



*Ninety-Fourth
Annual Commencement
June 10, 1988*

CALIFORNIA INSTITUTE OF TECHNOLOGY

Ninety-Fourth
Annual
Commencement

FRIDAY MORNING AT TEN O'CLOCK
JUNE TENTH, NINETEEN EIGHTY-EIGHT

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
Professor of History, Emeritus

Academic Procession

Chief Marshal, Jenijoy La Belle, Ph.D.

Assistant Marshals

Christopher E. Brennen, Ph.D. Robert W. Oliver, Ph.D.

Gary A. Lorden, Ph.D. Ward Whaling, Ph.D.

David S. Wood, Ph.D.

Faculty Officers

Sunney I. Chan, Ph.D. Bruce E. Cain, Ph.D.

Ward Whaling, Ph.D.

MARCHING ORDER

CANDIDATES FOR THE DEGREE OF BACHELOR OF SCIENCE

CANDIDATES FOR THE DEGREE OF MASTER OF SCIENCE

CANDIDATES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

FACULTY OFFICERS

THE FACULTY

THE CHAIRMEN OF DIVISIONS

THE DEANS

THE PROVOST

THE TRUSTEES

THE COMMENCEMENT CHAPLAIN

THE COMMENCEMENT SPEAKER

THE PRESIDENT

THE CHAIRMAN OF THE BOARD OF TRUSTEES

Program

PRESIDING Ruben F. Mettler, Ph.D.
Chairman of the Board of Trustees

ORGAN PRELUDE Leslie J. Deutsch, Ph.D.

PROCESSIONAL . . . The Caltech Wind Ensemble Brass and Organ
William Bing, M.M., Conductor

INVOCATION The Reverend Donald P. Merrifield, S.J.
*Chancellor
Loyola Marymount University*

COMMENCEMENT ADDRESS Robert L. Sinsheimer, Ph.D.
*Visiting Associate in Biology
California Institute of Technology
Former Chancellor
University of California, Santa Cruz*

CHORAL SELECTION The Caltech Glee Clubs
Donald G. Caldwell, D.M.A., Conductor
"Hallelujah" from *Messiah*
George Frederick Handel

CONFERRING OF DEGREES Thomas E. Everhart, Ph.D.
*President
California Institute of Technology*

PRESENTATION OF CANDIDATES FOR DEGREES

For the Degree of Bachelor of Science . . . Gary A. Lorden, Ph.D.
Dean of Students

For the Degree of Master of Science . . . James J. Morgan, Ph.D.
Vice President for Student Affairs

For the Degree of Doctor of Philosophy . . . Arden L. Albee, Ph.D.
Dean of Graduate Studies

Biology . . . Charles J. Brokaw, Ph.D.
Executive Officer for Biology

Chemistry and Chemical Engineering . . . Fred C. Anson, Ph.D.
Division Chairman

Engineering and Applied Science . . . Paul C. Jennings, Ph.D.
Division Chairman

Geological and Planetary Sciences . . . Gerald J. Wasserburg,
Ph.D., D.h.c., Sc.D.
Division Chairman

Humanities and Social Sciences . . . David M. Grether, Ph.D.
Division Chairman

Physics, Mathematics and Astronomy . Edward C. Stone, Jr., Ph.D.
Division Chairman

CONCLUDING REMARKS . . . President Everhart

BENEDICTION . . . Father Merrifield

RECESSIONAL . . . The Caltech Wind Ensemble Brass and Organ

ORGAN POSTLUDE . . . Dr. Deutsch

Candidates for Degrees

BACHELOR OF SCIENCE

Jinane Abounadi*	Marrakesh, Morocco	Electrical Engineering
Hamid Akhavan*	Anaheim, California	Electrical Engineering
Laura Marie Anderson*	Gahanna, Ohio	Mathematics
Richard M. Arrieta	Schererville, Indiana	Engineering and Applied Science
Nusrat Jamil Azher	Dhaka, Bangladesh	Electrical Engineering
Eric Kendall Babson*	Salem, Oregon	Mathematics
Gregory L. Bailey	Thousand Oaks, California	Applied Physics
Michael A. Bajura*	Morgantown, West Virginia	Engineering and Applied Science
Ray Paul Bambha	Alexandria, Virginia	Applied Physics
Ashok Bansal*	Madras, India	Electrical Engineering
Mark Fleming Beauchamp	Calipatria, California	Electrical Engineering
Joseph Riley Beckenbach III	Carbondale, Illinois	Engineering and Applied Science
Jason Randolph Beresford	Diamond Bar, California	Engineering and Applied Science
Mark Berman*	Beverly Hills, California	Electrical Engineering
Ross Kristen Berteig	Seattle, Washington	Engineering and Applied Science
Daniel Belford Bikle	Monterey, California	Electrical Engineering
Anthony James Bladek*	Spokane, Washington	Electrical Engineering
William Lee Breazeal*	Livermore, California	Physics
Tom G. Brinck*	Kansas City, Missouri	Mathematics and Engineering and Applied Science
Leland Frank Brown*	Rancho Palos Verdes, California	Applied Mathematics
David John Bruning	Oakdale, Minnesota	Biology
Charles John Budney	Bristol, Connecticut	Geochemistry
Robert Charles Burch	Ponca City, Oklahoma	Biology and Chemistry
James W. Busacker	Madison, Wisconsin	Electrical Engineering
Andrew James Campbell	Frederick, Maryland	Geophysics
Brian Edward Catanzaro	San Diego, California	Applied Physics
Hung Se Cha*	New York, New York	Electrical Engineering
Lloyd Cecil Cha	Silver Spring, Maryland	Electrical Engineering
Kayee Yennie Chan*	Hong Kong	Mathematics
Michael Owen Chandler	Fall City, Washington	Engineering and Applied Science
Kenneth William Chaney*	Anaheim, California	Engineering and Applied Science
Douglas Chang*	Adelphi, Maryland	Engineering and Applied Science
Tylis Y. Chang*	Gibsonia, Pennsylvania	Biology

Students whose names are followed by an asterisk are being graduated with honor in accordance with a vote of the faculty.

