



*Seventy-Fifth  
Annual Commencement  
June 13, 1969*

CALIFORNIA INSTITUTE OF TECHNOLOGY

*Seventy-Fifth  
Annual  
Commencement*

FRIDAY AFTERNOON AT FOUR-THIRTY O'CLOCK  
JUNE THIRTEENTH, NINETEEN SIXTY-NINE

# *Academic Procession*

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

## *Assistant Marshals*

William R. Cozart, Ph.D.      Marshall Hall, Jr., Ph.D.

Wolfgang G. Knauss, Ph.D.      David F. Welch, I.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-FIFTH 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 . . The Reverend Brandoch L. Lovely, A.B., S.T.B.  
*Neighborhood Church*

COMMENCEMENT ADDRESS . "A Personal View of the Arms Race"  
Herbert F. York, Ph.D., D.Sc., LL.D.  
*Professor of Physics and Chairman of the Department  
of Physics, University of California at San Diego*

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 . . . H. Frederic Bohnenblust, Ph.D.  
*Dean of Graduate Studies*

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

CONCLUDING REMARKS . . . . . President Brown

BENEDICTION . . . . . Reverend Lovely

RECESSIONAL . . . . . Mr. Shearer

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

## ACADEMIC PROCESSION

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
Education, <i>Light Blue</i>	Service, <i>Peacock Blue</i>
Engineering, <i>Orange</i>	Public Health, <i>Salmon Pink</i>
Fine Arts, including Architecture, <i>Brown</i>	Science, <i>Golden Yellow</i>
Law, <i>Purple</i>	Theology, <i>Scarlet</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

Daniel Hubbard Addis, *Winnetka, Illinois*. Chemistry.  
James Bradford Andrew, *Kailua, Hawaii*. Engineering.  
Donald Leo Aney, *North Sacramento, California*. Engineering.  
John T. Armstrong, *Northport, Long Island, New York*. Chemistry.  
Timothy Stephen Axelrod, *San Francisco, California*. Physics.  
Arunas Peter Barkus, *Omaha, Nebraska*. Astronomy.  
**Mark Louis Bartelt**, *Valparaiso, Indiana*. Mathematics.  
Thomas D. Baze, *Arlington, Virginia*. Engineering.  
Michael Russ Beaver, *Modesto, California*. Engineering.  
John Charles Bennett, *Beverly Hills, California*. Engineering-History.  
Melvin Howard Bernstein, *Hartford, Connecticut*. Chemistry.  
Gary Norbert Billerbeck, *Sonora, California*. Physics.  
Glen Jeffrey Brown, *Fullerton, California*. Engineering.  
Robert Leland Bunker, *Alhambra, California*. Engineering.  
Thomas Dee Burton, *Hatboro, Pennsylvania*. Engineering.  
Thomas Eugene Burton, *Arcadia, California*. Engineering.  
**Harvey Raymond Butcher III**, *Webster Groves, Missouri*. Astronomy.  
Gary Dean Cable, *Tucson, Arizona*. Physics.  
**Jerry Hans Chirico**, *Santa Clara, California*. Physics.  
**Gene Alan Clough**, *Long Beach, California*. Physics.  
William Allen Coty, *Van Nuys, California*. Chemistry.  
Bruce Clark Crosby, *Seattle, Washington*. Engineering.  
**John C. Cummings, Jr.**, *Albuquerque, New Mexico*. Engineering.  
Donald James Curry, *Exeter, California*. Engineering.  
Jerome Wexler Davis, *Oakland, California*. Engineering.  
Michael Donahue Decker, *Long Grove, Illinois*. English.  
**Christopher James Dede**, *Milwaukee, Wisconsin*. Chemistry-English.  
Walter Martin Denekas, *Hinsdale, Illinois*. Engineering.  
Joseph Stirling Devinny, *Salt Lake City, Utah*. Chemistry.  
**John Gerald DeVore**, *Santa Barbara, California*. Physics.  
Ted William Dillingham, *Woodland Hills, California*. Engineering.  
Martin John Dowd, *Costa Mesa, California*. Physics.  
**W. Donald Dresser**, *Pasadena, California*. Mathematics-Economics.  
Robert Miles Drew, *Garden Grove, California*. Physics.  
Andrew John Duell, *New York, New York*. Physics-Economics.  
Robert Alexander Dukelow, *Kansas City, Kansas*. Engineering.  
Michael Elam, *Kansas City, Missouri*. Engineering.  
**Raymond Walter Ellis**, *Camarillo, California*. Engineering.  
Frederick David Elston, *Northvale, New Jersey*. 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

Robert Lawrence Enenstein, *Fullerton, California*. Engineering.  
**Gregory Walter Evans**, *Whittier, California*. Physics.  
**Michael Bruce Farber**, *Los Angeles, California*. Biology.  
Joseph Shao-Ying Feng, *Skoki, Illinois*. Physics.  
**William Allen Fertig**, *Manhattan Beach, California*. Physics.  
Charles Henry Fisher, *Thousand Oaks, California*. Physics.  
John E. Forbes, *Appleton, Wisconsin*. Engineering.  
George Fox, *San Diego, California*. Mathematics.  
Richard Kintzi Franz, *Los Angeles, California*. Astronomy.  
**Michael Lawrence Fredman**, *San Diego, California*. Mathematics.  
Martin Edward Frost, *Dallas, Texas*. Mathematics.  
Michael Steven Garet, *Glendale, California*. Mathematics.  
Richard Allan Gillman, *Homewood, Illinois*. Engineering.  
Michael Girard, *Apple Valley, California*. Physics.  
Robert Paul Goddard, *Arlington, Virginia*. Physics.  
**Ronald L. Gregg**, *Seattle, Washington*. Physics.  
Ronald Dean Gremban, *Reno, Nevada*. Engineering.  
**Gerald Franklin Grove, Jr.**, *Colorado Springs, Colorado*. Engineering.  
Robert Eugene Haas, *Omaha, Nebraska*. Engineering.  
**Stephen Craig Hadler**, *Washington, D.C.* Biology.  
**Nicolas M. Haralambis**, *Athens, Greece*. Mathematics.  
Allan Mark Hartstein, *West Hartford, Connecticut*. Physics.  
John Prentiss Healy, *Park Ridge, Illinois*. Engineering.  
Jeffrey Charles Hecht, *Nutley, New Jersey*. Engineering.  
Craig Peter Helberg, *Azusa, California*. Engineering.  
Christopher Duval Henry, *Phoenix, Arizona*. Geology.  
Richard Noble Hey, *St. Paul, Minnesota*. Geology.  
**John William Hockert**, *Troy, Ohio*. Physics.  
Robert T. Hsu, *Staten Island, New York*. Physics.  
**Lawrence Allen Hunt**, *Vallejo, California*. Chemistry.  
**James T. Ishida**, *San Mateo, California*. Biology.  
**George Anthony Jackson**, *New Orleans, Louisiana*. Physics.  
**Mark Sennett Jackson**, *Alhambra, California*. Physics.  
Harry Joel Jeffrey, *Phoenix, Arizona*. Mathematics.  
**Scott William Jennings**, *Cupertino, California*. Mathematics.  
**Frank Ray Johnson**, *Amarillo, Texas*. Mathematics.  
Kenneth Lawrence Jones, *Leawood, Kansas*. Geology.  
**Stanley Eldon Jones**, *Anchorage, Alaska*. Engineering.  
Thomas Hillman Jordan, *Alexandria, Virginia*. Geophysics.  
Vesa Tapio Junkkarinen, *Oceanside, California*. Astronomy.  
**Maarten Kalisvaart**, *Houston, Texas*. Physics.  
**Kenneth Salem Kamm**, *Chicago, Illinois*. Chemistry.  
Barry Ruland Keller, *Redondo Beach, California*. Geology.  
Larry Lee Kesmodel, *Fort Worth, Texas*. Astronomy.  
Patrick David Kidd, *Covina, California*. Chemical Engineering.  
Dennis Albert Kodimer, *Phoenix, Arizona*. Engineering.

