
Thesis: The Polarization of the Recoil Proton in Eta Photoproduction.
- Nicholas Wilhelm Winter (*Chemistry*). B.S., Northern Illinois University, 1965.
Thesis: I. Numerical Solution of Exact Pair Equations.
II. Numerical Solution of First-Order Pair Equations.
- Warren Jackman Wiscombe (*Applied Mathematics*). S.B., Massachusetts Institute of Technology, 1964; M.S., California Institute of Technology, 1966.
Thesis: Non-Linear Dispersive Waves with a Small Dissipation.
- Max Wyss (*Geophysics and Geology*). Dipl., Eidgenossische Technische Hochschule, Zurich, 1964; M.S., California Institute of Technology, 1967.
Thesis: Observation and Interpretation of Tectonic Strain Release Mechanisms.
- Amos Yahil (*Physics*). B.Sc., Hebrew University, Israel, 1966.
Thesis: Two Topics in Elementary Particle Physics:
I. Crossing as a Group and Elimination of Exotic Channels.
II. Real Parts of Meson-Nucleon Forward Scattering Amplitude.
- I-Min Yang (*Applied Mechanics*). B.S., National Taiwan University, 1958; M.S., 1964; M.S., California Institute of Technology, 1965.
Thesis: Stationary Random Response of Multidegree-of-Freedom Systems.
- John Kzun-Ke Yoh (*Physics*). B.A., Cornell University, 1964; M.S., California Institute of Technology, 1966.
Thesis: Anti-Proton-Proton Backward Elastic Scattering from 0.70 to 2.37 GeV/c.

Prizes and Awards

GEORGE W. GREEN MEMORIAL AWARD

Awarded to the undergraduate student who, in the opinion of the Division Chairmen, has shown outstanding ability and achievement in the field of creative scholarship.

(Recipient to be announced)

FREDERICK W. HINRICHS, JR., MEMORIAL AWARD

Awarded to the senior who, in the opinion of the Undergraduate Deans, has throughout his years at the Institute made the greatest contribution to the welfare of the student body and whose qualities of leadership, character and responsibility have been outstanding.

(Recipient to be announced)