BACHELOR OF SCIENCE — Continued

Catherine Teh-Yao Chen *Piedmont, California* Engineering and Applied Science
George T. Chen* *Edison, New Jersey* Electrical Engineering
Eric John Christensen *Castle Rock, Colorado* Electrical Engineering
Timothy Scott Cotter *Pasadena, California* Engineering and Applied Science
James Nelson Daniel III* *Northfield, Illinois* Physics
Brian Paul Daniels* *Meriden, Connecticut* Economics
Kevin Fleming Delgadillo *Canyon Country, California* Applied Physics
Christopher Thomas Dodd *Madeira, Ohio* Engineering and Applied Science
Mark Dubinsky *Monterey, California* Electrical Engineering
Stephen Hilary Edwards *Springfield, Virginia* Electrical Engineering
John Stephen Eras* *Arcadia, California* Electrical Engineering
Manuel Salvador Esquivel* *Wilmington, California* Engineering and Applied Science
William Joseph Foster, Jr.* *Annandale, Virginia* Physics
Terry Fu* *Potomac, Maryland* Physics
Eric J. Gaidos* *Portland, Oregon* Applied Physics
David Alan Gates* *Tustin, California* Electrical Engineering
John Carl Gehring* *Wellesley, Massachusetts* Physics
Susan Marie Gerhart *South Pasadena, California* Engineering and Applied Science
Kouros Ghandehari* *Brea, California* Physics
Nadeem Ghani *San Francisco, California* Physics
David Michael Goedecke *Hudson, Massachusetts* Biology
David Goldreich* *Toronto, Canada* Engineering and Applied Science and Economics
Michael Todd Gorder *Thornton, Colorado* Applied Physics
Jeffrey Kenneth Greason* *Carver, Oregon* Electrical Engineering
Adam Kalmon Greenblatt* *College Station, Texas* Biology
Sheikh Imran Hameed* *Karachi, Pakistan* Electrical Engineering
Joel David Hamkins* *Lexington, Kentucky* Mathematics
James Arthur Hammond* *San Diego, California* Electrical Engineering
Daniel John Harrison *Woodland Hills, California* Engineering and Applied Science
Christopher Paul Hassler *Rathdrum, Idaho* Astronomy
Kenneth De Lay Haynes* *Salem, New Hampshire* Independent Studies Program
Francis Ho* *Honolulu, Hawaii* Physics
Mark Keith Holdsworth* *San Marino, California* Engineering and Applied Science
Eric Nord Hoover* *Toronto, Ontario* Physics and Mathematics
Peter Jay Hughes *Denver, Colorado* Engineering and Applied Science
Andrew J. Huntington *San Diego, California* Engineering and Applied Science
Kent David Irwin* *Cary, North Carolina* Physics
Robert Leo Jarecki, Jr.* *Hardyston, New Jersey* Chemical Engineering
Robert Arthur Jensen *Delta Junction, Alaska* Engineering and Applied Science

BACHELOR OF SCIENCE — *Continued*

Marit Andrea Jentoft-Nilsen *Delhi, New York* Physics
Kenneth Antonio Kable *Elbert, Colorado* Electrical Engineering
Randall David Kamien* *Wilmette, Illinois* Physics
Michael Keating *Savannah, Georgia* Engineering and Applied Science
Yoo Chun Kim *Langhorne, Pennsylvania* Physics
Terrence Y. Kiyabu *Wahiawa, Hawaii* Electrical Engineering
Kristine R. Koh* *Pasadena, California* Biology
Edward Lin-Wei Koo *Anaheim, California* Physics
Sho Kuwamoto *Thousand Oaks, California* Physics
Ali Reza Lashgari* *Fullerton, California* Biology
Manuel Law *Hong Kong* Electrical Engineering
Charles C. Lee *Wilmington, California* Electrical Engineering
Kevin Kar Lee* *Los Angeles, California* Physics
Jerome Edward Lengyel *Eureka, California* Engineering and Applied Science
Glenn M. Lewis *Newport Beach, California* Electrical Engineering
James C. Li *Hacienda Heights, California* Engineering and Applied Science
Lushalan Boy-Yu Liao* *Alhambra, California* Applied Physics
Jay Henry Lieske, Jr. *La Cañada, California* Geology
Hank I-Hung Lin *Daly City, California* Engineering and Applied Science
Kenneth Ken-Tang Lin *St. Louis, Missouri* Engineering and Applied Science
Windsor Wen-Hsiang Lin* *Wilmette, Illinois* Engineering and Applied Science
Curtis Chih-shan Ling *Hingham, Massachusetts* Electrical Engineering
David Harold Lipin *Mission Viejo, California* Engineering and Applied Science
Wayne Wendell Lukens* *Loveland, Ohio* Chemistry
Timothy Jo-Fei Ma *Porterville, California* Electrical Engineering
Saroj Manandhar* *Kathmandu, Nepal* Engineering and Applied Science
Stefan Charles Mårelid* *Huddinge, Sweden* Engineering and Applied Science
Gregory Allen Martin* *St. Louis, Missouri* Physics and Electrical Engineering
James Edward Mayhugh *Mountain Rest, South Carolina* Chemistry
Scott D. McCauley *Los Altos Hills, California* Electrical Engineering
Sean Christopher McNamara* *Everett, Washington* Physics
Ignacio Sean McQuirk* *San Pedro, California* Electrical Engineering
Richard Mgrdechian *Bayside, New York* Electrical Engineering
Andrew Van Miller II *Chicago, Illinois* Engineering and Applied Science
Rusty Scott Miskovich* *Donegal, Pennsylvania* Engineering and Applied Science
Demetrios Basil Missios *Long Beach, California* Engineering and Applied Science
Michael Peter Mittmann *Corvallis, Oregon* Engineering and Applied Science
Raymond B. Moberly *Philadelphia, Pennsylvania* Engineering and Applied Science
Jamaludin Mohd. Yusof* *Bandar Seri Begawan, Brunei* Engineering and Applied Science

