



*Eighty-Fifth
Annual Commencement
June 8, 1979*

CALIFORNIA INSTITUTE OF TECHNOLOGY

Eighty-Fifth
Annual
Commencement

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

The Commencement Ceremony

These tribal rites have a very long history. They go back to the ceremony of initiation for new university teachers in mediaeval Europe. It was then customary for students, after an appropriate apprenticeship to learning and the presentation of a thesis as their masterpiece, to be admitted to the Guild of Masters of Arts and granted the license to teach. In the ancient University of Bologna this right was granted by authority of the Pope and in the name of the Holy Trinity. We do not this day claim such high authority.

As in any other guild, whether craft or merchant, the master's status was crucial. In theory at least, it separated the men from the boys, the competent from the incompetent. On the way to his master's degree, a student might collect a bachelor's degree in recognition of the fact that he was half-trained, or partially equipped. The doctor's degree was somewhat different. Originally indistinguishable from the masters, the doctors gradually emerged by a process of escalation into a supermagisterial role—first of all in the higher faculties of theology, law, and medicine. It will come as no surprise that the lawyers had a particular and early yen for this special distinction.

These gradations and distinctions are reflected in the quaint and colorful niceties of academic dress.

Of particular interest is the cap or mortarboard. In the form of the biretta it was the peculiar sign of the master. Its use has now spread far beyond that highly select group to school boys and choir girls and even to the nursery school. *Sic transit*. . .

The gown, of course, is the basic livery of the scholar, with its clear marks of rank and status—the pointed sleeves of the bachelor, the oblong sleeves of the master, the full sleeves and velvet trimmings of the doctor. The doctors, too, may depart from basic black and break out into many colors—Harvard crimson or Yale blue or the scarlet splash of Oxford.

Color is the very essence of the hood: color in the main body to identify the university; color perhaps in the binding to proclaim the subject of the degree—orange for engineering, gold for science, the baser copper for economics, white for arts and letters, green for medicine, purple for law, scarlet for theology, and so on. Size is a further variable, as the hoods tend to lengthen from the three feet of the bachelor to the four of the doctor. So the birds are known by their plumage.

With this color and symbolism, which is mediaeval though mutated, we stage our brief moment of pageantry, paying homage to that ancient community of scholars in whose shadow we stand and acknowledging our debt to the university as one of the great institutional constructs of the middle ages. While looking back, however, we also celebrate the achievements of this present generation of students and look forward to the future of these our younger colleagues, whom we now welcome to our midst.

David C. Elliot
Secretary of the Faculty

Academic Procession

Chief Marshal, J. Kent Clark, Ph.D.

Assistant Marshals

Arden L. Albee, Ph.D.

Jenijoy La Belle, Ph.D.

Christopher Brennen, Ph.D.

Robert V. Langmuir, Ph.D.

David S. Wood, Ph.D.

Faculty Officers

James J. Morgan, Ph.D.

David L. Goodstein, Ph.D.

David C. Elliot, Ph.D.

MARCHING ORDER

CANDIDATES FOR THE DEGREE OF BACHELOR OF SCIENCE

CANDIDATES FOR THE DEGREE OF MASTER OF SCIENCE

CANDIDATE FOR THE DEGREE OF ENGINEER

CANDIDATES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

FACULTY OFFICERS

THE FACULTY

THE CHAIRMEN OF DIVISIONS

THE DEANS

THE TRUSTEES

THE COMMENCEMENT CHAPLAIN

THE PRESIDENT

THE CHAIRMAN OF THE BOARD OF TRUSTEES

Program

PRESIDING R. Stanton Avery, LL.D.
Chairman of the Board of Trustees

ORGAN PRELUDE Leslie J. Deutsch, M.S.

PROCESSIONAL . . . The Convocation Brass Ensemble and Organ
William W. Bing, M.M., Conductor

INVOCATION The Reverend Walter W. Meader
Director of the Caltech Y

COMMENCEMENT ADDRESS "The Challenge of Success"
Bruce C. Murray, Ph.D.
*Professor of Planetary Science and
Director of the Jet Propulsion Laboratory,
California Institute of Technology*

MUSICAL SELECTION The Caltech Combined Glee Clubs
Olaf M. Frodsham, A.M., Director
Jubilate Deo, by Benjamin Rogers
ed. J. Perry White

CONFERRING OF DEGREES Marvin L. Goldberger, Ph.D.
*President
California Institute of Technology*

PRESENTATION OF CANDIDATES FOR DEGREES

For the Degree of Bachelor of Science . . . Ray D. Owen, Ph.D., Sc.D.
Dean of Students

For the Degree of Master of Science . . . Stirling L. Huntley, Ph.D.
Associate Dean of Graduate Studies

For the Degree of Engineer Cornelius J. Pings, Ph.D.
Dean of Graduate Studies

For the Degree of Doctor of Philosophy Dean Pings

Biology Norman H. Horowitz, Ph.D.
Division Chairman

Chemistry and Chemical Engineering . . . Harry B. Gray, Ph.D.
Division Chairman

Engineering and Applied Science Roy W. Gould, Ph.D.
Division Chairman

Geological and Planetary Sciences Arden L. Albee, Ph.D.
*Professor of Geology and
Chief Scientist, Jet Propulsion Laboratory*

Humanities and Social Sciences Roger G. Noll, Ph.D.
Division Chairman

Physics, Mathematics and Astronomy . . Rochus E. Vogt, Ph.D.
Division Chairman

CONCLUDING REMARKS President Goldberger

BENEDICTION Reverend Meader

RECESSIONAL The Convocation Brass Ensemble and Organ

ORGAN POSTLUDE Leslie Deutsch

Candidates for Degrees

BACHELOR OF SCIENCE

Sebastian Everett Aleman *Los Angeles, California* Applied Physics
Budak Ziya Barkan *Istanbul, Turkey* Engineering and Applied Science
Clifford James Beall *Palos Verdes Estates, California* Biology
Henry Berkley *Mt. Vernon, Illinois* Engineering and Applied Science
Edmund William Bertschinger *Chino, California* Physics
Patricia Lee Bornmann *St. Charles, Missouri* Physics
Roy Robert Borst *Mercer Island, Washington* Applied Physics
Robert Brewster Bourret *Scotts Valley, California* Chemistry
Douglas Alan Breisky *Baltimore, Maryland* Engineering and Applied Science
Walter George Bright *Glendale, Arizona* Engineering and Applied Science
Tom Harry Brikowski *Englewood, Colorado* Geology
Schelte John Bus II *Paradise, California* Geology
Paul Alexander Calzada *Redondo Beach, California* Literature
Julius Leroy Campbell, Jr. *Tucson, Arizona* Applied Physics
Richard John Carlson *Whittier, California* Astronomy
Vincent Caterina *Cupertino, California* Geophysics
Philip Lee Chang *Thousand Oaks, California* Biology
Stanley Shun-Chou Chen *Princeton, New Jersey* Engineering and Applied Science
Liew-Chuang Chiu *Singapore* Physics
Ping Yiu Chiu *Hong Kong* Engineering and Applied Science
Bo Hyung Cho *Seoul, Korea* Engineering and Applied Science
Debra Anne Cisar *Marinette, Wisconsin* Biology
Stanley Alan Cohn *Denver, Colorado* Chemistry
James Robert Cole, Jr. *Los Alamitos, California* Chemistry
Kenneth Spencer Coles *Altadena, California* Geology
Jeffrey Lawrence Copeland *Hackensack, New Jersey* Engineering and Applied Science
Philip George Cormier *Sunnyvale, California* Applied Mathematics
Neil Edward Cotter *Springville, Utah* Engineering and Applied Science
Pamela Judith Crane *Colorado Springs, Colorado* Chemical Engineering
Fred Joseph Crimi *Hillsborough, New Jersey* Engineering and Applied Science
Bart Eric Croes *Carson, California* Chemical Engineering
Charles Joseph Curatalo *Temple City, California* Biology