BACHELOR OF SCIENCE—continued

**David Serkes Komm**, *Northridge, California*. Physics.  
**Edward Neil Kort**, *Canoga Park, California*. Biology.  
**David Gordon Kuehn**, *White Bear Lake, Minnesota*. Physics.  
**David Bruce Lackey**, *Sacramento, California*. Biology.  
**Jeffrey Roy Larson**, *Sioux Falls, South Dakota*. Biology.  
**Larry Allen Lebofsky**, *Milford, Connecticut*. Astronomy.  
**James Edward Leininger**, *Bellaire, Texas*. Chemistry.  
**Steven M. Lewis**, *Seattle, Washington*. Mathematics.  
**Edwin Din Loh**, *Blacksburg, Virginia*. Physics.  
**William Harrison Long, Jr.**, *Fair Oaks, California*. Physics.  
**Jonathan West Lutton**, *Richland, Washington*. Physics.  
**Michael Christopher MacLeod**, *Ridgefield Park, New Jersey*. Biology.  
**David Rodgers MacQuigg**, *Albuquerque, New Mexico*. Engineering.  
**Thomas Owen Mahon**, *Ojai, California*. Mathematics.  
**Gregory Ray Markowski**, *Milwaukee, Wisconsin*. Physics.  
**William Linus Martin III**, *Arlington, Virginia*. Engineering.  
**Francis Lane Mason**, *San Diego, California*. Physics.  
**John Hilbert McCord**, *Hazel Crest, Illinois*. Mathematics.  
**Michael Meo**, *Marblehead, Massachusetts*. Astronomy.  
**Robert Wayne Mitze**, *University City, Missouri*. Mathematics.  
**Gavien Nobuyuki Miyata**, *Honolulu, Hawaii*. Engineering.  
**Jeffrey Mitchell Moller**, *Downey, California*. Physics.  
**Dennis Ray Molodowitch**, *Glendora, California*. Physics.  
**James Marshall Mosher**, *Los Angeles, California*. Physics.  
**Edward Thomas Murphy**, *El Centro, California*. Engineering.  
**LeRoy Ernest Nelson**, *Portland, Oregon*. Mathematics.  
**Daniel Edward Nemzer**, *Worthington, Ohio*. Mathematics.  
**Pericles Leonidas Nicolaidis**, *Athens, Greece*. Mathematics.  
**Mihcael E. Nolan**, *Hamilton, Brisbane, Australia*. Engineering.  
**Robert Leland Norton**, *Alexandria, Virginia*. Physics.  
**Jon Philip Okada**, *Kahului, Hawaii*. Astronomy.  
**Oberdan William Otto**, *Palo Alto, California*. Physics.  
**Stephen Herm Paavola**, *Denver, Colorado*. Mathematics.  
**Joseph William Parmelee**, *Walla Walla, Washington*. Physics.  
**Dale Duane Paynter**, *Seattle, Washington*. Engineering.  
**David Charles Perasso**, *Richmond, California*. Biology.  
**Stephen Samuel Pomeroy**, *St. Louis, Missouri*. Physics.  
**Alfred Warren Potter**, *Alhambra, California*. Geology.  
**Mark Stephen Radomski**, *Miami, Florida*. Physics.  
**Douglas Kent Reece**, *Pasadena, California*. Engineering.  
**Edward Andrew Rehbein**, *Portland, Oregon*. Geology.  
**Joseph Rhodes, Jr.**, *Pittsburgh, Pennsylvania*. History.  
**Donald Dean Rintala**, *Kent, Washington*. Physics.  
**Burton Joseph Roffman**, *Los Angeles, California*. Engineering.  
**John Arthur Roth**, *Lakewood, California*. Physics.  
**Richard Rubinstein**, *Los Gatos, California*. Engineering.



BACHELOR OF SCIENCE—*continued*

- Peter Alan Rumsey, *Berkeley, California*. Astronomy.  
Richard John Russell, *Marblehead, Massachusetts*. Engineering.  
Philip Frederick Rust, *Orinda, California*. Astronomy.  
Frank Joseph Ryan, *Pebble Beach, California*. Physics.  
**Richard Arthur Sacks**, *Valparaiso, Indiana*. Physics.  
Kevin James Savage, *New York, New York*. Physics.  
Stephen Edward Savas, *Garden Grove, California*. Mathematics.  
August Lee Schultz, *Lewistown, Montana*. Engineering.  
Lawrence Hoyt Shirley, *Mesa, Arizona*. Mathematics-History.  
**Murray David Smigel**, *New York, New York*. Biology.  
Harding Eugene Smith, Jr., *Tucson, Arizona*. Astronomy.  
Kenneth Martin Stevenson III, *Palos Verdes Estates, California*. Engineering.  
**Robert Endre Tarjan**, *Pomona, California*. Mathematics.  
Kin H. Tsang, *Hong Kong*. Engineering.  
**Daniel Dexter Villani**, *Pensacola, Florida*. Physics.  
**George Wesley Waller**, *Albuquerque, New Mexico*. Physics.  
Willis George Watrous, Jr., *Saratoga, California*. Engineering.  
Grant Daniel Lee Webster, *Los Angeles, California*. Physics.  
John Franklin Williams, *Sioux City, Iowa*. Mathematics.  
**Robert Dennis Wilson**, *San Diego, California*. Physics.  
**George Appel Wiltsee, Jr.**, *Caracas, Venezuela*. Chemical Engineering.  
James Alan Woodhead, *Walnut Creek, California*. Geology.  
Barry Lee Woolley, *Fontana, California*. Physics.  
**Gregg Fleetwood Wright**, *Lincoln, Nebraska*. Biology.  
**Kenneth Young**, *Hong Kong*. Physics.  
David Alexander Yuen, *Flushing, New York*. Chemistry.