BACHELOR OF SCIENCE—Continued

- Samuel David Naffziger *San Diego, California* Electrical Engineering
Lev Nayvelt* *Gaithersburg, Maryland* Physics
Charles Francis Neugebauer* *Ballston Spa, New York* Electrical Engineering and Physics
Kwok Lun Ngan *San Francisco, California* Physics
Owen Koh Nishikawa* *Honolulu, Hawaii* Electrical Engineering
Flavio Noca* *Durban, South Africa* Engineering and Applied Science
Christopher Scott Nolle *Omaha, Nebraska* Physics
Frederick Jorgen Nordby III *Claremont, California* Physics
James K. Okamoto* *Honolulu, Hawaii* Physics
Van T. Okamura* *Hilo, Hawaii* Electrical Engineering
Mark Olmos *La Puente, California* Chemical Engineering
Konstantin Othmer* *Overland Park, Kansas* Electrical Engineering and Economics
Keith Joseph Owens *Greensburg, Indiana* Engineering and Applied Science
Marios-Christos Papaefthymiou* *Athens, Greece* Electrical Engineering
Charles Andrew Patwell *Westminster, California* Electrical Engineering
Nikola Panajot Pavletich* *Athens, Greece* Chemistry
Janice Linn Peters *New Brighton, Pennsylvania* Chemistry
Son Van Pham *Waldwick, New Jersey* Electrical Engineering
Thai Ngoc Pham* *Portland, Oregon* Engineering and Applied Science
David Forrest Phillips* *Livermore, California* Physics
Stephan Pietrusiak* *Montreal, Quebec, Canada* Electrical Engineering
Dana Pillsbury *Elburn, Illinois* Engineering and Applied Science
Mark Andrew Porter *Anchorage, Alaska* Engineering and Applied Science
Eugene Lyon Pottenger* *DeKalb, Illinois* Mathematics
Michael George Pravica* *Des Plaines, Illinois* Physics and Applied Mathematics
Phyllis Cheri Pugh* *Ashtabula, Ohio* Biology
Susan Elizabeth Ridgway* *Santa Monica, California* Physics
Douglas Alan Roberts* *Richfield, Minnesota* Physics
James David Roberts *Beavercreek, Ohio* Engineering and Applied Science
Masahiro Sayano* *Montebello, California* Electrical Engineering
Eric Gustave Scharin* *Morristown, New Jersey* Chemical Engineering
Richard Coin Schirato *San Diego, California* Physics
Linda Marie Schlueter *Pacific Palisades, California* Engineering and Applied Science
Mel Eugene Senft *Pulaski, Wisconsin* Applied Physics
Bineet Sherwin Sharma *Tucson, Arizona* Engineering and Applied Science and Economics
Joseph John Shiang* *Washington, District of Columbia* Chemistry
Michael Kramer Shonle* *Boulder, Colorado* Electrical Engineering

BACHELOR OF SCIENCE — Continued

- Ali Ghani Siddiqui* *Karachi, Pakistan* Electrical Engineering
- William Barrett Slate* *Sudbury, Massachusetts* Engineering and Applied Science
- Adam Slovik *New York, New York* Engineering and Applied Science
- Michael Doyle Smith* *Seattle, Washington* Physics
- William Christopher Smith* *Edmonds, Washington* Physics
- Robert William Soderbery* *San Jose, California* Electrical Engineering
- Bradley Edward Solberg *Seattle, Washington* Engineering and Applied Science
- VanEric Edward Stein* *Allentown, Pennsylvania* Chemical Engineering
- Jason Edward Stewart *Lancaster, Pennsylvania* Biology
- Alejandro Szabo* *Buenos Aires, Argentina* Physics
- Jeffrey Decker Tekanic* *Euclid, Ohio* Biology and Chemistry
- Seen-Liang Thong* *Singapore* Electrical Engineering
- Charles Hugh Todd IV *Meridian, Mississippi* Engineering and Applied Science
- Ross Nobuo Tomita* *Kaneohe, Hawaii* Electrical Engineering
- Sean Francis Trabosh *New York, New York* Engineering and Applied Science
- Minh Quoc Tran* *Santa Clara, California* Physics
- Thao Nguyen Tran* *Santa Ana, California* Physics
- Alexios Tsernos* *Thessaloniki, Greece* Engineering and Applied Science
- Christopher Bruce Umminger* *Parkville, Missouri* Electrical Engineering
- Brett David van de Sande *Neptune, New Jersey* Physics
- Francis Anthony Vasquez, Jr. *Cedar Rapids, Iowa* Economics and Engineering and Applied Science
- Keith Orman Vertrees* *Olympia, Washington* Electrical Engineering
- Nicole Paula Vogt* *Pasadena, California* Physics
- Gary Lee Vondran, Jr. *Los Altos, California* Electrical Engineering
- Sean Rikio Wakayama* *Honolulu, Hawaii* Engineering and Applied Science
- Steven Beyer Waltman *Fairfax, Virginia* Electrical Engineering
- Eric Wang *Pullman, Washington* Engineering and Applied Science
- Michael Scott Warren *Rapid City, South Dakota* Physics and Engineering and Applied Science
- John Michael Wiltse* *Omaha, Nebraska* Engineering and Applied Science
- Ralph Christian Wolf* *Castro Valley, California* Physics
- Jorden Emanuel Woods* *Evanston, Illinois* Physics and Astronomy
- William Edward Woody *Fresno, California* Mathematics
- GloryAnne Yango *Kaneohe, Hawaii* Engineering and Applied Science
- Tung Yin *Placentia, California* Economics
- Robert Chien Hwa Young* *South Pasadena, California* Engineering and Applied Science
- Miriam Sharon Zucker *East Moriches, New York* Biology

MASTER OF SCIENCE

- Joel Whitney Adamson (*Environmental Engineering Science*) B.S., University of California, Irvine 1987.
- William Wyatt Anderson (*Planetary Science*) B.A., David Lipscomb College 1981; M.S., Vanderbilt University 1984.
- Julian Lawrence Anthony (*Applied Mathematics*) B.S., Southern Methodist University 1985.
- Eric Kendall Babson (*Mathematics*) (*Physics*) B.S., California Institute of Technology 1988.
- Silvano Balemi (*Electrical Engineering*) Diploma, Swiss Federal Institute of Technology 1987.
- Darin Emerson Beigie (*Physics*) B.Sc., University of Toronto 1986.
- Jennifer Glee Blank (*Geochemistry*) A.B., B.S., Stanford University 1983; M.S., The University of Washington 1986.
- Richard Thomas Boylan (*Social Science*) B.A., Pitzer College 1986.
- Wilson Brumiller, Jr. (*Electrical Engineering*) B.S., State University in Campinas 1986.
- Robert Bury (*Electrical Engineering*) Ingénieur, Université Libre de Bruxelles 1985.
- Thomas Hubertus Büttgenbach (*Physics*) Vordiplom, Universität zu Köln 1985.
- David Paul Carico (*Physics*) B.S., University of California, Berkeley 1983.
- Miguel Arcangel Carmona (*Electrical Engineering*) B.S., University of Illinois at Chicago Circle 1987.
- Laurinda Ann Chamberlin (*Geology*) A.B., University of California, Berkeley 1986.
- Man Shun Chan (*Electrical Engineering*) B.Sc., University College London 1987.
- Chun Chang (*Environmental Engineering Science*) B.S., Tongji University 1982.
- Ivan Lode André Maria Claeys (*Chemical Engineering*) M.S., Catholic University of Leuven 1986.
- Gerald Bryan Cleaver (*Physics*) B.S. (Physics), Valparaiso University 1985; B.S. (Mathematics) 1985.
- Olivier Steven Cojot-Goldberg (*Electrical Engineering*) B.S., California Institute of Technology 1987.
- Charles David Coleman (*Social Science*) B.S., George Mason University 1985.
- Luca Cortelezzi (*Engineering Science*) B.S., Milano State University 1978.
- John Philip Creamer III (*Aeronautics*) B.S.A.E., West Virginia University 1983.
- Stephen Paul Cutts (*Environmental Engineering Science*) B.S., Oakland University 1985.
- Cynthia Evors Daniell (*Electrical Engineering*) B.S.E.E., University of South Alabama 1985.
- J. Huw Davies (*Geophysics*) B.A., University of Cambridge 1983.
- Loïc Gaëtan de Surville (*Applied Mechanics*) Diplome, Technical University of Toulon 1984; Diplome d'Ingenieur, University of Technology of Compiègne 1987.