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

BACHELOR OF SCIENCE—Continued

- Derek Lee Davis *Davenport, Iowa* Engineering and Applied Science
Robert Garo Dergarabedian *Montebello, California* Biology
Peter Allen Dewees *Hemet, California* History
Lawrence R. Doolittle *La Jolla, California* Engineering and Applied Science
Robert Charles Downs *Anaheim, California* Engineering and Applied Science
Steve T. Eckmann *Valinda, California* Biology
Byrwee Ellison *Long Beach, California* Engineering and Applied Science
Veit Elser *San Jose, California* Physics
Dean Willett Face *Grosse Pointe Farms, Michigan* Engineering and Applied Science
David I. Feinstein *Menlo Park, California* Physics
Dennis P. Ferrill *Seattle, Washington* Literature
Jeffrey Michael Fier *Newport Beach, California* Applied Mathematics
Harold Thomas Finney II *Pasadena, California* Engineering and Applied Science
Brian Mark Freeman *Windsor, Connecticut* Engineering and Applied Science
Andrew James Friedson *Palos Verdes Estates, California* Physics
Michael J. Frisch *Los Angeles, California* Chemistry
Sai-Wai Fu *Hong Kong* Applied Physics
Clark Randolph Funsten *Arcadia, California* Applied Physics
Gregory John Galvin *West Hartford, Connecticut* Engineering and Applied Science
Carl Robert Gilray *Milwaukee, Wisconsin* Engineering and Applied Science
David Mark Glover *Kenmore, New York* Geology
Leila Margarita González *Redlands, California* Biology
William Reginald Choate Graham *Edmonton, Alberta, Canada* Chemical Engineering
Herbert Breckenridge Greenlee *River Forest, Illinois* Physics
Frederick Stephen Grennan *Holbrook, Arizona* Engineering and Applied Science
Timothy Craig Groat *Torrance, California* Engineering and Applied Science
Bruce Alvin Gurney III *San Diego, California* Physics
Paul André Gutierrez *Rancho Palos Verdes, California* Biology
Mark Edwin Hall *Newtown Square, Pennsylvania* Mathematics
Edward Brian Hamrick *Tacoma, Washington* Engineering and Applied Science
Bruce Robert Hancock *Portola Valley, California* Engineering and Applied Science
Robert Mark Hanson *Littleton, Colorado* Chemistry
John Bernhard Hattick *La Crescenta, California* Physics
José Francisco Helú, Jr. *Yonkers, New York* Geophysics
Walter Craig Hess *Boulder, Colorado* Engineering and Applied Science
Artie Peter Hodges *Fort Worth, Texas* Physics
Gregory Scott Hoffman *Snohomish, Washington* Engineering and Applied Science
Tad Henry Hogg *Oxford, England* Physics
David Seth Horowitz *Pasadena, California* Chemistry
Robert Mackay Howard *Savannah, Georgia* Astronomy

BACHELOR OF SCIENCE—Continued

Barbara Toshiko Hsu *Pasadena, California* Chemistry
Cora Ann Hunter *Sherman Oaks, California* Chemical Engineering
Stephen Craig Jackson *St. Louis, Missouri* Mathematics
James Howard Jacobs II *San Diego, California* Chemistry
Kurt Emil Jechel *Anaheim, California* Engineering and Applied Science
David Charles Johannsen *San Diego, California* Physics
Dale Hilding Johnson *Chicago, Illinois* Engineering and Applied Science
Michael Hiroshi Kawai *Los Angeles, California* Mathematics
Albert LeRoy Kellner *Baltimore, Maryland* Applied Physics
Thongchai Kengmana *Bangkok, Thailand* Mathematics
Peter Stothe Kezios *Atlanta, Georgia* Chemical Engineering
Isabella Brygida Kierkowska *Gdansk, Poland* Physics
Sangtae Kim *Brossard, Quebec, Canada* Chemical Engineering
Ronald Jay Klapproth *Cincinnati, Ohio* Engineering and Applied Science
Michael Frank Klein *Rancho Palos Verdes, California* Engineering and Applied Science
Jack William Kohn *San Mateo, California* Engineering and Applied Science
Gregory Bruce Korelich *Hawthorne, California* Astronomy
Aleksander Kupiszewski *Passaic, New Jersey* Engineering and Applied Science
Michael Gregory Kurilla *Trenton, New Jersey* Chemistry
Albert Yauyee Lam *Hong Kong* Engineering and Applied Science
Tracy Lynn Larrabee *Santa Maria, California* Engineering and Applied Science
Tod Richard Lauer *Willingboro, New Jersey* Astronomy
Mark Lawrence *Anaheim, California* Engineering and Applied Science
Christopher William Lee *Poway, California* Engineering and Applied Science
Wing Hong Lee *Mission Viejo, California* Chemical Engineering
Leonard Robert Levy *Sacramento, California* Biology
Brian Thomas Lew *Monterey Park, California* Chemistry
Ernest Roy Lewis *Mason City, Iowa* Physics
Till Wolfgang Liepmann *Pasadena, California* Applied Physics
James G. Llewellyn *Washington, District of Columbia* Biology
Carolyn Ann MacDonald *Camarillo, California* Applied Physics
Michael George Machado *Yorba Linda, California* Engineering and Applied Science
Paul Daniel Magliocco *Woodland Hills, California* Engineering and Applied Science
John Christopher Manley *East Northport, New York* Biology
Martin Edward Mann *Arcadia, California* Biology and Chemistry
Victor Joseph Manzella, Jr. *Pawcatuck, Connecticut* Mathematics
James Carlton Marr IV *Los Angeles, California* Engineering and Applied Science
Peter B. Mathews *Pasadena, California* Engineering and Applied Science
Koleen Yumi Matsuda *Harbor City, California* Literature

BACHELOR OF SCIENCE—Continued

Robert Dennis McAnelly *Austin, Texas* Engineering and Applied Science
Michael Wayne McCool *Del City, Oklahoma* Chemistry
Mark Gregory McHarg *Carlsbad, New Mexico* Engineering and Applied Science
Eden Y. C. Mei *San Francisco, California* Engineering and Applied Science
Paul Wells Meyer *San Rafael, California* Engineering and Applied Science
Guy Scott Miller *Bethel, Connecticut* Astronomy
Kevin James Miller *Covina, California* Engineering and Applied Science
Frank E. Mills *Costa Mesa, California* Engineering and Applied Science
Suzanne Claire Mills *Glendora, California* Engineering and Applied Science
Wendell Masanobu Miyaji *San Diego, California* Chemical Engineering
Patrick Bartholomew Moran *Minnetonka, Minnesota* Engineering and Applied Science
Richard Bowen Morris *Pasadena, California* Chemical Engineering
Robert Darsie Morrison *Glendale, California* Engineering and Applied Science
Ruth Ann Mullen *Richland, Washington* Applied Physics
Norman William Murray *Santa Barbara, California* Applied Physics
Paul Hassel Nicholas *Sylmar, California* Engineering and Applied Science
Mark Thomas Nussmeier *Thousand Oaks, California* Engineering and Applied Science
Kenneth Yuji Ogami *South Pasadena, California* Engineering and Applied Science
Glen Kazumi Okita *Honolulu, Hawaii* Engineering and Applied Science
Ralph Weyson Ong *Sacramento, California* Engineering and Applied Science
Patty Pik-Ying Pang *Hong Kong* Biology
Christian Michael Saforo Parry *Akropong-Akwapim, Ghana* Engineering and Applied Science
Leslie Ann Paxton *Seattle, Washington* Engineering and Applied Science
Michael Blair Porter *Anaheim, California* Applied Mathematics
Theodore Warren Post *Woodland Hills, California* Biology
John Marshall Pursch *Long Beach, California* Mathematics
Mark Ragins *Woodland Hills, California* Biology
Tony Blake Ramey *Decatur, Georgia* Biology
Charles Philip Reames *Long Beach, California* Engineering and Applied Science
Jeffrey Reed Record *Raton, New Mexico* Engineering and Applied Science
John Harold Reimer *San Rafael, California* Engineering and Applied Science
Tim X Rentsch *Mathematics*
Christopher Bruce Rogers *Huntington Beach, California* Chemistry
Kenneth Vincent Rousseau *Fullerton, California* Physics and Literature
Michael Rubinstein *Los Angeles, California* Physics
Todd Spencer Rust *Anchorage, Alaska* Engineering and Applied Science
Mansour Sabeti *Tehran, Iran* Engineering and Applied Science