## MASTER OF SCIENCE

- Kathleen Ellen Abbott (*Aeronautics*). B.S., Michigan Technological University, 1968.
- Floyd Richard Ault (*Engineering Science*). B.S., University of California, Los Angeles, 1967.
- Mohsen Mohamed Baligh (*Civil Engineering*). B.Sc., Cairo University, 1966.
- Jean-Henry Barth (*Electrical Engineering*). Eng. in Radioelectricity, Institute Polytechnique de Grenoble, 1968.
- Jean-Paul Berges (*Electrical Engineering*). A.E.A., Faculte des Sciences de Toulouse, 1968.
- Daniel Robert Berker (*Electrical Engineering*). B.S., Purdue University, 1968.
- Uri Bernstein (*Physics*). S.B., Massachusetts Institute of Technology, 1963.
- John Harold Bieging (*Astronomy*). A.B., Dartmouth College, 1966.
- Ricardo A. Bloch (*Chemical Engineering*). B. S., Rose Polytechnic Institute, 1968.
- Steven Raymond Boettcher (*Applied Mathematics*). B.S., University of Wisconsin, 1967.
- James Armacost Bowman (*Mechanical Engineering*). A.B., Susquehanna University, 1968; B.S., University of Pennsylvania, 1968.
- Samuel Arthur Bradley (*Electrical Engineering*). B.S., University of New Mexico, 1968.
- Jim Neal Brantner (*Mechanical Engineering*). B.S., United States Military Academy, 1967.
- Garth Gerald Brown, Jr. (*Chemistry*). B.S., Arizona State University, 1968.
- Richard Ross Burke (*Electrical Engineering*). B.S.E.E., Rensselaer Polytechnic Institute, 1968.
- Sabastien Candel (*Mechanical Engineering*). Ing., Ecole Centrale des Arts et Manufactures, 1968.
- Thomas Glen Carne (*Applied Mechanics*). B.A., Pomona College, 1968.
- James Philip Cerne (*Geology*). B.S., Case Institute of Technology, 1967.
- Clyde Chadwick (*Geology*). S.B., Massachusetts Institute of Technology, 1965.
- George Ka Cheung Chan (*Civil Engineering*). B.E., McGill University, 1968.
- Daniel Pan Yih Chang (*Mechanical Engineering*). B.S., California Institute of Technology, 1968.
- Shuan-Ping Chao (*Aeronautics*). B.S., Columbia University, 1968.
- Judith Gamora Cohen (*Astronomy*). B.A., Radcliffe College, 1967.
- Ross Theo Collard (*Engineering Science*). B.E., University of Auckland, 1968.
- Charles Brian Crouse (*Civil Engineering*). B.S., Case Institute of Technology, 1968.
- Jeffrey Nicholas Cuzzi (*Geology*). B.S., Cornell University, 1967.
- Joseph Eugene Davis (*Aeronautics*). B.S.A.E., University of Southern California, 1968.

MASTER OF SCIENCE—continued

- Paul Emmanuel Dimotakis (*Aeronautics*). B.S., California Institute of Technology, 1968.
- William Ray Dodson (*Engineering Science*). B.S., New Mexico State University, 1958; M.S., 1960.
- Jean Paul Dol (*Electrical Engineering*). Dipl., Ecole Nationale Supérieure des Arts et Métiers, 1968.
- William Kyle Dugan, Jr. (*Mathematics*). B.S., St. John's University, 1967.
- Charles El Achi (*Electrical Engineering*). Eng. of Radioelectricity, Polytechnic Institute of Grenoble, 1968.
- Benjamin Fishler (*Mechanical Engineering*). B.Sc., Israel Institute of Technology, 1965.
- Michel Henri Flandrin (*Mechanical Engineering*). Eng., Ecole Nationale d'Ingenieurs des Constructions Aeronautiques, 1964.
- Okitsugu Furuya (*Mechanical Engineering*). B.E., University of Tokyo, 1965.
- Mark Parne Goldstein (*Physics*). B.S., Harvey Mudd College, 1965.
- Antony Wilfred Goodwin (*Engineering Science*). B.Sc., University of the Witwatersrand, 1967.
- Olav Louis Hansen (*Geology*). B.Sc., Simon Fraser University, 1968.
- Murray Keith Hill (*Mechanical Engineering*). B.A.Sc., University of British Columbia, 1968.
- Lee Barton Holcomb (*Mechanical Engineering*). B.S., University of California, Los Angeles, 1968.
- Henri Michel Horgen (*Materials Science*). Ing., Mining School of Paris, 1968.
- Dominique Christian Hovart (*Mechanical Engineering*). Ing., Ecole Centrale des Arts et Manufactures, 1966.
- Bruce Samuel Hudson (*Chemistry*). B.S., California Institute of Technology, 1967.
- Mary Suzanne Speck Hudson (*Chemistry*). B.S., Michigan State University, 1967.
- David Lee Huestis (*Chemistry*). B.A., Macalester College, 1968.
- Gregory Don Hulcher (*Aeronautics*). B.S., University of Minnesota, 1968.
- Luis Nnaemeka Ikweke (*Civil Engineering*). B.S., Drexel Institute of Technology, 1968.
- William Herbert Ingham (*Astronomy*). B.S., Massachusetts Institute of Technology, 1968.
- Navin Jerath (*Aeronautics*). B. Tech., Indian Institute of Technology, 1968.
- Ching-Lin Jiang (*Electrical Engineering*). B.S.E.E., National Taiwan University, 1967.
- Delmar Lee Johnson (*Mechanical Engineering*). B.S., California Institute of Technology, 1968.
- Jack Frank Juraco (*Aeronautics*). B.S.A.E., Auburn University, 1968.
- Remi Gustave Henri Kaiser (*Mechanical Engineering*). Ing., Ecole Nationale Supérieure de Mécanique, 1968.
- James Paul Keener (*Applied Mathematics*). B.S., Case Institute of Technology, 1968.

MASTER OF SCIENCE—continued

- Saburo Kikuchi (*Electrical Engineering*). B.S., Jiyu Gakuen College, 1962.
- Byung-Koo Kim (*Applied Mechanics*). B.S.E., University of Michigan, 1968.
- Randall Keenan Kirschman (*Physics*). B.S.E.Ph., University of California, Berkeley, 1966.
- Paul Lung Sang Lee (*Physics*). B.S., California Institute of Technology, 1967.
- John Priidik Lindal (*Mathematics*). B.Sc., University of British Columbia, 1966.
- Ting Lung Liu (*Aeronautics*). B.S., Chinese Naval College of Technology, 1956; M.S., Cheng Kung University, 1966.
- Donald Wayne Lobitz, Jr., (*Mechanical Engineering*). B.S., University of California, Santa Barbara, 1968.
- Ruth Blanchard Logan (*Biology*). B.S., Michigan State University, 1966.
- Samuel Ernest Logan (*Aeronautics*). B.S., California Institute of Technology, 1968.
- Stewart Christian Loken (*Physics*). B.Sc., McMaster University, 1966.
- Sali Gee-Chung Ma (*Mechanical Engineering*). B.S., California Institute of Technology, 1968.
- Bharat Bhushan Mahajan (*Mechanical Engineering*). B.Tech., Indian Institute of Technology, 1967; M.E., Union College, 1968.
- Robert Marcel Mattheyses (*Mechanical Engineering*). B.S., California Institute of Technology, 1968.
- Bejan Nader Mehta (*Chemical Engineering*). B.Tech., Indian Institute of Technology, 1968.
- Ronald Hiro Miyakawa (*Applied Mechanics*). B.S., University of California, Berkeley, 1968.
- Yoshioki Moriwaki (*Materials Science*). S.B., Massachusetts Institute of Technology, 1968.
- Edward Payson Myers (*Civil Engineering*). B.S., Oregon State University, 1965.
- John Nella (*Electrical Engineering*). B.S.E.E., Polytechnic Institute of Brooklyn, 1968.
- Stanley Craig Nelson (*Applied Mathematics*). B.S., California Institute of Technology, 1968.
- Gary James Neuner (*Aeronautics*). B.S.A.E., California State Polytechnic College, 1968.
- Sheung-Lip Ng (*Mechanical Engineering*). B.Sc., Imperial College of Science and Technology, 1968.
- James Albert Perry (*Civil Engineering*). B.S., Walla Walla College, 1968.
- Jacques Andre Philippet (*Engineering Science*). Diploma, Civil, Electrical and Mechanical Engineering, University of Liege, 1967.
- David Frank Pilmer (*Mechanical Engineering*). B.S. Stanford University, 1961.
- Kenneth Lawrence Pyle (*Aeronautics*). B.S., United States Naval Academy, 1968.