MASTER OF SCIENCE — *Continued*

- Pierre Elie Marie De Villiers De La Noue (*Electrical Engineering*) Diplômé, École Polytechnique de Montréal 1986.
- Stéphane Desjardins (*Aeronautics*) Bachelier en Ingénierie, École Polytechnique de Montréal 1987.
- Achim Ditzen (*Mathematics*) Diplom-Vorprüfung, Technische Universität Berlin 1986; Diplom-Vorprüfung, Freie Universität Berlin 1986.
- Andrea Donnellan (*Geophysics*) B.S., Ohio State University 1986.
- Gordon Scott Dudley (*Applied Mechanics*) B.S., University of Oregon 1981; B.S., The University of Washington 1985.
- Thomas Sheehan Duffy (*Geophysics*) B.S., Boston College 1982; M.S., University of Illinois at Chicago Circle 1986.
- Alexander Hewgill Elliott (*Environmental Engineering Science*) B.Sc., University of Auckland 1986.
- Edith Celeste Erlanson (*Aeronautics*) S.B., Massachusetts Institute of Technology 1987.
- Allen Holt Farrington (*Electrical Engineering*) B.S.E., Duke University 1986.
- David Gillespie (*Computer Science*) B.S., California Institute of Technology 1986.
- Robert Wilson Graves (*Geophysics*) B.S., University of California, Riverside 1984.
- Pierre Guern (*Electrical Engineering*) Diplôme d'Ingénieur Mécanicien-Electronicien, École Spéciale de Mécanique et d'Électricité 1987.
- Eric Martin Hanczyc (*Chemical Engineering*) B.S., Lehigh University 1986.
- Robert Adam Harley (*Environmental Engineering Science*) B.A.Sc., University of Toronto 1987.
- Ann Terese Heil (*Chemical Engineering*) B.S.E., The University of Michigan 1984.
- Reed Taylor Henry (*Electrical Engineering*) B.S., The University of Washington 1986.
- Thomas O. Herb (*Physics*) Diplom, University of Göttingen 1985.
- David Louis Herrick (*Planetary Science*) B.S., University of Kentucky 1987.
- Edward Andrew Hoo (*Aeronautics*) B.M.E., University of Dayton 1986.
- Jonathan Noel Hurley (*Chemistry*) B.A., Cambridge University 1986.
- Lorraine Joyce Hwang (*Geophysics*) B.A., University of California, Berkeley 1985.
- Phillip Dean Ihinger (*Geochemistry*) B.A., Pomona College 1983.
- Nanette Jackson (*Computer Science*) B.S., University of Alabama 1986.
- Brett Alan Johnson (*Applied Mechanics*) B.S., University of Missouri-Rolla 1986.
- Randall David Kamien (*Physics*) B.S., California Institute of Technology 1988.
- Shawn Everett Kantor (*Social Science*) B.A., University of Rochester 1987.
- Douglas Alexander Kerns (*Electrical Engineering*) B.S., Northwestern University 1987.
- Moonil Kim (*Electrical Engineering*) B.S., Illinois Institute of Technology 1987.

MASTER OF SCIENCE — Continued

- Sukhoon Roger Kim (*Aeronautics*) B.S., University of Illinois at Urbana-Champaign 1981.
- Young Shil Kim (*Applied Physics*) B.S., California Institute of Technology 1983.
- Petros D. Koumoutsakos (*Aeronautics*) Diploma, National Technical University of Athens 1986; M.S.E., The University of Michigan 1987.
- Carl Emil Krill III (*Applied Physics*) B.S., University of Notre Dame 1986.
- Corinne Patricia Labaune (*Electrical Engineering*) Diplôme d'Ingénieur, École Supérieure d'Ingénieurs en Électrotechnique et en Électronique 1988.
- Helene Jane Lapierre (*Applied Mechanics*) B.Eng., École Polytechnique de Montréal 1983; M.Sc.A., 1986.
- Anastasios Mike Lappas (*Aeronautics*) Diploma, National Technical University of Athens 1987.
- Thomas LaTourrette (*Geology*) B.A., University of California, Berkeley 1985.
- Brian Kwan Fong Lau (*Mathematics*) B.S., California Institute of Technology 1984.
- Tak Kwan Lee (*Computer Science*) B.S., B.A., University of California, San Diego 1986.
- Patrick Alberic Legros (*Social Science*) Maitrise, Université Paris XII 1979; D.E.A., 1981; Doctorat, 1985.
- Andrew David Lewis (*Applied Mechanics*) B.Sc.E., University of New Brunswick 1987.
- Michael Robert Lewis (*Chemistry*) B.S., The University of North Carolina at Chapel Hill 1984.
- Louis William Lombardo (*Physics*) B.S., California State University, Sacramento 1983.
- Peter Stanley Lum (*Applied Mechanics*) B.S., The George Washington University 1987.
- Arthur William Lupia Jr. (*Social Science*) B.A., University of Rochester 1986.
- Keith A. Matthews (*Biology*) B.S., Jackson State University 1984.
- Robert Thomas M'Closkey III (*Mechanical Engineering*) B.A.Sc., University of Windsor 1987.
- Lindsay K. McKinley (*Chemistry*) B.S., Georgia Institute of Technology 1983; M.A., The University of Texas at Austin 1985.
- Janet Mary McWaid (*Electrical Engineering*) B.S., California Institute of Technology 1986.
- Susan Melnik (*Aeronautics*) B.S., Case Western Reserve University 1986.
- John Warren Miller (*Electrical Engineering*) B.S., Texas A&M University 1987.
- Hamid Reza Montazeri (*Aeronautics*) B.Eng., Imperial College of Science and Technology, University of London 1987.
- Srihari Murthy (*Applied Physics*) B.Tech., Banaras Hindu University 1987.
- David Per Georg Nilsson (*Applied Physics*) Civilingenjör, Lund Tekniska Högskolan 1987.