BACHELOR OF SCIENCE—Continued

- John Everett Sartelle** *Tucson, Arizona* Engineering and Applied Science
- Dale Steven Schultz** *Woodland Hills, California* Chemical Engineering
- Peter George Schultz** *Milford, Ohio* Chemistry
- Joy Diane Shaffer** *Gainesville, Florida* Biology
- Charles Alva Shaller** *Newport Beach, California* Biology
- Patrick M. Shea** *Long Beach, California* Physics and Economics
- David Norman Shenton** *Scarborough, New York* Engineering and Applied Science and Applied Mathematics
- Yin Lung Shih** *Howard Beach, New York* Engineering and Applied Science
- Lee Alan Shombert** *Berkeley Heights, New Jersey* Chemistry and Engineering and Applied Science
- Erik Remzi Sirri** *La Cañada, California* Astronomy
- Anna Slomovic** *Kiev, Union of Soviet Socialist Republics* Engineering and Applied Science
- Maxwell Rich Smith** *Vancouver, British Columbia, Canada* Physics
- Hock Chuen So** *Kowloon, Hong Kong* Engineering and Applied Science
- Geoffrey St. John Sommer** *Coronado, California* Engineering and Applied Science
- Gary Peter Stockinger** *Brawley, California* Engineering and Applied Science
- Aileen Stone** *Sylmar, California* Literature
- Bryan Joseph Sutula** *Annandale, New Jersey* Engineering and Applied Science
- Douglas Lee Tally** *Mt. Shasta, California* Chemistry
- Clement Kit Tam** *Hong Kong* Engineering and Applied Science
- Alice Tang** *Redlands, California* Chemical Engineering
- Kenneth Houston Taylor** *Memphis, Tennessee* Engineering and Applied Science
- Michael Olgar Thompson** *El Paso, Texas* Applied Physics
- Stephen James Toner** *Forest Park, Illinois* Engineering and Applied Science
- Michael Folsom Toney** *Oakland, California* Physics
- Steven Gregory Trabert** *Concord, California* Chemistry and Biology
- David James Trawick** *Placentia, California* Mathematics
- Lee William Tutt** *Boca Raton, Florida* Chemistry
- Timothy Nathan Tutt** *Farmington, New Mexico* Social Science
- Dean Tsutomu Uehara** *Honolulu, Hawaii* Engineering and Applied Science
- Jonathan Thomas Uhl** *York, Pennsylvania* Chemical Engineering
- Michael Emil Umbricht** *Naples, Florida* Engineering and Applied Science
- Jon Lee Vavrus** *Walnut Creek, California* Chemistry
- Duncan Moore Walker** *Rancho Palos Verdes, California* Engineering and Applied Science
- James Curtis Walseth** *Seattle, Washington* Applied Physics
- David Lap Kwan Wang** *Canoga Park, California* Engineering and Applied Science
- Michael Wert** *Las Vegas, Nevada* Chemistry

BACHELOR OF SCIENCE—Continued

- David Andrew Wheeler *Edinboro, Pennsylvania* Biology
Daniel S. Whelan *Whittier, California* Engineering and Applied Science
Robert John Winchell *Loyalton, California* Chemistry
Marc Sverre Wold *St. Paul, Minnesota* Chemistry
Ping Cheung Wong *Hong Kong* Engineering and Applied Science
Dale Alexander Woodford *Sacramento, California* Physics
Gary Tad Yamaguchi *Seattle, Washington* Engineering and Applied Science
Kimo Bernard Yap *Sepulveda, California* Engineering and Applied Science
Kit-Lai Yu *Hong Kong* Physics
David Steven Zelinsky *Wilmette, Illinois* Mathematics

MASTER OF SCIENCE

- Andris Ritvars Abele (*Environmental Engineering Science*) B.S., University of California, Los Angeles 1978.
MD Khairul Alam (*Mechanical Engineering*) B. Tech., Indian Institute of Technology, Kanpur 1978.
Mark Carter Anderson (*Mechanical Engineering*) B.S., Christian Brothers College 1977.
Ross Kay Anderson, Jr. (*Aeronautics*) B.S., United States Naval Academy 1963; M.B.A., Stanford University 1973.
Paul Armstrong (*Applied Physics*) B.Sc., Imperial College 1975.
Eileen Angelique Bagdonas (*Biology*) B.S., Cornell University 1975.
Joel Abe Balbien (*Social Science*) B.A., University of California, San Diego 1977.
Gregory John Ball (*Physics*) B.Sc., University of Melbourne 1977.
Jean-Pierre Bardet (*Civil Engineering*) Diploma, École Centrale de Lyon 1978.
John Joseph Barton (*Applied Physics*) B.S., California Institute of Technology 1977.
Thomas Michael Bemis (*Applied Physics*) B.S., University of Illinois, Urbana 1976; M.S., 1977.
Geneviève Michèle Blik (*Electrical Engineering*) Diplôme d'Ingénieur, École Polytechnic Feminine 1978.
Anthony Michael Bloch (*Physics*) B.Sc., University of the Witwatersrand 1977; B.Sc. Honors, 1978.
Dirceu Luiz Rodrigues Bothelho (*Civil Engineering*) Engenheiro, Escola Politecnica de Universidade de Sao Paulo 1975; Mestre em Engenharia 1978.

MASTER OF SCIENCE—Continued

- Mark John Bowick (*Physics*) B.Sc., University of Canterbury 1976.
- Robert John Calvet (*Aeronautics*) B.S., California Institute of Technology 1978.
- Eric Paul Chael (*Geophysics*) B.S., Purdue University 1977.
- Stephen Thomas Chambers (*Electrical Engineering*) B.S., Oregon State University 1978.
- Philip Lowe Chan (*Chemical Engineering*) B.S., University of California, Berkeley 1977.
- Alain Pierre Charneau (*Mechanical Engineering*) Diplôme d'Ingénieur, École Nationale Supérieure d'Arts et Métiers 1978.
- Chen-Hsue Chen (*Civil Engineering*) B.S., California State Polytechnic University, Pomona 1978.
- John Sau-Chung Chen (*Electrical Engineering*) B.S., Brown University 1978.
- Edward Alan Clark (*Electrical Engineering*) B.S., University of Oklahoma 1978.
- Bruce Montgomery Clemens (*Applied Physics*) B.S., Colorado School of Mines 1978.
- Kenneth Spencer Coles (*Geology*) B.S., California Institute of Technology 1979.
- Steven Wade Cordray (*Electrical Engineering*) B.S., University of Oklahoma 1977.
- Mark Bernard Cronshaw (*Chemical Engineering*) B.A., St. John's College 1976.
- Brian Glenn Easton (*Mechanical Engineering*) B.S., Rutgers University 1978.
- Gary M. Edmonds (*Electrical Engineering*) B.S., University of Tennessee, Knoxville 1978.
- Nader Engheta (*Electrical Engineering*) B.S., Tehran University 1978.
- Cheri Lee Erickson (*Applied Physics*) B.A., University of California, Berkeley 1971.
- Gilles Jean Favard (*Mechanical Engineering*) Diplôme, École Supérieure d'Ingénieurs de Marseille 1978.
- Kenneth Paul Fecteau (*Electrical Engineering*) B.S., University of New Hampshire 1978.
- Richard Karl Feldman (*Electrical Engineering*) B.S., California Institute of Technology 1977.
- Paul Ronald Gagnon (*Electrical Engineering*) A.S., Wentworth Institute 1972; B.S., Northeastern University 1978.
- David Mark Glover (*Geology*) B.S., California Institute of Technology 1979.
- Boris Gokhman (*Astronomy*) M.S., Leningrad Polytechnical Institute 1975.
- John Matthew Golding (*Civil Engineering*) B.Sc., Exeter University 1978.
- Julia Reid Goss (*Geology*) A.B., Radcliffe College 1974.
- Robert William Hahn (*Social Science*) A.B., A.M., Brown University 1975.
- Jeffrey John Hamilton (*Physics*) B.S., Cornell University 1973; M.S., California Institute of Technology 1974.