MASTER OF SCIENCE—*continued*

- Nancy Katherine Rathjen (*Chemistry*). B.S., Rochester Institute of Technology, 1966.
- Manuel Rebollo (*Aeronautics*). Ingeniero Aeronautico, Escuela Technica Superior de Ingenieros Aeronauticos, 1968.
- Fred Miller Reiff (*Civil Engineering*). B.S., Washington University, 1960.
- Edward Failing Ritz, Jr. (*Physics*). S.B., Massachusetts Institute of Technology, 1966.
- Michael Allen Rogalski (*Materials Science*). Met.E., Colorado School of Mines, 1966.
- Yavuz Rona (*Civil Engineering*). B.S., Roberts College, 1968.
- Ralph Edward Roper, Jr. (*Mechanical Engineering*). B.S.M.E., Purdue University, 1968.
- Craig Lee San Pietro (*Mechanical Engineering*). B.S., California Institute of Technology, 1968.
- Julio Santos (*Civil Engineering*). B.S., Colegio La Salle, Dominican Republic, 1956; Ing. Civil, University of Santo Domingo, 1961.
- Rena Rachel Schwartz (*Mathematics*). B.Sc., McGill University, 1965.
- Thomas Edward Sharon (*Engineering Science*). S.B., Massachusetts Institute of Technology, 1967.
- Gregory Alan Shields (*Astronomy*). B.S., Stanford University, 1968.
- George Juhani Siltanen (*Aeronautics*). B.S., Technical College of Helsinki, 1963.
- Robert Donald Small (*Applied Mathematics*). B.A.Sc., University of Toronto, 1968.
- Richard Ross Smith (*Engineering Science*). S.B., Massachusetts Institute of Technology, 1967.
- Constantine George Spyropoulos (*Mechanical Engineering*). B.S., New York University, 1968.
- Joseph John Stupak, Jr. (*Mechanical Engineering*). B.S., California Institute of Technology, 1966.
- William Noel Sullivan (*Mechanical Engineering*). B.S., State University of New York, Buffalo, 1968.
- Richard Leigh Sweet III (*Electrical Engineering*). Sc.B., Brown University, 1968.
- Edward Stephen Tice (*Mechanical Engineering*). B.S.M.E., Newark College of Engineering, 1968.
- Firdaus Erach Udwadia (*Civil Engineering*). B.Tech., Indian Institute of Technology, 1968.
- David Edwin Van Dillen (*Aeronautics*). B.S., Rutgers University, 1967.
- Luis Alfonso Vega (*Aeronautics*). B.S., United States Naval Academy, 1968.
- Alan August Vetter (*Mechanical Engineering*). B.S., State University of New York, Stony Brook, 1968.

MASTER OF SCIENCE—*continued*

- David Charles Viano (*Applied Mechanics*). B.S.E.E., University of Santa Clara, 1968.
- Claude Antoine Vidal (*Mechanical Engineering*). Ing., Ecole Centrale de Paris, 1968.
- John Michael Vitek (*Materials Science*). S.B., Massachusetts Institute of Technology, 1968.
- John Thomas Ward, Jr. (*Engineering Science*). B.S., University of Virginia, 1968.
- Quinn Ernest Whiting (*Mathematics*). B.A., University of Utah, 1963.
- Jay Wilson Wiley, Jr. (*Civil Engineering*). B.S.C.E., Purdue University, 1968.
- John Bernard Wilgen (*Electrical Engineering*). B.A., University of Minnesota, 1968.
- Ashley Deas Williamson (*Chemistry*). B.S., Emory University, 1968.
- William Edwin Wright (*Physics*). B.S., Michigan State University, 1967.
- Yoshio Yamada (*Aeronautics*). B.S., Yokohama National University, 1965.

## ENGINEER

Terry Joseph Delph (*Aeronautical Engineer*). B.A.E., Georgia Institute of Technology, 1967; M.S., California Institute of Technology, 1968.

Jean-Pierre Georges Morel (*Aeronautical Engineer*). Dr. Ing., Universite de Paris, 1967; M.S., California Institute of Technology, 1968.

Rex Bredezen Peters (*Mechanical Engineer*). B.S., California Institute of Technology, 1956; M.S., 1963.

William C. Stavro (*Aeronautical Engineer*). B.S., University of California, Los Angeles, 1962; M.S., 1964.

Robert George Stevenson (*Aeronautical Engineer*). B.S., United States Naval Academy, 1960.

Nathan Raymond Thach, Jr. (*Aeronautical Engineer*). B.S. University of Tennessee, 1964; M.S., 1965.

## DOCTOR OF PHILOSOPHY

- Kurt Steven Jarl Anderson (*Astronomy*). B.S., California Institute of Technology, 1963.  
*Thesis*: A Spectrophotometric Study of Seyfert Nuclei.
- Gerald Richard Ash (*Electrical Engineering and Mathematics*). B.S., Rutgers University, 1964; M.S., California Institute of Technology, 1965.  
*Thesis*: Optimal Guidance of Low-Thrust Interplanetary Space Vehicles.
- Soe Aung (*Chemistry*). B.Sc., University of Rangoon, 1963.  
*Thesis*: I. Approximate Hartree-Fock Wavefunctions, One-Electron Properties, and Electronic Structure of the Water Molecule.  
II. Perturbation-Variational Calculation of the Nuclear Spin-Spin Isotropic Coupling Constant in HD.
- Steven Worth Baldwin (*Chemistry*). A.B., Dartmouth College, 1964.  
*Thesis*: Studies Directed Toward the Total Synthesis of Germanicol.
- Benedict William Bangarter (*Chemistry*). B.A., Macalester College, 1963.  
*Thesis*: Studies of Dinucleoside Monophosphates and Monomer-Polynucleotide Interactions by Proton Magnetic Resonance.
- John Roger Barker (*Chemical Engineering*). B.Sc., College of Science and Technology, London, 1961.  
*Thesis*: The Pyrolysis of n-Butane.
- Carl Edward Baum (*Electrical Engineering*). B.S., California Institute of Technology, 1962; M.S., 1963.  
*Thesis*: A Scaling Technique for the Design of Idealized Electromagnetic Lenses.
- Joseph William Blum (*Applied Mathematics*). B.S., Purdue University, 1963; M.S., 1964.  
*Thesis*: Wave Propagation in an Inhomogeneous Medium.
- William Garfield Bridges, Jr. (*Mathematics*). A.B., University of Connecticut, 1964; M.S., Syracuse University, 1966.  
*Thesis*:  $\lambda$ -Designs and Related Combinatorial Configurations.
- Gary Duane Brinker (*Engineering Science*). S.B., Massachusetts Institute of Technology, 1962; M.Ae., Cornell University, 1963.  
*Thesis*: A Kinetic Theory Description for External Spherical Flows with Arbitrary Knudsen Number by a Moment Method.
- Robert Terry Brinkman (*Planetary Science and Astronomy*). B.S., Capital University, 1964; M.S., University of Florida, 1966.  
*Thesis*: The Photodissociation of Water Vapor, Evolution of Oxygen and Escape of Hydrogen in the Earth's Atmosphere.
- Thomas Edmund Burke (*Chemistry*). B.A., University of Minnesota, 1962.  
*Thesis*:  $F^{19}$  Nuclear Spin Lattice Relaxation in Liquids.
- William Lionel Burke (*Physics*). B.S., California Institute of Technology, 1963.  
*Thesis*: The Coupling of Gravitational Radiation to Nonrelativistic Sources.
- Jerry Butman (*Electrical Engineering and Applied Mathematics*). B. Eng., McGill University, 1965; M.S., California Institute of Technology, 1966.  
*Thesis*: Phase-Incoherent Feedback Communication.