MASTER OF SCIENCE — *Continued*

- Gordon Preston Oliver (*Electrical Engineering*) B.S., Carnegie-Mellon University 1987.
- Luiz Nogueira Palma (*Environmental Engineering Science*) B.S., Universidade Federal de Santa Catarina 1983.
- Spyros N. Pandis (*Chemical Engineering*) Dipl.Ing., University of Patras 1986.
- Douglas Harvey Pearson (*Applied Physics*) B.S., University of Wisconsin, Eau Claire 1985.
- Kathryn Knight Pierce (*Planetary Science*) B.A., Cornell University 1986.
- Stephan Anthony Pietrusiak (*Electrical Engineering*) B.S., California Institute of Technology 1988.
- Jack Tai-On Poon (*Electrical Engineering*) B.S., The University of Washington 1987.
- Maria D. Poviones (*Electrical Engineering*) B.S., University of Miami 1987.
- Eric Jay Raiten (*Physics*) B.S., Massachusetts Institute of Technology 1986.
- Rajaram Ramesh (*Electrical Engineering*) B.Tech., Indian Institute of Technology, Madras 1987.
- Steven Jay Rizzi (*Mechanical Engineering*) B.S.M.E., The Cooper Union 1986.
- Aaron John Rulison (*Aeronautics*) B.S.E., The University of Michigan 1987.
- Jean-Marc Saint-Pierre (*Electrical Engineering*) Diplôme d'Ingénieur, École Supérieure d'Ingénieurs en Électrotechnique et en Électronique 1988.
- Steven Sanders (*Applied Physics*) B.S., Yale University 1986.
- Thomas Pierre Schrans (*Electrical Engineering*) Ingenieur, State University of Ghent 1984; Ingenieur Zwakstroom, 1987.
- Jakov N. Seizovic (*Computer Science*) B.S.E.E., University of Belgrade 1986.
- Peter Charles Sercel (*Applied Physics*) B.S., University of Arizona 1987.
- Jeffrey Arthur Seto (*Aeronautics*) B.S., University of Southern California 1987.
- Murali Sharma (*Physics*) B.E., Birla Institute of Technology and Science 1985; M.Sc., 1985.
- Steinn Sigurdsson (*Physics*) B.S., University of Sussex 1986.
- Kumar Nellicherry Sivarajan (*Electrical Engineering*) B.Tech., Indian Institute of Technology, Madras 1981.
- Joseph Michael Sivo (*Mechanical Engineering*) B.E., The Cooper Union 1987.
- Patricia Jo Stoddard (*Aeronautics*) B.S., California Institute of Technology 1982.
- Gregory Daniel Sullivan (*Aeronautics*) B.A.Sc., University of Toronto 1987.
- Scott Cameron Thornburg (*Physics*) B.S., Stanford University 1986.
- Lori Ann Torry (*Environmental Engineering Science*) B.S.E., University of Pennsylvania 1985.
- Alexios Tsernos (*Applied Mechanics*) B.A., Reed College 1988; B.S., California Institute of Technology 1988.
- Yucon Tsien (*Engineering Science*) B.Sc., Chang Sha Institute of Technology 1982.
- Koichiro Tsujino (*Electrical Engineering*) B.E., Keio University 1982; M.E., 1984.
- Alberto A. Valdes (*Civil Engineering*) B.S., Utah State University 1987.

MASTER OF SCIENCE — *Continued*

- Bruce Gordon Valerius (*Aeronautics*) B.S., Parks College of St. Louis University 1987.
- Dawn Braley Valero (*Applied Mechanics*) B.S.E., Princeton University 1985.
- Sean Rikio Wakayama (*Aeronautics*) B.S., California Institute of Technology 1988.
- John William Weber (*Mechanical Engineering*) B.S., Tennessee Technical University 1987.
- Michael Bennett Wolf (*Geology*) B.A., Hamilton College 1985.
- Yuqian Wong (*Electrical Engineering*) B.S.E.E., Shanghai University of Technology 1984.
- Bradley Brett Woods (*Geophysics*) B.S.E., Princeton University 1985.
- Charles Bruce Worden (*Geophysics*) B.S., University of California, Riverside 1986.
- Moon-Tai Yeung (*Aeronautics*) B.S., California Institute of Technology 1987.
- Dongping Yin (*Social Science*) B.S., Huazhong University of Science and Technology 1984; M.S., 1986.
- Peter Joseph Zampardi (*Applied Physics*) B.E., Stevens Institute of Technology 1986.
- Bin Zhao (*Applied Physics*) B.S., Tsinghua University 1985.
- George Allan Zimmerman (*Electrical Engineering*) B.S., Stanford University 1985.

DOCTOR OF PHILOSOPHY

DIVISION OF BIOLOGY

- Edward Matthew Callaway (*Biology*) B.S., Stanford University 1984.
Thesis: Regulation of Competitive Interactions During Neuromuscular Synapse Elimination.
- Caren Chang (*Molecular Biology*) A.B., University of California, Berkeley 1982.
Thesis: Molecular Genetic Studies in *Arabidopsis thaliana*:
I. Complementation of an Alcohol Dehydrogenase Mutant by Transformation.
II. A Restriction Fragment Length Polymorphism Map of the Genome.
- Mark David Garfinkel (*Biology*) B.A., Wesleyan University 1980.
Thesis: Structural and Functional Studies of the 68C Glue Protein Gene Cluster of *Drosophila melanogaster*.
- Chang Soo Hahn (*Biology*) B.S., Yon Sei University 1983.
Thesis: Structure-Function Relationships in the Structural Proteins and in the RNAs of Alphaviruses and Flaviviruses.
- Alexander Kamb (*Biology*) A.B., Harvard University 1982.
Thesis: Molecular Biology of *Shaker*, A *Drosophila* Gene That Encodes Multiple Potassium Channel Components.
- Michael Paul King (*Biology*) B.A., Johns Hopkins University 1981.
Thesis: Studies of Human Mitochondria. I. Steady-State Levels and Metabolic Properties of the Mitochondrial tRNAs. II. Injection of Mitochondria into Human Cells Leads to a Rapid Replacement of the Endogenous Mitochondrial DNA.
- Christopher Hayes Martin (*Biology*) A.B., University of California, Berkeley 1982.
Thesis: Evolution and Expression at the 68C Glue Gene Cluster of *Drosophila*.
- Stephen G. Miller (*Biology*) B.S., University of Minnesota-Twin Cities 1977.
Thesis: Brain Type II Calcium and Calmodulin-Dependent Protein Kinase: Characterization of a Brain-Region Specific Isozyme and Regulation by Autophosphorylation.
- James Martin Soha (*Biology*) B.S., California Institute of Technology 1967; M.S., University of Southern California 1973.
Thesis: Specificity and Competition during Maturation of Neuromuscular Synapses.