MASTER OF SCIENCE—*Continued*

- Sai Yuen Billy Ho (*Computer Science*) B.Eng., McGill University 1978.
- Moh-jiann Huang (*Civil Engineering*) B.S., National Taiwan University 1977.
- Mark David Iwanowski (*Aeronautics*) B.S.M.E., University of Pennsylvania 1977.
- Garrett Duane Jeong (*Civil Engineering*) B.S., University of Southern California 1978.
- Ann Renee Karagozian (*Mechanical Engineering*) B.S., University of California, Los Angeles 1978.
- Narendra Krishna Karmarkar (*Electrical Engineering*) B. Tech., Indian Institute of Technology, Bombay 1978.
- David Clark Keezer (*Applied Physics*) A.B., University of California, Berkeley 1978.
- David Louis Keller (*Electrical Engineering*) Sc.B., Brown University 1978.
- John Francis Kelley (*Aeronautics*) B.S., University of Notre Dame 1973.
- Thongchai Kengmana (*Mathematics*) B.S., California Institute of Technology 1979.
- Rosemary Gillian Kennett (*Applied Mathematics*) B.Sc., University of Nottingham 1972; M.S., California Institute of Technology 1977.
- Ahmad Farid Khorrami (*Aeronautics*) B.S., Purdue University 1977.
- Sangtae Kim (*Chemical Engineering*) B.S., California Institute of Technology 1979.
- Edward Charles Kistner (*Chemical Engineering*) B.S., University of Notre Dame 1978.
- Evelyn Ann Kramer (*Applied Physics*) B.S., Cornell University 1977.
- Robert Raymond Krchnavek (*Electrical Engineering*) B.S., Marquette University 1978.
- Keith E. Krombel (*Physics*) B.S., Wilkes College 1976.
- Robert Samuel Kuenzi (*Mechanical Engineering*) B.S., University of Missouri, Columbia 1976.
- Albert Niu Lin (*Civil Engineering*) B.S., University of Missouri, Columbia 1978.
- Paul Linares (*Electrical Engineering*) Engineer Degree, École Nationale Supérieure de l'Aéronautique et de l'Espace 1978.
- James Carlton Marr IV (*Mechanical Engineering*) B.S., California Institute of Technology 1979.
- William Beall McKinnon (*Planetary Science*) S.B., Massachusetts Institute of Technology 1976.
- Ian Rowland McLenaghan (*Physics*) B.A., Hertford College 1978.
- Michael Charles McNab (*Physics*) B.S., Florida Technical University 1976.
- Maurice Eugene Miller (*Chemical Engineering*) B.S., University of Notre Dame 1978.
- Robert Miorelli (*Aeronautics*) Sc.B., Brown University 1976.
- Corinne Sue Morse (*Chemistry*) B.S., Harvey Mudd College 1975.

MASTER OF SCIENCE—Continued

- Donald Edward Narhi (*Aeronautics*) B.S.E., University of Michigan, Ann Arbor 1978.
- Peter John Nicklin (*Civil Engineering*) B.E., University of Auckland 1977.
- Joseph Michael Nilsen (*Physics*) B.S., Cornell University 1977.
- Michael A. Niman (*Mechanical Engineering*) B.S.M.E., Carnegie-Mellon University 1978.
- Deanna Kae Ojala (*Biology*) B.S., Washington State University 1967.
- Carol Ann Oken (*Chemistry*) B.A., Douglass College 1976.
- Panayiotis Nikolas Papanicolaou (*Civil Engineering*) B.Sc., National Technical University of Athens 1978.
- Dimitris Antony Papantoniou (*Mechanical Engineering*) B.S., California Institute of Technology 1978.
- Quinn R. Passey (*Planetary Science*) B.S., Brigham Young University, Provo 1978.
- James William Christopher Pechmann (*Geophysics*) A.B., Hamilton College 1976.
- Jean-Pierre Francois Perrin (*Materials Science*) Diplôme d'Ingénieur, École Nationale Supérieure d'Arts et Métiers 1978.
- Jeffrey Ross Pier (*Astronomy*) B.A., University of Minnesota 1968; B.S., California Institute of Technology 1977.
- William Michael Polivka (*Electrical Engineering*) B.S., Pennsylvania State University 1974.
- Carolyn C. Porco (*Planetary Science*) B.S., State University of New York, Stony Brook 1974.
- Ahmed Atef Rashed (*Civil Engineering*) B.Sc., Cairo University 1975; M.Sc., 1979.
- Danny David Reible (*Chemical Engineering*) B.S., Lamar University 1977.
- Tim X Rentsch (*Engineering Science*) B.S., California Institute of Technology 1979.
- William Scott Richardson (*Aeronautics*) B.S., United States Air Force Academy 1978.
- Rex Wade Ridenoure (*Aeronautics*) B.S., Iowa State University, Ames 1978.
- Christopher Bruce Rogers (*Chemistry*) B.S., California Institute of Technology 1979.
- Paul David Ronney (*Aeronautics*) B.S., University of California, Berkeley 1978.
- Bruce S. Rosen (*Aeronautics*) B.S., University of Rhode Island 1978.
- Isabelle Roux-Buisson (*Electrical Engineering*) Ingénieur, École National Supérieure des Télécommunications 1978.
- Augusto Sagnotti (*Electrical Engineering*) Laurea, University of Rome 1978.
- Carlos Alberto Salvadó (*Geophysics*) B.A., University of Rhode Island 1973; M.S., 1974.
- David Alan Samburg (*Electrical Engineering*) B.S., Bradley University 1978.

MASTER OF SCIENCE—Continued

- Richard Alan Searfoss (*Aeronautics*) B.S., United States Air Force Academy 1978.
- Constance Lynn Senior (*Environmental Engineering Science*) B.S., Rice University 1978.
- Sarah A. Sheard (*Chemistry*) B.A., University of Rochester 1976.
- Kathryn Nanette Shuck (*Electrical Engineering*) B.S., Purdue University 1978.
- Michael D. Shunn (*Civil Engineering*) A.B., Occidental College 1977.
- Wayne Waldrip Simmons (*Mechanical Engineering*) B.S., Texas A&M University 1978.
- Richard Stanley Simon (*Astronomy*) B.A., University of California, Santa Barbara 1977.
- David Lee Skinner (*Applied Mechanics*) B.S.A.A.E., Purdue University 1977.
- Roger Paul Stout (*Mechanical Engineering*) B.S.M.E., Arizona State University 1977.
- Dean Grant Sturtevant (*Mathematics*) S.B., Massachusetts Institute of Technology 1977.
- Jebriel Ahmed Swedan (*Electrical Engineering*) B.Sc., University of Tripoli 1975.
- Constantine Emmanuel Synolakis (*Civil Engineering*) B.S., California Institute of Technology 1978.
- Gary Mario Tarolli (*Computer Science*) B.S., Rensselaer Polytechnic Institute 1978.
- Paul Warren Thompson (*Electrical Engineering*) B.S., University of Illinois, Urbana 1978.
- David James Trawick (*Computer Science*) B.S., California Institute of Technology 1979.
- Jonathan Thomas Uhl (*Chemical Engineering*) B.S., California Institute of Technology 1979.
- Eddy Hubert Van Bouwel (*Environmental Engineering Science*) Civil Engineer, University of Gent 1975; Civil Chemical Engineer 1978.
- Richard Jean Varennes (*Electrical Engineering*) Diplôme d'Ingénieur, École Nationale Supérieure de l'Aéronautique et de l'Espace 1977; DEA, University Pierre et Marie Curie 1978.
- Marios Simon Vassiliou (*Geology*) A.B., Harvard College 1978.
- Steven Ray Vosen (*Aeronautics*) B.S., University of California, Berkeley 1978.
- David Lap Kwan Wang (*Electrical Engineering*) B.S., California Institute of Technology 1979.
- Joseph Kam-Leung Wat (*Aeronautics*) A.S., Yuba College 1975; B.S., California State University, Sacramento 1978.
- David Giles Williams (*Civil Engineering*) B.S.C.E., Louisiana Tech University 1978.
- Derek Raymond Wong (*Environmental Engineering Science*) B.C.E., University of Delaware 1978.

MASTER OF SCIENCE—Continued

- Ping Cheung Wong (*Aeronautics*) B.S., California Institute of Technology 1979.
Tak-Yiu Wong (*Mechanical Engineering*) B.S., Loyola Marymount University 1978.
James Hideto Yamamoto (*Civil Engineering*) B.A., Whitman College 1978; B.S., California Institute of Technology 1978.
Kimo Bernard Yap (*Chemistry*) B.S., California Institute of Technology 1978, 1979.
Kunio Yoshizumi (*Environmental Engineering Science*) B.Eng., Yokohama National University 1967; M.Eng., Tokyo Institute of Technology 1969.
Kit-Lai Paul Yu (*Applied Physics*) B.S., California Institute of Technology 1979.
Michael John Zelensky (*Mechanical Engineering*) B.Sc., University of Alberta 1977.