DOCTOR OF PHILOSOPHY—*continued*

- John Millard Caywood (*Electrical Engineering, Chemistry and Physics*). B.S., California Institute of Technology, 1963; M.S., 1964.  
*Thesis*: Electrical and Optical Properties of  $\alpha$ -monoclinic Selenium.
- Milton M. T. Chang (*Electrical Engineering and Physics*). B.S., University of Illinois, 1964; M.S., California Institute of Technology, 1965.  
*Thesis*: Holographic Dielectric Gratings: Theory and Practice.
- Wilfred Peter Charette (*Electrical Engineering and Business Economics*). B.S., California Institute of Technology, 1962; M.S., 1964.  
*Thesis*: Control Systems Theory Applied to Metabolic Homeostatic Systems and the Derivation and Identification of Mathematical Models.
- Man-Cheong Cheung (*Aeronautics*). B.S., Taiwan Provincial Cheng Kung University, 1964; M.S., California Institute of Technology, 1965.  
*Thesis*: Static and Dynamic Stability of Clamped Shallow Circular Arches.
- Wu-sun Chia (*Chemical Engineering*). B.S., National Taiwan University, 1962; M.S., University of Saskatchewan, 1965.  
*Thesis*: I. Convective Thermal Transfer in a Steady, Nearly Uniform Flow of Air Between Parallel Plates.  
II. A Study of Combustion Oscillations of Premixed Gases in a Combustor with Variable Length at Atmospheric Pressure.
- Theresa Kee Yu Chow (*Mathematics*). B.S., National Taiwan University, 1962; M.A., Oregon State University, 1965.  
*Thesis*: The Egoroff Property and its Relation to the Order Topology in the Theory of Riesz Spaces.
- Frank I-Chien Chu (*Chemical Engineering and Applied Mathematics*). B.S., National Taiwan University, 1964.  
*Thesis*: Investigations on Some Diffusion Problems in Rarefied Gases.
- George Richmond Clark II (*Geobiology and Planetary Science*). A.B., Cornell University, 1961; M.S., California Institute of Technology, 1966.  
*Thesis*: Shell Characteristics of the Family Pectinidae as Environmental Indicators.
- Donald James Collins (*Aeronautics*). B.S., University of Arizona, 1962; M.S., 1963.  
*Thesis*: The Near Wake of a Hypersonic Blunt Body with Mass Addition.
- Stephen Paul Creekmore (*Physics*). A.B., Williams College, 1963.  
*Thesis*: I. Non-linear Effects in a Self-consistent Calculation of  $SU_3$  Symmetry Breaking in Strong Interaction Coupling Constants.  
II. Direct-channel Reggeization of Strong Interaction Scattering Amplitudes.
- John Gillette Curro (*Materials Science and Chemical Engineering*). B.ChE., University of Detroit, 1965.  
*Thesis*: Theoretical Investigation of the Effect of Intramolecular Interactions on the Configuration of Polymeric Chains.
- Frederick Willis Dahlquist (*Chemistry*). B.A., Wabash College, 1964.  
*Thesis*: The Binding and Catalytic Properties of Lysozyme.

DOCTOR OF PHILOSOPHY—continued

- Allyn Merrill Davis (*Chemical Engineering, Chemistry and Business Economics*). B.S., Clarkson College of Technology, 1964; M.S., California Institute of Technology, 1965.  
*Thesis*: The Rate and Mechanism of the Partial Oxidation of Acetaldehyde by PPM Concentrations of Nitrogen Dioxide.
- Daniel Lee Davis (*Mathematics*). B.S., Georgia Institute of Technology, 1965.  
*Thesis*: On the Distribution of the Signs of the Conjugates of the Cyclotomic Units in the Maximal Real Subfield of the  $q$ th Cyclotomic Field,  $q$  a Prime.
- Joseph Bernard Dence (*Chemistry*). B.A., Bowling Green State University, 1963.  
*Thesis*: I. Efforts toward the Synthesis of Aliphatic Iodonium Salts.  
II. Fluorine-19 Nuclear Magnetic Resonance Spectroscopy of Cyclic and Bicyclic Systems.
- Satish Vithal Desai (*Chemical Engineering and Business Economics*). B. Tech., Indian Institute of Technology, 1964; M.S., California Institute of Technology, 1965.  
*Thesis*: I. Thermodynamic and Kinetic Behavior of an Argon Plasma Jet.  
II. Decomposition of Nitric Oxide between 1300-1750°K in an Argon Plasma.
- Peter Gerard Dodds (*Mathematics*). B.Sc. (Hons), University of New England, Australia, 1964.  
*Thesis*: The Riesz Space Structure of an Abelian  $W^*$ -Algebra.
- Mirmira Ramarao Dwarakanath (*Physics*). B.Sc. (Hons), The Central College, Bangalore, 1958; M.Sc., 1961.  
*Thesis*: Total Cross Section Measurements for  $^3\text{He}$  ( $^3\text{He}, 2p$ )  $^4\text{He}$  at Low Energies.
- Philip John Erdelsky (*Mathematics*). B.S., Case Institute of Technology, 1966.  
*Thesis*: Projections in a Normed Linear Space and a Generalization of the Pseudo-Inverse.
- Fernando Lawrence Fernandez (*Aeronautics*). M.E., Stevens Institute of Technology, 1960; M.S., 1961.  
*Thesis*: Two-Dimensional Viscous Flows with Large Distributed Surface Injection.
- James Louis Fisher (*Mathematics*). B.Sc. (Hons), University of Alberta, 1965.  
*Thesis*: Structure Theorems for Noncommutative Complete Local Rings.
- Jeffrey Edward Flatgaard (*Genetics and Chemistry*). A.B., Johns Hopkins University, 1962.  
*Thesis*: The Role of the Gene 9 Product in the Assembly and Triggering of Bacteriophage T4.
- Michael Ralph Foster (*Aeronautics and Applied Mathematics*). S.B., Massachusetts Institute of Technology, 1965; S.M., 1966.  
*Thesis*: I. The Rotation of a Gravitating Sphere in a Monatomic Gas.  
II. The Drag of a Body Moving Transversely in a Confined Stratified Fluid.