DIVISION OF CHEMISTRY AND CHEMICAL ENGINEERING

- Eric Van Anslyn (*Chemistry*) B.S., California State University, Northridge 1983.
Thesis: Mechanistic, Synthetic and Theoretical Studies of High Valent Metallacycles and Metal Alkylidenes.
- William G. Antypas, Jr. (*Chemistry*) B.A., Williams College 1978.
Thesis: Nuclear Magnetic Resonance Studies of Biological Systems.

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*

- Edward Paul Ascoli (*Chemical Engineering*) S.B., Massachusetts Institute of Technology 1982; M.S., California Institute of Technology 1987.
Thesis: The Effects of a Planar Wall on the Low Reynolds Number Motion of Solid Particles, Drops and Bubbles.
- Miguel Jorge Bagajewicz (*Chemical Engineering*) Ingeniero Químico, Universidad Nacional del Litoral 1977; M.S., California Institute of Technology 1984.
Thesis: Studies on Hot Gas H₂S Removal Sorbents in Fixed-Bed Reactors at High Temperatures.
- Brenda Faye Baker (*Chemistry*) B.S., Colorado State University 1982.
Thesis: Sequence-Specific Cleavage of Double-Helical DNA
N-Bromoacetyldistamycin.
- Mark John Brusich (*Chemistry*) B.S., The University of Washington 1981.
Thesis: Theoretical Insights into the Bonding in Thorium Organometallic Complexes: A Comparison with Group IV Transition Metal Chemistry.
- Al Ray Bulls (*Chemistry*) B.S., University of Texas at Arlington 1980; M.A., 1982.
Thesis: Carbon-Hydrogen Bond Activation by Peralkylhafnocene and Peralkylscandocene Derivatives.
- Louis Fiscel Cannizzo (*Chemistry*) B.S., University of New Mexico 1982.
Thesis: Titanium Carbenes: Reactions with Selected Carbonyl Compounds and Ring-Opening Metathesis Polymerization of Cyclic Olefins.
- Hong-Man Chan (*Chemical Engineering*) B.E., The Cooper Union 1981; M.S., California Institute of Technology 1984.
Thesis: Numerical Study of Quiescent and Sheared Sedimenting Suspensions.
- Leigh Ellen Clawson (*Chemistry*) B.S., The University of North Carolina at Chapel Hill 1982.
Thesis: Studies on the Reactivity of Titanocene Alkylidenes and Titanocene Alkyl Chlorides.
- Joseph Isaac Cline III (*Chemistry*) B.S., University of Virginia 1983.
Thesis: Photodissociation Dynamics of Triatomic van der Waals Molecules.
- Nancy Anderson Da Silva (*Chemical Engineering and Biology*) B.S., University of Massachusetts at Amherst 1982; M.S., California Institute of Technology 1985.
Thesis: Host-Plasmid Interactions and Regulation of Cloned Gene Expression in Recombinant Cells.
- Richard Leslie Dubs (*Chemistry*) B.S., Union College 1983.
Thesis: Single- and Multiphoton Ionization Processes in Molecules.
- Dwight David Evard (*Chemistry*) B.S., Andrews University 1982.
Thesis: Structure and Dynamics of Several Rare Gas-Halogen van der Waals Molecules.
- Sally Reid Hair (*Chemistry*) A.B., Bryn Mawr College 1982.
Thesis: Experimental and Theoretical Studies of van der Waals Molecule Photodissociation.

DOCTOR OF PHILOSOPHY — *Continued*

- Betty Jane Miller Hannoun (*Chemical Engineering and Biology*) B.S., Cornell University 1982; M.S., California Institute of Technology 1985.
Thesis: Ethanol Production by *Saccharomyces cerevisiae* Immobilized in Calcium Alginate.
- Paul Gregory Hipes (*Chemistry*) B.S., Texas Tech University 1981.
Thesis: Three Dimensional Atom-Diatomic Reactive Scattering Calculations Using Symmetrized Hyperspherical Coordinates.
- Mickey ChienTsung Hu (*Chemistry*) B.S., National Taiwan University 1977; M.S., 1982.
Thesis: I. The *E. Coli* Lac Operator-Repressor System Is Functional for Control of Gene Expression in Animal Cells. II. Molecular Cloning and Characterization of the Mouse Skeletal Muscle (α) Actin Gene.
- Brent Lee Iverson (*Chemistry*) B.S., Stanford University 1981.
Thesis: 1. Nonenzymatic Cleavage of Single-Stranded DNA to Nucleotide Resolution.
2. Novel Base Specific DNA Cleavage Reactions.
- Sheila Anne Iverson (*Chemistry*) B.A. (Chemistry), University of Oregon 1982; B.A. (Mathematics), 1982.
Thesis: Blue Copper Proteins: Gene Synthesis and Expression.
- Carol Leslie Jones Adkins (*Chemical Engineering*) B.S., University of New Mexico 1981.
Thesis: Use of a Continuous Stirred Tank Reactor for the Study of Aqueous Aerosol Chemistry.
- In Seok Kang (*Chemical Engineering and Applied Mathematics*) B.S., Seoul National University 1978; M.S., Korea Advanced Institute of Science and Technology 1980.
Thesis: Bubble Dynamics and Breakup in Straining Flows.
- Lutfur Rahman Khundkar (*Chemistry*) B.A., Pomona College 1982.
Thesis: Microcanonical Rates of Unimolecular Reactions Studied by Time-Resolved Photofragment Spectroscopy.
- Stephen Jacob Klippenstein (*Chemistry*) B.Sc., University of British Columbia 1983.
Thesis: Theoretical Studies of Chemical Reaction Dynamics.
- Bette Tina Marie Korber (*Chemistry*) B.S., California State University, Long Beach 1981.
Thesis: Regulation of Class I Genes by Interferons.
- Gary Hermann Kruppa (*Chemistry*) B.S., University of Delaware 1982.
Thesis: Photoelectron Spectroscopy of Reactive Intermediates.
- Daniel Lee Laughlin (*Chemical Engineering*) B.S., University of Minnesota-Twin Cities 1983; M.S., California Institute of Technology 1985.
Thesis: Control System Design for Robust Performance Despite Model Parameter Uncertainties: Application to Cross-Directional Response Control in Paper Manufacturing.

DOCTOR OF PHILOSOPHY — *Continued*

Steven Mark Lederman (*Chemistry*) B.S., University of Maryland at College Park 1982.