ENGINEER

- Philip Louis Rogers (*Aeronautical Engineer*) B.S., Cornell University 1974; M.S., 1975.

DOCTOR OF PHILOSOPHY

DIVISION OF BIOLOGY

- David Lee Armstrong (*Neurophysiology and Biochemistry*) B.A., University of Oregon 1972.
Thesis: The Kinetics of Curare Action and Restricted Diffusion within the Synaptic Cleft of Motor Nerve Terminals on Frog Skeletal Muscle.
- Elizabeth Peters Blankenhorn (*Immunology*) A.B., Cornell University 1969.
Thesis: Immunogenetic Studies of the Mouse and the Rat.
- Anne Chomyn (*Biochemistry*) B.S., Drexel University 1972.
Thesis: Studies on Protein Synthesis after Heat Shock in *Drosophila melanogaster*.
- Antonia R. Claudio (*Biochemistry*) A.B., University of California, Berkeley 1972.
Thesis: The Acetylcholine Receptor and Its Role in Induction of Experimental Auto-immune Myasthenia Gravis.
- Susan Ellen Conrad (*Biochemistry*) B.S., Tufts University 1974; M.S., California Institute of Technology 1977.
Thesis: I. Sequence Organization of *Drosophila melanogaster* SsRNA and 4sRNA Genes. II. *In vitro* Studies on Replications of Plasmid DNAs.
- Michaël Lee Cooper (*Neurobiology*) B.S., Duke University 1974; M.S., California Institute of Technology 1976.
Thesis: Studies in the Visual System of the Cat. I. The Retinohalamic Pathway in Normal and Siamese Cats. II. The Vertical Horopter.
- A. J. Hill (*Biology and Physics*) B.S., Michigan State University 1968.
Thesis: Investigations of "Spatial" Firing in Dorsal Hippocampus of the Rat.
- Bruce D. Hubbard (*Cell Biology*) S.B., Massachusetts Institute of Technology 1973.
Thesis: Biochemical Studies on the 10 nm Filaments of Avian Muscle.
- Elwyn Yuan Loh (*Biochemistry*) B.S., California Institute of Technology 1971.
Thesis: Amino Acid Sequence Studies of Immunoglobulins: Implications for the Storage, Processing, and Expression of Genetic Information.
- Charles Edward Novitski (*Biophysics*) B.A., Columbia College 1969.
Thesis: Aspects of Regulation of Mitochondrial DNA Replication and Transcription in Mammalian Cells.
- Richard Carl Parker (*Biochemistry*) S.B., Massachusetts Institute of Technology 1974.
Thesis: I. Methods for Restriction Endonuclease Studies of DNA Structure. II. Restriction Endonucleolytic Characterization of Animal Mitochondrial DNAs and Human Globin Genes.
- David Eugene Presti (*Biology*) B.S., Butler University 1974; M.S., California Institute of Technology 1976.
Thesis: Studies of the Blue Light Receptor in *Phycomyces*.

When more than one field of study is indicated, the first is the major and the second and others are minors.

DOCTOR OF PHILOSOPHY—*Continued*

Mavis Shure (*Biophysics*) B.S., Yale University 1974.

Thesis: I. Studies of Closed Circular DNA: Physical and Biological Implications of Heterogeneity in the Topological Winding Number, *a.* II. The Structure of Virion SV40 DNA *in situ* Examined by Chemical Modification with Dimethylsulfate.

William Edward Stumph (*Biochemistry*) B.S., Purdue University 1972.

Thesis: Gene Enrichment Using Antibodies to DNA/RNA Hybrids: Mapping the Ribosomal DNA of Slime Mold and Rat.

DIVISION OF CHEMISTRY AND CHEMICAL ENGINEERING

Amy Abe (*Chemistry*) B.A., Lake Forest College 1974.

Thesis: I. Structural Analysis Using ^{15}N NMR Spectroscopy. II. An Investigation of the Interaction of Grignard Reagents with Mesityl Ketones.

Judith Lee Allison (*Chemistry*) B.S., University of Delaware 1974.

Thesis: An Investigation into the Bonding of Copper(I) Macrocycles to Fifth Ligands.

David Joseph Baillargeon (*Chemistry*) B.S., University of New Hampshire 1974.

Thesis: Oxy Anion-Accelerated Rearrangements.

Kenneth Edward Bencala (*Chemical Engineering*) B.S., Harvey Mudd College 1973; M.S., California Institute of Technology 1975.

Thesis: I. Linear Distributed Parameter Filtering: Observation Processes and Boundary Conditions for Engineering Systems. II. Statistical Analysis of Air Pollutant Observations and Model Predictions.

Douglas Peter Burum (*Applied Physics*) B.S., Harvey Mudd College 1974; M.S., California Institute of Technology 1975.

Thesis: Nuclear Spin Dynamics and Thermodynamics of Pulsed NMR in Solids.

Boyd Jay Carter (*Chemistry*) A.B., Occidental College 1974.

Thesis: The Substitution Kinetics and Electronic Absorption Spectroscopy of Some Molybdenum and Tungsten Bis-Dinitrogen Complexes.

Chi Ming Chan (*Chemical Engineering*) B.S., University of Minnesota 1975; M.S., California Institute of Technology 1977.

Thesis: A Theoretical and Experimental Investigation of Surface Structures and Gas-Surface Interactions.

David Marlin Dooley (*Chemistry*) B.A., University of California, San Diego 1974.

Thesis: Spectroscopic and Magnetic Studies of the Coordination Environment and Electronic Structure of Copper Sites in Blue Copper Oxidases.

David Keith Erwin (*Chemistry*) B.S., University of Louisville 1974.

Thesis: Activation of Carbon-Hydrogen Bonds by Some Derivatives of Bis(cyclopentadienyl)zirconium(IV).

Fred Gelbard (*Chemical Engineering*) S.B., Massachusetts Institute of Technology 1974; M.S., California Institute of Technology 1975.

Thesis: The General Dynamic Equation for Aerosols.

Lawrence Brook Harding (*Chemistry*) B.A., Wesleyan University 1973.

Thesis: *Ab Initio* Studies of Excited States and Reactions of Organic Molecules.

DOCTOR OF PHILOSOPHY—*Continued*

- Frances Anne Houle (*Chemistry*) B.A., University of California, Irvine 1974.
Thesis: Studies of Alkyl Free Radicals and Reaction Mechanisms by Photoelectron Spectroscopy.
- Gilbert Collier Johnson (*Chemistry*) A.B., Harvard College 1974.
Thesis: Approaches to the Elucidation of the Nature of 1,4-Dehydrobenzene.
- Carol Ruth Jones (*Chemistry*) B.A., Rutgers University 1974.
Thesis: The Syntheses and Thermal Decompositions of Six-Membered Cyclic Diacyl Peroxides.
- William Davidson Jones II (*Chemistry*) S.B., Massachusetts Institute of Technology 1975.
Thesis: Reactivity Patterns of Transition Metal Hydrides and Alkyls.
- Carl Anthony Koval (*Chemistry*) B.S., Juniata College 1974.
Thesis: Synthesis, Electrochemistry, and Physical Studies of Graphite Electrodes with Chemically Modified Surfaces and Copper Complexes with Macrocyclic Ligands.
- Donald L. Kuehne (*Chemical Engineering*) B.S., Cornell University 1973; M.S., California Institute of Technology 1975.
Thesis: Selective Transport of Sulfur Dioxide through Polymer Membranes.
- Deborah Ann Levin (*Chemistry*) B.S., State University of New York, Stony Brook 1974.
Thesis: *Ab Initio* Calculations of Processes in Low Energy Electron-Molecule Scattering.
- Kevin William Moore (*Chemistry*) A.B., Princeton University 1974.
Thesis: The Mechanism of Action of Adenosylcobalamin — Dependent Diol Dehydratase. I. Glycerol and Other Substrate Analogs as Substrates and Inactivators of Diol Dehydratase: Kinetics, Stereospecificity, and Mechanism. II. Hydrogen Transfer in the Inactivation of Diol Dehydratase by Glycerol. III. Hydrogen Transfer in Catalysis by Diol Dehydratase.
- Ann Tryon Nicol (*Chemistry*) A.B., Clark University 1961.
Thesis: Solid State NMR Studies of Metal Hydrides.
- Barry Duane Olafson (*Chemistry*) B.S., University of North Dakota 1971.
Thesis: A Molecular Description of Oxygen Binding to Hemoglobin.
- Thomas Edward Orlowski (*Chemistry*) B.S., Rochester Institute of Technology 1973; M.S., California Institute of Technology 1976.
Thesis: New Techniques in Coherent Optical Spectroscopy: Optical Dephasing and Radiationless Processes in Molecules.
- Daryl Lynn Roberts (*Chemical Engineering*) B.S., Rice University 1974.
Thesis: Sulfur Dioxide Transport through Aqueous Solutions.
- Jeffrey Alan Sell (*Chemistry*) B.S., Purdue University 1974.
Thesis: Angular Distributions in Photoelectron Spectroscopy.
- John T. Slankas (*Chemistry*) B.S., University of Notre Dame 1968; M.S., Northwestern University 1970; B.S., University of Albuquerque 1973.
Thesis: Interaction Potentials of Atom-Molecule and Molecule-Molecule Systems from Crossed Beam Experiments.