DOCTOR OF PHILOSOPHY—continued

- David Charles Gakenheimer (*Applied Mechanics*). B.E.S., Johns Hopkins University, 1965; M.S., California Institute of Technology, 1966.  
*Thesis*: Transient Excitation of an Elastic Half-Space by a Point Load Traveling on the Surface.
- Michael James George (*Physics*). B.S., University of North Carolina, 1963.  
*Thesis*: New Measurements on the Absolute Cosmic Ray Ionization from Sea Level to 1540 Kilometers Altitude.
- Robert Allen Gillham, Jr. (*Chemistry*). B.S., San Jose State College, 1965.  
*Thesis*: Alkylation of Ketones with 3-Bromomethyl-1, 2-Benzisothiazoles.
- Paul Sheldon Grand (*Chemistry*). B.S., Queens College, 1963.  
*Thesis*: The Structural Elucidation of a Proposed Intermediate in the Stereoselective Synthesis of dl-Desoxypodocarpic Acid.
- Richard Rutherford Green (*Electrical Engineering and Applied Mathematics*). B.S., California Institute of Technology, 1964; M.S., 1965.  
*Thesis*: Decoding Cosets of First-Order Reed-Muller Codes.
- Curtis Greene (*Mathematics*). A.B., Harvard College, 1966.  
*Thesis*: Combinatorial Properties of Finite Geometric Lattices.
- Richard William Griffith (*Physics*). B.S., California Institute of Technology, 1963.  
*Thesis*: Chiral Symmetry Breaking: Meson and Nucleon Masses.
- Edward Ted Grinthal (*Electrical Engineering and Philosophy*). B.E.E., New York University, 1962; M.S.E., University of Pennsylvania, 1964.  
*Thesis*: Derivation and Interpretation of a Generalized Charge-Control Theory and Reciprocity for a Bipolar Transistor.
- Roger Allison Haas (*Engineering Science and Physics*). B.E.S., University of Florida, 1964; M.S., California Institute of Technology, 1965.  
*Thesis*: Particle Kinetics of Gas-Solid Particle Mixtures.
- David Marvin Hanson (*Chemistry*). A.B., Dartmouth College, 1964.  
*Thesis*: Energy States and Intermolecular Interactions in Molecular Aggregates—Crystalline Naphthalene.
- Ryusuke Hasegawa (*Materials Science*). B.E., Nagoya University, 1962; M.E., 1964; M.S., California Institute of Technology, 1968.  
*Thesis*: Conduction-Electron Localized-Moment Interaction in Palladium-Silicon Base Amorphous Alloys Containing Transition Metals.
- Kenneth Leon Heitner (*Applied Mechanics*). B.S., Webb Institute of Naval Architecture, 1964.  
*Thesis*: A Mathematical Model for Calculation of the Run-up of Tsunamis.
- David Cecil Hensley (*Physics*). B.S., University of Arizona, 1960.  
*Thesis*: A Study of the Bound States of  $^{15}\text{O}$  and A Study of  $T = 3/2$  States in  $^{13}\text{C}$ ,  $^{17}\text{O}$ , and  $^{21}\text{Ne}$ .
- Roger Calvert Hill (*Physics*). B.S., California Institute of Technology, 1963.  
*Thesis*: Relativistic Quark Models and the Current Algebra.
- Evan Eugene Hughes, Jr. (*Physics*). B.S., California Institute of Technology, 1962; M.S., 1963.  
*Thesis*: The Luminosities and the Spatial Distribution of Stars Detected on a Two Micron Sky Survey.

DOCTOR OF PHILOSOPHY—continued

- Clyde Allen Hutchison III (*Biophysics and Genetics*). B.S., Yale University, 1960.  
*Thesis*: Bacteriophage  $\phi X174$ : Viral Genes and Functions.
- James Reid Ipser (*Physics*). B.S., Loyola University, New Orleans, 1964.  
*Thesis*: The Stability of Relativistic, Spherically Symmetric Star Clusters.
- Martin Henry Israel (*Physics*). S.B., University of Chicago, 1962.  
*Thesis*: Primary Cosmic Ray Electrons and Albedo Electrons in 1967 at Energies between 12 and 1000 MeV.
- Kenneth Charles Jacobs (*Physics*). S.B., Massachusetts Institute of Technology, 1964.  
*Thesis*: Bianchi Type I Cosmological Models.
- Howard Arthur Kabakow (*Physics*). B.S., California Institute of Technology, 1962.  
*Thesis*: A Perturbation Procedure for Nonlinear Oscillations.
- Elton Neil Kaufmann (*Physics*). B.S., Rensselaer Polytechnic Institute, 1964.  
*Thesis*: The Measurement of Magnetic Moments of Excited States in Palladium, Tungsten, and Thulium Nuclei.
- William Morris Kinnersley III (*Physics*). B.S., Rensselaer Polytechnic Institute, 1964.  
*Thesis*: Type D Gravitational Fields.
- Denny Ru-Sue Ko (*Aeronautics and Applied Mathematics*). B.S., National Taiwan University, 1960; M.S., University of California, 1964.  
*Thesis*: I. Supersonic Laminar Boundary Layer Along a Two-dimensional Adiabatic Curved Ramp.  
II. Non-Linear Stability Theory for a Laminar, Incompressible Wake.
- Bruce Meno Lake (*Aeronautics*). B.S.E., Princeton University, 1963; M.S., California Institute of Technology, 1964.  
*Thesis*: Velocity Measurements Ahead of a Semi-Infinite Body in Magnetohydrodynamic Flow with Aligned Fields.
- Alvin Henry Larsen (*Chemical Engineering and Chemistry*). B.S. (Ch & Eng) (Hons), University of Utah, 1965; B.A., (Ph), 1965.  
*Thesis*: I. Combinatorial Theory of Nonlinear Graphs Applied to the Virial Equation of State.  
II. Chemical Thermodynamics of Open Systems.
- Jean-Pierre Raymond Laussade (*Electrical Engineering*). Ing., Ecole Supérieure D'Electricité, Paris, 1964; M.S., California Institute of Technology, 1965.  
*Thesis*: I. Mode-locking and Ultrashort Laser Pulses with a Refractive Index Non-linearity.  
II. A Theoretical Study of Wave Propagation through a Random Medium and its Application to Optical Communication.
- Don Howard Lee (*Electrical Engineering*). B.S., California Institute of Technology, 1963; M.S., 1964.  
*Thesis*: Double-injection: High Frequency Noise and Temperature Dependence.