Thesis: Artificial Intelligence in Quantum Intramolecular Dynamics with Application to a Heavy Central Mass Problem.

Julia Catherine Lester (*Chemical Engineering*) B.S., Purdue University 1981.

Thesis: Hydrodynamic Dispersion in Concentrated Sedimenting Suspensions.

Michael Loewenberg (*Chemical Engineering*) B.S., Purdue University 1982.

Thesis: A Theoretical Study of Reaction and Diffusion in Microstructured Materials.

Stephen Leon Mayo (*Chemistry*) B.S., The Pennsylvania State University 1983.

Thesis: Electron Transfer in Structurally Engineered Metalloproteins.

Mark Herbert McAdon (*Chemistry*) B.A., State University of New York at Binghamton 1979.

Thesis: New Concepts of Metallic Bonding.

Paul Scott Northrop (*Chemical Engineering*) B.S., Washington University 1983, *M.S. CIT 1984*

Thesis: A Fundamental Study of Char Combustion: Changes in Particle Morphology During Oxidation.

Garth Rockwood Parker, Jr. (*Chemistry*) B.S., Haverford College 1981.

Thesis: Determination of Nascent H_2 Rovibrational Distributions by Laser Induced Fluorescence: Applications to Formaldehyde Photodissociation and Hydrogen Exchange Reactions.

John Ethan Parmeter (*Chemistry*) B.S., University of California, Berkeley 1983.

Thesis: The Organometallic Chemistry of the Ru(001) Surface.

Dianne Marie Perez (*Chemistry*) B.A., The College of Wooster 1982.

Thesis: Structure-Function Studies of Serine Hydrolases: Synthesis of a Gene for α -Lytic Protease and the Purification and Characterization of a Mutant β -Lactamase.

Michael Anthony Petti (*Chemistry*) S.B., Massachusetts Institute of Technology 1982.

Thesis: Studies in Molecular Recognition.

Kenneth Frederick Reardon (*Chemical Engineering and Biology*) B.S., University of Pennsylvania 1981.

Thesis: Deactivation and Regeneration Kinetics during Bioconversions by Immobilized *Clostridium acetobutylicum*.

Vicente Mendoza Reyes (*Chemistry*) B.S.(Chemistry), University of The Philippines 1979; B.S.(Mathematics), 1980; M.S., 1982.

Thesis: Transcription and Processing of Transfer RNA in *S. cerevisiae*.

Alexandros Seressiotis (*Chemical Engineering and Biology*) Diploma, National Technical University of Athens 1982.

Thesis: Mathematical Models Based on Molecular Processes of the Cell.

DOCTOR OF PHILOSOPHY — *Continued*

- Brent Howard Shanks (*Chemical Engineering*) B.S., Iowa State University 1983;
M.S., California Institute of Technology 1985.
Thesis: Reactor Input Manipulation for Developing Models for Catalytic Reactions.
- Timothy Jon Shepodd (*Chemistry*) B.S., University of California, Los Angeles 1982.
Thesis: Studies in Molecular Recognition: Hydrophobic Binding of Water-Soluble Guests by High-Symmetry, Chiral Hosts.
- James P. Sluka (*Chemistry*) B.S., San Jose State University 1980; M.S., 1982.
Thesis: Design, Synthesis and Characterization of Sequence Specific DNA Cleaving Agents.
- Gary James Snyder (*Chemistry*) B.S., University of New Mexico 1981.
Thesis: 2,4-Dimethylene-1,3-cyclobutanediyl and 2,4-Dimethylenebicyclobutane. Synthesis, Spectroscopy, and Reactivity of a Triplet Biradical and Its Covalent Isomer.
- Jennifer E. Stern (*Chemical Engineering*) B.S.E., Princeton University 1983.
Thesis: Aerosol Formation and Growth in Aromatic Hydrocarbon/NO_x Systems.
- Howard Alvin Stone (*Chemical Engineering*) B.S., University of California, Davis 1982.
Thesis: Dynamics of Drop Deformation and Breakup in Time-Dependent Flows at Low Reynolds Numbers.
- James Arthur Stoos (*Chemical Engineering*) B.Ch.E., University of Minnesota-Twin Cities 1981.
Thesis: Particle Dynamics near Fluid Interfaces in Low-Reynolds Number Flows.
- Timothy Manning Swager (*Chemistry*) B.S., Montana State University 1983.
Thesis: Precursor Routes to Conducting Polymers From the Ring Opening Metathesis Polymerization of Cyclic Olefins.
- Brian G. R. T. Treco (*Chemistry*) B.S., University of Delaware 1982.
Thesis: Production of Transition Metal Oxidants through Design and Synthesis of Polyanionic Chelating Ligands.
- Stephan N. Witt (*Chemistry*) B.S., Union College 1981.
Thesis: The Mechanism of Cytochrome *c* Oxidase-Catalyzed Dioxygen Reduction.
- Robert Scott Youngquist (*Chemistry*) B.S., Miami University 1982.
Thesis: Sequence Specific Recognition and Cleavage of DNA by Synthetic Molecules.

DIVISION OF ENGINEERING AND APPLIED SCIENCE

- Steven Mark Anlage (*Applied Physics*) B.S., Rensselaer Polytechnic Institute 1982;
M.S., California Institute of Technology 1984.
Thesis: Icosahedral Order in Metastable Metallic Alloys.
- Norbert Karl Erhard Arndt (*Mechanical Engineering*) Diplomvorprüfung,
Rheinisch-Westfälische Technische Hochschule Aachen, 1982; M.S., California Institute of Technology 1984.
Thesis: Experimental Investigation of Rotor-Stator Interaction in Diffuser Pumps.

DOCTOR OF PHILOSOPHY — *Continued*

Francisco E. Avila Segura (*Mechanical Engineering*) B.Sc., Universidad Veracruzana 1978; M.Sc., Universidad Nacional Autónoma de México 1980.

Thesis: The Creeping Motion of Immiscible Drops Through A Converging/Diverging Tube: I. Non-Newtonian Effects of Viscoelastic Drops. II. Effects of Constant Pressure Gradient Condition for the Flow. III. Motion of Drops Through a Parallel Channel.

Mark Robert Bell (*Electrical Engineering*) B.S., California State University, Long Beach 1981; M.S., California Institute of Technology 1982.

Thesis: Information Theory and Radar: Mutual Information and the Design and Analysis of Radar Waveforms and Systems.

Robert William Cox (*Applied Mathematics*) B.S., California Institute of Technology 1976.

Thesis: A Model for Stress-Driven Diffusion in Polymers.