DOCTOR OF PHILOSOPHY—Continued

- James Long Taylor (*Chemical Engineering and Chemistry*) B.S., University of Illinois, Urbana 1973.
Thesis: A Study of CO Oxidation over Ir(110) with Surface Sensitive Probes.
- Glenn E. Thomas (*Chemical Engineering*) B.A., Amherst College 1974; M.S., California Institute of Technology 1976.
Thesis: The Chemisorption of Carbon Monoxide, Oxygen and Nitric Oxide on the Ruthenium (001) Surface.
- David Ralph Tyler (*Chemistry*) B.S., Purdue University 1975.
Thesis: The Photochemistry and Electronic Structures of Metal Carbonyl Cluster Complexes.
- Craig Stephens Wilcox (*Chemistry*) B.S., Illinois Institute of Technology 1974.
Thesis: An Approach to the Total Synthesis of Polyether Antibiotics.
- Roger Macauley Williams (*Chemistry*) B.A., Cornell University 1974.
Thesis: Crystallographic Order and Disorder in Quasi-One-Dimensional Conductors.
- Richard Lawrence Woodin (*Chemistry*) B.S., Michigan State University 1974.
Thesis: Ion Cyclotron Resonance Studies of Vibrationally Excited Ions. I. Low Intensity Multiphoton Dissociation of Gas Phase Ions Using CW CO₂ Laser Radiation. II. Infrared Radiative Stabilization of Energized Species in the Gas Phase.
- Yanis Christos Yortsos (*Chemical Engineering*) Diploma, National Technical University of Athens 1973; M.S., California Institute of Technology 1974.
Thesis: Analytical Modelling of Oil Recovery by Steam Injection.

DIVISION OF ENGINEERING AND APPLIED SCIENCE

- Rohan Chandra Abeyaratne (*Applied Mechanics*) B.S., University of Ceylon 1975; M.S., California Institute of Technology 1976.
Thesis: Discontinuous Deformation Gradients in Plane Finite Elastostatics of Incompressible Materials. I. General Considerations. II. An Example.
- John Chen Wei Au Yeung (*Electrical Engineering*) S.B., Massachusetts Institute of Technology 1974; M.S., California Institute of Technology 1975.
Thesis: Phase Conjugate Optics and Nonlinear Optical Phenomena in Optical Fibers.
- Ronald Frederick Ayres (*Computer Science*) B.S., California Institute of Technology 1974.
Thesis: A Language Processor and a Sample Language.
- James Leslie Beck (*Civil Engineering*) B.Sc., University of Auckland 1970; M.Sc., 1971.
Thesis: Determining Models of Structures from Earthquake Records.
- John Stewart Best (*Applied Physics*) B.S., California Institute of Technology 1975.
Thesis: Schottky Barriers on Compound Semiconductors: I. HgSe Highly Electronegative Contacts. II. Au Schottky Barriers on n-Ga_{1-x}Al_xAs.
- Robert Edward Breidenthal, Jr. (*Aeronautics*) B.S.A.E., Wichita State University 1973; M.S., California Institute of Technology 1974.
Thesis: A Chemically Reacting, Turbulent Shear Layer.

DOCTOR OF PHILOSOPHY—Continued

- Terrance Michael Darcey (*Engineering Science*) B.S., University of California, Berkeley 1972.
Thesis: Methods for Localization of Electrical Sources in the Human Brain and Applications to the Visual System.
- Gregory Gartrell, Jr. (*Environmental Engineering Science*) B.S., California Institute of Technology 1973; M.S., 1974.
Thesis: Studies on the Mixing in a Density-Stratified Shear Flow.
- Derek Garard Goring (*Civil Engineering*) B.E., University of Canterbury 1970; M.S., California Institute of Technology 1975.
Thesis: Tsunamis — The Propagation of Long Waves onto a Shelf.
- William Mark Grossman (*Applied Physics*) B.S., Case Western Reserve University 1974; M.S., California Institute of Technology 1975.
Thesis: Combustion of CS_2/O_2 in a Laminar Mixing Layer and Processes in the CO Chemical Laser.
- Patrick Shawn Hagan (*Applied Mathematics*) B.S., California Institute of Technology 1975.
Thesis: The Stability of Traveling Wave Solutions of Parabolic Equations.
- Chi-Shain Hong (*Electrical Engineering*) B.S., National Taiwan University 1971; M.S., Carnegie-Mellon University 1974.
Thesis: New Optical Waveguide Devices Using Periodic and Chirped Surface Corrugations and Optical Waves in Periodic Layered Structures.
- David Li-Shui Quek Hwang (*Applied Physics*) B.S., Rensselaer Polytechnic Institute 1973; M.S., California Institute of Technology 1974.
Thesis: Propagation of the Fast Magnetosonic Wave in a Tokamak Plasma.
- Mark Jay Kushner (*Applied Physics*) B.S., University of California, Los Angeles 1976; M.S., California Institute of Technology 1977.
Thesis: Electronic and Kinetic Processes in the Cu/CuCl Double Pulse Laser.
- Ross Martin Larkin (*Engineering Science*) B.S., Harvey Mudd College 1974.
Thesis: Photopic Rapid Adaptation in the Electroretinogram: A White Noise Analysis.
- Zong-Long Liao (*Applied Physics*) B.S., National Taiwan University 1972.
Thesis: Ion Bombardment Effects on Material Compositions — Preferential Sputtering and Atomic Mixing.
- Stephen Aplin Lyon (*Applied Physics*) B.S., Cornell University 1974; M.S., California Institute of Technology 1976.
Thesis: Optical Properties of Excited Silicon and Germanium at Low Temperatures.
- Bruce Edward MacNeal (*Applied Physics*) B.A., Pomona College 1974; M.S., California Institute of Technology 1977.
Thesis: Horizontal Bloch Line Motion in Magnetic Bubble Materials.
- Alfred Barr Mason, Jr. (*Mechanical Engineering*) B.S., Case Western Reserve University 1974; M.S., California Institute of Technology 1975.
Thesis: Some Observations on the Random Response of Linear and Nonlinear Dynamical Systems.