DOCTOR OF PHILOSOPHY—continued

- Wen Kuan Lin (*Physics*). B.S., National Taiwan University, 1962.  
*Thesis*: Study of the  $p + {}^3\text{H}$  and  $n + {}^3\text{He}$  Final-state Interactions in the Reactions  ${}^7\text{Li}(p,\alpha)$  and  $\text{D}({}^3\text{He},p)$ .
- Richard Gwin Lipes (*Physics*). S.B., Massachusetts Institute of Technology, 1964.  
*Thesis*: I. Application of Multi-Regge Theory to Production Processes.  
II. High Energy Model for Proton-Proton Scattering.
- James Barrie Logan (*Biochemistry and Chemistry*). B.S., University of Texas, 1962.  
*Thesis*: Biochemistry and Genetics of Canavanine Resistance in *Neurospora*.
- Alexander Newell Lyon (*Biochemistry and Genetics*). B.S., California Institute of Technology, 1962.  
*Thesis*: Studies on the Isolation of Messenger RNA.
- Peter Bruce Lyons (*Physics*). B.S., University of Arizona, 1964.  
*Thesis*: Total Yield Measurement for the  ${}^{24}\text{Mg}(\alpha,\gamma) {}^{28}\text{Si}$  and  ${}^{27}\text{Al}(p,\gamma) {}^{28}\text{Si}$  Reactions.
- Philippe Louis Maitrepierre (*Materials Science*). Ing., Ecole Nationale Supérieure des Mines, Paris, 1965; M.S., California Institute of Technology, 1966.  
*Thesis*: Influence of Composition on the Structure and Properties of Fe-Pd-P and Ni-Pd-P Amorphous Alloys.
- Jerry Mar (*Physics*). B.Sc., University of British Columbia, 1964.  
*Thesis*: A Comparison of Electron-Proton and Positron-Proton Elastic Scattering at Momentum Transfers up to  $5(\text{GeV}/c)^2$ .
- Donald Eugene Maurer (*Mathematics*). B.A., University of Colorado, 1964.  
*Thesis*: Modules with Integral Discriminant Matrix.
- John Thomas McCrickerd (*Engineering Science and Physics*). S.B., Massachusetts Institute of Technology, 1964; M.S., California Institute of Technology, 1965.  
*Thesis*: The Holographic Stereogram.
- James Thomas McFarland (*Chemistry*). B.A., College of Wooster, 1964.  
*Thesis*: I. The Structure of 1,2-Dimethylnorbornyl Cation.  
II. Relative Stabilities of Some Tertiary Aliphatic Cations.
- Thomas Conley McGill, Jr. (*Electrical Engineering, Physics and Chemistry*). B.S. (Math), Lamar State College of Technology, 1963; B.S. (EE), 1964; M.S., California Institute of Technology, 1965.  
*Thesis*: The Evaluation of E-k Curves from Tunneling Currents.
- John Robert McGinley, Jr. (*Geophysics*). S.B., Massachusetts Institute of Technology, 1952; M.S., University of Tulsa, 1963.  
*Thesis*: A Comparison of Observed Permanent Tilts and Strains Due to Earthquakes with Those Calculated from Displacement Dislocations in Elastic Earth Models.

DOCTOR OF PHILOSOPHY—continued

- Robert Melville Metzger (*Chemistry*). B.S., University of California, Los Angeles, 1962.  
*Thesis*: Crystal Coulomb Energies: I. Organic Donor-Acceptor Complexes—A Review.  
II. Classical Ewald Calculations of the Coulomb Binding Energy of Four Donor-Acceptor Crystals and Wurster's Blue Perchlorate.  
III. A Rapid-Convergence Quantum-Mechanical Formalism for Crystal Electronic Energies.
- Tse-Chin Mo (*Electrical Engineering and Physics*). B.S., National Taiwan University, 1964; M.S., California Institute of Technology, 1966.  
*Thesis*: Theory of Electrodynamics of Media in Non-Inertial Frames and Applications.
- John Irving Molinder (*Electrical Engineering*). B.S., University of Nebraska, 1963; M.S., Air Force Institute of Technology, 1964.  
*Thesis*: Binary Coding Using Standard Run Lengths.
- Robert Alan Moline (*Physics*). B.S., California Institute of Technology, 1964.  
*Thesis*: An Experimental Investigation of the Parity Purity of the 110-KeV Gamma-Decay of  $^{19}\text{F}$ .
- Malcolm Cameron Morrison (*Chemical Engineering*). B.S., California Institute of Technology, 1964.  
*Thesis*: I. The Effects of Variations in Certain Parameters upon the Efficiency of *In Vivo* Hemodialysis with a Kiil Dialyzer.  
II. Interfacial Structure of Concurrent Air-Water Flow in a Two-Inch Diameter Horizontal Tube.
- Stanley Tetsu Murayama (*Chemistry*). B.S., University of California, Los Angeles, 1963.  
*Thesis*: I. Synthesis of *dl-cis*-Tetrahydroeremophilone.  
II. Studies on Systems Free from Angular Strain.
- James Jenry Nelson (*Chemistry*). B.S., Brigham Young University, 1964.  
*Thesis*: Studies of the Conformational Properties of Dinucleoside Monophosphates and Oligoribonucleotides by Proton Magnetic Resonance.
- Michael Harvey Nesson (*Cell Biology and Genetics*). S.B., Massachusetts Institute of Technology, 1960.  
*Thesis*: Studies on Radula Tooth Mineralization in the Polyplacophora.
- John Dennis Norgard (*Electrical Engineering*). B.E.E., Georgia Institute of Technology, 1966; M.S., California Institute of Technology, 1967.  
*Thesis*: Radiation from an Antenna Entering the Martian Atmosphere.
- Richard John O'Connell (*Geophysics*). B.S., California Institute of Technology, 1963; M.S., 1966.  
*Thesis*: I. Dynamic Response of Phase Boundaries in the Earth's Mantle to Surface Loads.  
II. Pleistocene Glaciation and the Viscosity of the Lower Mantle.
- Hiroshi Ohtakay (*Electrical Engineering*). B.S., Tokyo Institute of Technology, 1961.  
*Thesis*: Variable Lift Control of a Space Vehicle during the Reentry into the Martian Atmosphere.

DOCTOR OF PHILOSOPHY—*continued*

- Christopher Alan Parr (*Chemistry*). B.S., University of California, Berkeley, 1962.  
*Thesis*: Classical Dynamics of Triatomic Systems.
- Shakkottai P. Parthasarathy (*Aeronautics*). B.Sc. (Hons), Central College, Bangalore, 1958; M.Sc. (Physics), 1959; M.Sc., Indian Institute of Science, 1964.  
*Thesis*: I. The Transient Boundary Layer Produced by a Sink on a Plane Wall.  
II. Flow of Dusty Gases.
- Bruce Alrick Peterson (*Astronomy and Physics*). S.B., Massachusetts Institute of Technology, 1963; M.S., California Institute of Technology, 1966.  
*Thesis*: A Study of Absorption and Reddening Using Absolute Magnitudes and Colors of Galaxies.
- Wayne Wallace Pfeiffer (*Engineering Science and Physics*). B.S., Wichita State University, 1965.  
*Thesis*: Reflection and Transmission Functions in Reactor Physics.
- Samuel Thomas Picraux (*Engineering Science and Physics*). B.S., University of Missouri, 1965; M.S., California Institute of Technology, 1967.  
*Thesis*: Channeling in Semiconductors and its Application to the Study of Ion Implantation.
- Philip Wayne Randles (*Applied Mechanics and Physics*). B.S., Oklahoma State University, 1962; M.S., 1963.  
*Thesis*: Modal Representations for the High-Frequency Response of Elastic Plates.
- Charles Forest Raymond (*Geophysics and Geology*). A.B., University of California, Berkeley, 1961.  
*Thesis*: Flow in a Transverse Section of Athabasca Glacier, Alberta, Canada.
- James Thomas Renfrow (*Mathematics*). B.S., University of Michigan, 1964.  
*Thesis*: A Study of Rank 4 Permutation Groups.
- James Kinsey Rice (*Chemistry*). B.S., Indiana University, 1963.  
*Thesis*: Low Energy, High Resolution, Variable Angle, Electron Impact Spectroscopy.
- William McKinley Robinson, Jr. (*Aeronautics*). B.S., University of Tennessee, 1963; M.S., Arizona State University, 1965.  
*Thesis*: Mass Spectrometric Studies of Ionization Precursors ahead of Strong Shock Waves.
- Valentin Rodriguez (*Electrical Engineering*). B.E.E., Catholic University of America, 1964; M.S., California Institute of Technology, 1965.  
*Thesis*: Measurement of the Electron Drift Velocity in Silicon.
- James Robert Rose (*Aeronautics and Applied Mathematics*). B.A.Sc., University of Toronto, 1964; M.S., California Institute of Technology, 1965.  
*Thesis*: An Analysis of the Incompressible Two-Dimensional Jet Ejector.
- Yilmaz Esref Sahinkaya (*Electrical Engineering*). Dipl. (M.E.), Loughborough College of Technology, 1961; M.S.E., University of Michigan, 1962.  
*Thesis*: Minimum Energy Control of Electric Propulsion Vehicles.

DOCTOR OF PHILOSOPHY—continued

- Phillip Cuthbert Schaefer (*Chemistry*). B.A., Dartmouth College, 1964.  
*Thesis*: Squalene Cyclization.
- Roger Selig Schlueter (*Engineering Science*). B.S., Purdue University, 1964;  
M.S., California Institute of Technology, 1965.  
*Thesis*: Thermal Wave Propagation in Helium II.
- Allen David Shearn (*Genetics*). B.A., University of Chicago, 1964.  
*Thesis*: A Study of the Possible Role of Transfer RNA in the Regulation of  
Enzyme Synthesis in *Neurospora*.
- Yuch-ning Shieh (*Geochemistry*). B.Sc., National Taiwan University, 1962.  
*Thesis*: Oxygen, Carbon, and Hydrogen Isotope Studies of Contact  
Metamorphism.
- Thomas Yu-tzong Shih (*Biochemistry and Chemistry*). M.B., National  
Taiwan University, 1965.  
*Thesis*: I. Chromosomal RNA of Calf Thymus Chromatin.  
II. The Template Properties of DNA-Polypeptide Complexes.  
III. Studies on DNA Complexes with Purified Histone Fractions.
- Stephen Chester Smelser (*Chemical Engineering*). B.S., University of  
Michigan, 1964; M.S., California Institute of Technology, 1965.  
*Thesis*: An X-Ray Diffraction Study of the Structure of Argon in the  
Dense Liquid Region.
- Douglas Smith (*Geology*). B.S., California Institute of Technology, 1962;  
A.M., Harvard University, 1963.  
*Thesis*: Mineralogy and Petrology of an Olivine Diabase Sill Complex and  
Associated Unusually Potassic Granophyres, Sierra Ancha, Central Arizona.
- Hartmut A. W. Spetzler (*Geophysics and Planetary Science*). B.S., Trinity  
College, 1961; M.S., 1962; M.S., California Institute of Technology, 1966.  
*Thesis*: I. The Effect of Temperature and Partial Melting on Velocity and  
Attenuation in a Simple Binary System.  
II. Effect of Temperature and Pressure on Elastic Properties of  
Polycrystalline and Single Crystal MgO.
- Ramachandra Srinivasan (*Electrical Engineering*). B.E., Madras  
University, 1960; M.E., Indian Institute of Science, Bangalore, 1962;  
M.S.E.E., Purdue University, 1965.  
*Thesis*: A Nonlinear Systems Model for the Control Mechanism of Free Fatty  
Acid-Glucose Metabolism in Normal Humans.
- Gaetan J. St-Cyr (*Electrical Engineering and Neurobiology*). B.S., California  
Institute of Technology, 1962; M.S., 1963.  
*Thesis*: Control Mechanisms in the Human Binocular Oculomotor System.
- Takao Suzuki (*Electrical Engineering*). B.S., Waseda University, Tokyo,  
1962; M.S., 1964.  
*Thesis*: I. Anisotropy and Crystal Structure of Ferromagnetic Thin Films.  
II. Investigations into Magnetic Microstructure by Lorentz Microscopy.
- Ivar Harald Tombach (*Aeronautics*). B.S., California Institute of  
Technology, 1963; M.A.E., Cornell University, 1964.  
*Thesis*: Velocity Measurements with a New Probe in Inhomogeneous  
Turbulent Jets.



DOCTOR OF PHILOSOPHY—continued

- Mihailo Dimitrije Trifunac (*Civil Engineering and Geophysics*). Dipl., University of Belgrade, 1965; M.S., Princeton University, 1966.  
*Thesis*: Investigation of Strong Earthquake Ground Motion.
- Nien-chien Tsai (*Civil Engineering*). B.S., National Taiwan University, 1961; M.S., California Institute of Technology, 1965.  
*Thesis*: Influence of Local Geology on Earthquake Ground Motion.
- Shirley Shieu-lang Cheng Tsai (*Chemistry*). B.S., National Taiwan University, 1963.  
*Thesis*: I. Phosphorescence and the True Lifetime of Triplet States in Fluid Solutions.  
II. Why is Condensed Oxygen Blue?
- Arthur P. L. Turner (*Materials Science*). B.S., California Institute of Technology, 1964.  
*Thesis*: The Effect of Stress and Temperature on the Velocity of Dislocations in Pure Iron Monocrystals.
- Larry Shelton Varnell (*Physics*). B.S., University of the South, 1961.  
*Thesis*: Beta and Gamma Vibrational Bands in Deformed Nuclei.
- Keith Jordis Victoria (*Aeronautics*). B.S.E., University of Michigan, 1962; M.S., California Institute of Technology, 1964.  
*Thesis*: The Hypersonic Laminar Boundary Layer near a Sharp Expansion Corner.
- Jon Edward Weinzierl (*Chemistry*). B.S., University of Illinois, 1963.  
*Thesis*: I. The 3.7 Å Crystal Structure of Horse Heart Ferricytochrome C.  
II. The Application of the Karle-Hauptman Tangent Formula to Protein Phasing.
- John Campbell Wells (*Mathematics and Physics*). S.B., Massachusetts Institute of Technology, 1963; S.M., 1963.  
*Thesis*: Smooth Banach Spaces and Approximations.
- Lewis Turner Wheeler (*Applied Mechanics*). B.S., University of Houston, 1963; M.S., 1964.  
*Thesis*: Some Theorems in Classical Elastodynamics.
- Arthur Karl Whitney (*Engineering Science*). B.Sc., Washington University, 1964.  
*Thesis*: Minimum Drag Profiles in Infinite Cavity Flow.
- Melvin Winokur (*Chemistry*). B.S., City College of New York, 1964.  
*Thesis*: I. Redistribution Equilibria and Configurational Stability in Organomagnesium Compounds.  
II. Redistribution Equilibria in Organocadmium Compounds.
- Felix Shek Ho Wong (*Engineering Science and Applied Mathematics*). B.S., Purdue University, 1964; M.S., California Institute of Technology, 1965.  
*Thesis*: Large Plane Deformations of Elastic Sheets of Neo-Hookean Material.
- James Yoh (*Electrical Engineering and Physics*). B.S., California Institute of Technology, 1962; M.S., 1963.  
*Thesis*: Gas Laser Discharge Noise and its Effect on the Laser Output.

## *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)*