DOCTOR OF PHILOSOPHY—Continued

- George Michael Morris (*Electrical Engineering*) B.S., University of Oklahoma 1975; M.S., California Institute of Technology 1976.
Thesis: Serrated Apertures: Statistical Diffraction Theory and Experiments.
- Willie Wing Lau Ng (*Electrical Engineering*) B.S., Case Western Reserve University 1973; M.S., California Institute of Technology 1974.
Thesis: Thin Film Bragg Lasers and Waveguides by Liquid Phase Epitaxy.
- Nicolaus Kiam Thian Oey (*Aeronautics*) B.S., Northrop Institute of Technology 1972; M.S., California Institute of Technology 1973.
Thesis: Leading Edge Flutter of a Supercavitating Hydrofoil.
- James Frederick Pankow (*Environmental Engineering Science and Chemistry*) B.A., State University of New York, Binghamton 1973; M.S., California Institute of Technology 1977.
Thesis: The Dissolution Rates and Mechanisms of Tetragonal Ferrous Sulfide (Mackinawite) in Anoxic Aqueous Systems.
- Stephen Vaughn Petersen (*Computer Science*) B.S., University of Wisconsin, Madison 1965; M.S.E., Arizona State University 1969.
Thesis: CARTAM, The Cartesian Access Method for Data Structures with n-dimensional Keys.
- Robert Lewis Powers (*Engineering Science*) B.S., Rensselaer Polytechnic Institute 1972.
Thesis: Iontophoretic Studies of Photoreception in *Drosophila melanogaster*.
- Satwindar Singh Sadhal (*Engineering Science*) B.A.Sc., University of Toronto 1975; M.A.Sc., 1976.
Thesis: Analysis of Heat Transfer in Several Media.
- Ömer Savas (*Aeronautics*) B.S., Middle East Technical University 1974; M.S., California Institute of Technology 1975.
Thesis: Some Measurements in Synthetic Turbulent Boundary Layers.
- Aharon P. Vinkler (*Aeronautics*) B.S., Israel Institute of Technology 1974; M.S., California Institute of Technology 1976.
Thesis: Optimal Controller Design Methods for Linear Systems with Uncertain Parameters — Development, Evaluation, and Comparison.
- Jack LeRoy Wise III (*Aeronautics*) B.S.E., University of Michigan, Ann Arbor 1973; M.S., California Institute of Technology 1974.
Thesis: Experimental Investigation of First- and Second-Sound Shock Waves in Liquid Helium II.
- Vincent Sydney Wong Wooi Yee (*Electrical Engineering*) B.S.E.E., Texas A&M University 1973; M.S., California Institute of Technology 1974.
Thesis: Computational Structures for Extracting Edge Features from Digital Images for Real-Time Control Applications.

DOCTOR OF PHILOSOPHY—*Continued*

DIVISION OF GEOLOGICAL AND PLANETARY SCIENCES

Warren Scott Baldridge (*Geology*) A.B., Hamilton College 1967; M.S., California Institute of Technology 1970.

Thesis: Petrology and Petrogenesis of Basaltic Rocks and Their Inclusions: Studies from the Rio Grande Rift, the Roman Comagmatic Province, and Oceanus Procellarum.

Rhett Giffen Butler (*Geophysics*) S.B., Massachusetts Institute of Technology 1974; M.S., California Institute of Technology 1976.

Thesis: Seismological Studies Using Observed and Synthetic Waveforms.

Wai-Ying Chung (*Geophysics*) B.S., National Taiwan Normal University 1969; M.S., National Central University 1972.

Thesis: I. Variation of Seismic Source Parameters and Stress Drop within a Descending Slab as Revealed from Body-Wave Pulse-Width and Amplitude Analysis. II. A Seismological Investigation of the Subduction Mechanism of Aseismic Ridges.

Anthony Robert Dobrovolskis (*Planetary Science and Astronomy*) B.S., Illinois Institute of Technology 1973; B.S., 1974; M.S., California Institute of Technology 1974.

Thesis: The Rotation of Venus. I. Atmospheric Tides. II. Obliquity and Evolution.

John Joseph Dvorak (*Planetary Science and Geophysics*) B.S., University of Washington 1974; M.S., California Institute of Technology 1978.

Thesis: Analysis of Small Scale Lunar Gravity Anomalies: Implications for Crater Formation and Crustal History.

Joel Earl Everson (*Geochemistry and Chemistry*) B.A., University of California, San Diego 1970; M.S., California Institute of Technology 1973.

Thesis: Regional Variations in the Lead Isotopic Characteristics of Late Cenozoic Basalts from the Southwestern United States.

Marian Judith Furst (*Geochemistry*) B.A., Reed College 1972; M.S., University of Chicago 1973.

Thesis: The Use of Boron in Fossil Materials as a Paleosalinity Indicator.

L. Peter Gromet (*Geochemistry and Chemistry*) B.S., State University of New York, Stony Brook 1972.

Thesis: Rare Earths Abundances and Fractionations and Their Implications for Batholithic Petrogenesis in the Peninsular Ranges Batholith, California, USA, and Baja California, Mexico.

Thomas Harrison Heaton (*Geophysics and Applied Mechanics*) B.S., Bates College 1972; B.S., Indiana University 1972.

Thesis: Generalized Ray Models of Strong Ground Motion.

Carl Edward Johnson (*Geophysics*) S.B., Massachusetts Institute of Technology 1972; S.M., 1972.

Thesis: I. CEDAR — An Approach to the Computer Automation of Short Period Local Seismic Networks. II. Seismotectonics of the Imperial Valley of Southern California.

DOCTOR OF PHILOSOPHY—Continued

- George Robert Mellman (*Geophysics*) S.B., Massachusetts Institute of Technology 1971; M.S., California Institute of Technology 1973.
Thesis: A Method for Waveform Inversion of Body-Wave Seismograms.
- Philip David Nicholson (*Planetary Science and Astronomy*) B.Sc., University of Queensland 1973.
Thesis: I. Tidal Synchronization of the Rotation of Early Main Sequence Stars in Close Binaries. II. The Rings of Uranus: Results of the 1978 April 10 Occultation. III. On the Resonance Theory of the Rings of Uranus.
- David Pollard (*Planetary Science and Aeronautics*) B.A., Cambridge University 1973; M.S., California Institute of Technology 1974.
Thesis: Barotropic and Baroclinic Instabilities in Jupiter's Zonal Flow.
- Russell Marsh Potter (*Geochemistry and Chemistry*) A.B., Kenyon College 1971.
Thesis: The Tetravalent Manganese Oxides: Clarification of Their Structural Variations and Relationships and Characterization of Their Occurrence in the Terrestrial Weathering Environment as Desert Varnish and Other Manganese Oxide Concentrations.
- José Antonio Rial M. (*Geophysics*) Ge.Eng., Universidad Central de Venezuela 1969; Diploma, International Institute of Seismology and Earthquake Engineering 1971; M.S., University of Michigan, Ann Arbor 1976.
Thesis: I. The Caracas, Venezuela Earthquake of 1967: A Multiple Source Event. II. Seismic Waves at the Epicenter's Antipode.
- Stephen Pritchard Smith (*Geochemistry*) A.B., Harvard College 1972.
Thesis: Studies of Noble Gases in Meteorites and in the Earth.
- David Ralph Van Alstine (*Geology*) B.A., Wesleyan University 1971.
Thesis: Apparent Polar Wandering with Respect to North America since the Late Precambrian.

DIVISION OF THE HUMANITIES AND SOCIAL SCIENCES

- Brian Robert Binger (*Social Science*) B.A., St. Olaf College 1974.
Thesis: Essays in Forward Markets and the Uranium Industry.
- Linda Cohen (*Social Science*) A.B., University of California, Berkeley 1974.
Thesis: Essays on the Economics of Licensing Nuclear Power Plants.
- Elizabeth Hoffman (*Social Science*) B.A., Smith College 1968; M.S., University of Pennsylvania 1969; Ph.D., 1972.
Thesis: Essays in Optimal Resource Allocation under Uncertainty with Capacity Constraints.
- Tom Kwan-Yau Lee (*Social Science*) B.A., University of Michigan, Flint 1974; M.A., State University of New York, Stony Brook 1975.
Thesis: Microeconomic Foundations of Research and Development.
- Matthew Laurence Spitzer (*Social Science*) B.A., University of California, Los Angeles 1973.
Thesis: Axiomatic Analysis of Legal/Institutional Issues.

DOCTOR OF PHILOSOPHY—Continued

DIVISION OF PHYSICS, MATHEMATICS AND ASTRONOMY

Bertrand C. Barrois (*Physics*) S.B., Massachusetts Institute of Technology 1973;
M.S., California Institute of Technology 1975.

Thesis: Non-Perturbative Effects in Dense Quark Matter.

John Richard Bond (*Physics*) B.Sc., University of Toronto 1972; M.S., California
Institute of Technology 1975.

Thesis: Neutrino Production and Transport during Gravitational Collapse.

Neville Ray Campbell (*Mathematics*) B.A., University of California, Santa Barbara
1974.

Thesis: Pushing Up in Finite Groups.

Carlton Morris Caves (*Physics*) B.A., Rice University 1972.

Thesis: Theoretical Investigations of Experimental Gravitation.

Benito Miguel Chen Charpentier (*Applied Mathematics*) Fisico, National University
of Mexico 1973.

Thesis: Steady Capillary-Gravity Waves on Deep Water.

France Anne-Dominic de Córdova (*Physics*) B.A., Stanford University 1969.

Thesis: X-Ray Observations of Dwarf Novae.

Brønt Lee Ellerbroek (*Mathematics*) B.A., University of California, Los Angeles 1975.

Thesis: Three Theorems of Paley and Wiener for Locally Compact Abelian Groups.

Athanassios Fokas (*Applied Mathematics*) B.S., Imperial College 1975.

Thesis: Invariants, Lie-Bäcklund Operators and Bäcklund Transformations.

George Fox (*Applied Physics and Economics*) B.S., California Institute of Technology
1969; M.A., University of California, Los Angeles 1971; M.S., California Institute
of Technology 1974.

Thesis: Charge Symmetry in ^{13}N and ^{13}C : A Coupled-Channel Model.

Joseph Edward Griffith (*Physics*) B.A., Rice University 1973.

Thesis: Sputtering of Insulators in the Electronic Stopping Region.

Steward Russell Hartman (*Physics*) B.S., University of Illinois, Urbana 1968.

Thesis: Observations of 1-6 MeV Jovian Electrons at 1 AU and a Study of Their
Propagation.

Daniel S. W. Kwoh (*Physics*) A.B., Princeton University 1970; M.S., California
Institute of Technology 1972.

Thesis: I. An Attempt to Produce Both Thick and Thinned Flowing Superfluid Films.
II. A Study of the Feasibility of Verifying Lifshitz's Theory of Van Der Waal's
Force for a Metallic Surface. III. The Electrohydrodynamic Instability of the Super
Thick Helium Film.

Barry James LaBonte (*Astronomy*) B.S., California Institute of Technology 1972.

Thesis: Studies of Chromospheric Activity Observed in H α and D δ .

Michael Murdock Lowry (*Physics*) B.S., University of Illinois, Urbana 1972.

Thesis: A Quest for Neutral-Current-Enhanced Parity Mixing in ^{18}F .

DOCTOR OF PHILOSOPHY—Continued

- Gordon Cecil Osbourn (*Physics*) B.S., University of Missouri, Kansas City 1974; M.S., 1975.
Thesis: Theoretical Studies of Bound Exciton Decay and of Transport across Semiconductor Interfaces.
- Jonathan Daniel MacLeish Romney (*Astronomy*) B.S., California Institute of Technology 1967; M.S., Cornell University 1969.
Thesis: Fine-Scale Structure of the Neutral Hydrogen Absorption in NGC1275.
- William A. Russell (*Physics*) B.S., University of Miami 1972.
Thesis: Studies of Calcium Isotope Fractionation Found in Nature and Produced during Ion Sputtering.
- Joel Nathan Schulman (*Physics*) B.A., University of Pennsylvania 1973.
Thesis: Electronic Structure of AlAs/GaAs and CdTe/HgTe Superlattices and Interfaces.
- Helene Marian Shapiro (*Mathematics*) A.B., Kenyon College 1975.
Thesis: Unitary Block Diagonalization and the Characteristic Polynomial of a Pencil Generated by Hermitian Matrices.
- Henry Clark Simpson (*Applied Mathematics*) B.S., M.S., New Mexico Institute of Mining and Technology 1974.
Thesis: Periodic Solutions of Integro-Differential Equations Which Arise in Population Dynamics.
- Eric Jonathan Siskind (*Physics*) B.A., Cornell University 1974.
Thesis: Production of the $\psi(3100)$ in 400 GeV Proton-Iron Interactions.
- Stephen Avery Slutz (*Physics and Astronomy*) B.S., Rensselaer Polytechnic Institute 1972; M.S., California Institute of Technology 1974.
Thesis: Three Problems in Astrophysical Dynamics.
- Keh-Chung Wang (*Physics*) B.S., National Taiwan University 1972.
Thesis: Experimental Determination of the Relativistic Fine-Structure Splitting in a Pionic Atom and Dependence of K X-Ray Energy upon the Mode of Excitation.
- Martha Carroll Riherd Weller (*Physics*) B.A., Rice University 1973.
Thesis: The Solar System Boron Abundance: A Measurement of Boron Concentrations in Carbonaceous Chondritic Meteorites.
- Peter John Young (*Astronomy*) B.A., Cambridge University 1975; M.A., University of Texas, Austin 1976.
Thesis: Supermassive Black Holes in Galactic Nuclei.
- Cosmas K. Zachos (*Physics*) A.B., Princeton University 1974.
Thesis: Extended Supergravity with a Gauged Central Charge.
- John Lehrer Zyskind (*Physics*) A.B., University of Chicago 1973; M.S., California Institute of Technology 1976.
Thesis: Competition Effects in Charged Particle Induced Reactions.

Prizes and Awards

FREDERIC W. HINRICHS, JR., MEMORIAL AWARD

Awarded to the senior who, in the opinion of the undergraduate Deans, has made the greatest undergraduate contribution to the welfare of the student body and whose qualities of leadership, character, and responsibility have been outstanding.
Recipient to be announced at Commencement.

DONALD S. CLARK MEMORIAL AWARDS

May be awarded to a sophomore and a junior in recognition of service to the campus community and good academic performance. Preference is given to students in the Division of Engineering and Applied Science and to those in Chemical Engineering.

1979 *Leslie T. Niles, sophomore, Joseph A. Zasadzinski, junior*

1978 *Leslie A. Paxton**

HAREN LEE FISHER MEMORIAL AWARD IN JUNIOR PHYSICS

Awarded to a junior physics major who demonstrates the greatest promise of future contributions in physics.

1979 *Kenneth G. Libbrecht*

1978 *Liew C. Chiu**

1977 *Isabella B. Kierkowska**

HENRY FORD II SCHOLAR AWARD

Awarded either to the engineering student with the best academic record at the end of the third year of undergraduate study, or to the engineering student with the best first-year record in the graduate program.

Pik-Chun Beatrice Lee, junior

JACK E. FROELICH MEMORIAL AWARD

Awarded to a junior in the upper five percent of his or her class who shows outstanding promise for a creative professional career.

1979 *Edward S. Phinney*

1978 *Thongchai Kengmana,* Sangtae Kim**

GEORGE W. GREEN MEMORIAL PRIZE

Awarded to the undergraduate student who, in the opinion of the division chairmen, has shown outstanding ability and achievement in creative scholarship.

1979 *Kenneth G. Libbrecht*

1978 *David L. Johannsen**

**The names of students who have received prizes or awards in previous years, but who are graduating in 1979, are also listed.*

PRIZES AND AWARDS—Continued

ARIE J. HAAGEN-SMIT MEMORIAL AWARD

Awarded to a sophomore or junior in biology or chemistry who has shown academic promise and who has made recognized contributions to Caltech.

1979 *Lynn M. Hildemann, junior*

1978 *Robert M. Hanson**

DAVID JOSEPH MACPHERSON PRIZE IN ENGINEERING

Awarded to the graduating senior in engineering who best exemplifies excellence in scholarship. Limited to U.S. citizens.

Jack W. Kohn

MARY A. EARL MCKINNEY PRIZE IN ENGLISH

The purpose of this prize is to cultivate proficiency in writing. It may be awarded for essays submitted in connection with regular English classes or awarded on the basis of a special essay contest.

1979 *Koleen Y. Matsuda, senior, Eileen Stone, senior*

1977 *Dennis P. Ferrill**

THE ROYAL SOCIETY FOR THE ENCOURAGEMENT OF ARTS MANUFACTURES AND COMMERCE SILVER MEDAL

Awarded to students who are receiving their first degrees from the most important institutions of learning in the United States. Winners are selected on the basis of outstanding academic records and significant participation in student activities.

Designee: Stanley A. Cohn

DON SHEPARD AWARD

Awarded to students who would find it difficult, without additional financial help, to engage in extracurricular and cultural activities. The recipients are selected on the basis of their capacity to take advantage of and to profit from these activities rather than on the basis of their scholastic standing.

1979 *Kenneth M. Gray, Samin A. Mithani, Charles R. O'Neil*

1977 *Kenneth V. Rousseau**

1976 *José F. Helú, Jr.,* Christian M. S. Parry**

1975 *Ruth Ann Mullen**

SIGMA XI AWARD

Awarded to a senior selected for an outstanding piece of original scientific research.

Peter G. Schultz

THE MORGAN WARD PRIZE

Awarded for the best problems and solutions in mathematics submitted by a freshman or sophomore.

1979 *David J. Mills, sophomore*

1976 *David I. Feinstein,* David S. Zelinsky**