David Dale Crouch (*Applied Physics*) B.S., University of California, Davis 1983; M.S., California Institute of Technology 1985.

Thesis: A Theoretical Study of the Generation of Squeezed-State Light via Degenerate Parametric Amplification.

David Russell Dowling (*Aeronautics*) B.S., California Institute of Technology 1982; M.S., 1983.

Thesis: Mixing in Gas Phase Turbulent Jets.

Michael John Dowling (*Civil Engineering*) B.E., National University of Ireland 1980; M.S., California Institute of Technology 1984.

Thesis: Nonlinear Seismic Analysis of Arch Dams.

Ziyad Hassan Durón (*Civil Engineering*) B.S., Harvey Mudd College 1981; S.M., Massachusetts Institute of Technology 1983.

Thesis: Experimental and Finite Element Studies of a Large Arch Dam.

Stephen D. Freeland (*Electrical Engineering*) B.S., Harvey Mudd College 1982; M.S., California Institute of Technology 1983.

Thesis: I. A Unified Analysis of Converters with Resonant Switches.
II. Input-Current Shaping for Single-Phase Ac-Dc Power Converters.

Susan Elizabeth Fuhs (*Mechanical Engineering*) B.S., California Institute of Technology 1980; M.S., 1981.

Thesis: Studies of Inertial Deposition of Particles onto Heat Exchanger Elements.

Jurgen J. Giezen (*Aeronautics*) B.S., State University of New York at Buffalo 1983; M.S., California Institute of Technology 1984.

Thesis: Plastic Buckling of Cylinders Under Biaxial Loading.

Sheldon Isaiah Green (*Mechanical Engineering*) B.A.Sc., University of Toronto 1984; M.S., California Institute of Technology 1985.

Thesis: Tip Vortices—Single Phase and Cavitating Flow Phenomena.

Enrique José Hernández Valencia (*Electrical Engineering*) Ingeniero Electrónico, Universidad Simón Bolívar 1982; M.S., California Institute of Technology 1985.

Thesis: Queues of Queues in Communication Networks.

DOCTOR OF PHILOSOPHY — *Continued*

- Pui-Kwan Andrew Hong (*Environmental Engineering Science*) B.S., California Institute of Technology 1981; M.S., 1982.
Thesis: Catalytic Oxidation of Sulfur Dioxide by Heterogeneous Cobalt-Phthalocyanine.
- Michael P. Karyeacis (*Mechanical Engineering*) B.S., Harvey Mudd College 1980; M.S., California Institute of Technology 1981.
Thesis: Dynamics of a Semi-Active Impact Damper: Regular and Chaotic Motions.
- Sung Joon Kim (*Electrical Engineering*) B.S., California Institute of Technology 1983; M.S., 1984.
Thesis: I. Ion-Solid Interactions with Markers. II. Oxidation Phenomena in Silicides and Aluminides.
- Susan Mary Larson (*Environmental Engineering Science*) A.B., Washington University 1981; M.S., California Institute of Technology 1982.
Thesis: A Study of Summer Midday Low-Visibility Events in the Los Angeles Area.
- Yiannis Angelo Levendis (*Environmental Engineering Science*) B.S.E., The University of Michigan 1980; M.S.E., 1981.
Thesis: A Fundamental Study of Char Oxidation Kinetics Using Model Materials.
- Liyuan Liang (*Environmental Engineering Science*) B.S., Northeastern University 1982; M.S., California Institute of Technology 1983.
Thesis: Effects of Surface Chemistry on Kinetics of Coagulation of Submicron Iron Oxide Particles (α -Fe₂O₃) in Water.
- Anne Lin (*Civil Engineering*) Engenheiro Civil, Escola Politécnica da Universidade de Sao Paulo 1975; M.S., Columbia University 1976.
Thesis: A Numerical Evaluation of the Method of Equivalent Nonlinearization.
- Raghu Madhavan (*Mechanical Engineering*) B.Tech., Indian Institute of Technology, Madras 1983; M.S., California Institute of Technology 1984.
Thesis: On the Collapse of Long Thick-Walled Circular Tubes under Biaxial Loading.
- Eric Etienne Majani (*Electrical Engineering*) Diplôme d'Ingénieur, Ecole Nationale Supérieure de l'Aéronautique et de l'Espace 1982; M.S., California Institute of Technology 1983.
Thesis: A Model for the Study of "Very Noisy" Channels and Applications.
- Wen Jin Meng (*Applied Physics*) B.S., California Institute of Technology 1982.
Thesis: Solid State Amorphization Reactions in Thin Film Diffusion Couples.
- Sotirios Natsiavas (*Mechanical Engineering*) Ptichion, Aristotelio University of Thessaloniki 1982.
Thesis: Response and Failure of Fluid-Filled Tanks under Base Excitation.
- Terese Marie Olson (*Environmental Engineering Science*) B.S., University of Notre Dame 1980; M.S., Northwestern University 1982.
Thesis: The Formation Kinetics, Mechanisms, and Thermodynamics of S(IV)-Aldehyde Addition Compounds.
- Ian Dennis Parsons (*Civil Engineering*) B.Sc., Imperial College of Science and Technology 1982; M.Sc., 1983.
Thesis: The Application of the Multigrid Method to the Finite Element Solution of Solid Mechanics Problems.

DOCTOR OF PHILOSOPHY — *Continued*

Chia-Yen Peng (*Applied Mechanics*) B.S., National Taiwan University 1980; M.S., California Institute of Technology 1983.

Thesis: Generalized Modal Identification of Linear and Nonlinear Dynamic Systems.

Christodoulos Pilinis (*Environmental Engineering Science and Applied Mathematics*) B.Sc., National Technical University of Athens 1983; M.S., California Institute of Technology 1984.

Thesis: Mathematical Modeling of the Dynamics and Thermodynamics of Multicomponent Atmospheric Aerosols.

Jeffrey David Pugh (*Aeronautics*) B.E., University of Auckland 1982; M.S., California Institute of Technology 1984.

Thesis: Finite Amplitude Waves in Plane Poiseuille Flow.

Gabriel M. Rebeiz (*Electrical Engineering*) B.E., American University of Beirut 1982; M.S., California Institute of Technology 1983.

Thesis: Monolithic Millimeter-Wave Two-Dimensional Horn Imaging Arrays.

Wade Gordon Regehr (*Applied Physics*) B.Sc., University of Regina 1982.

Thesis: Neuron-Microdevice Connections.

Syed Azhar Abbas Rizvi (*Electrical Engineering*) B.S., Shiraz University 1982; M.S., California Institute of Technology 1984.

Thesis: The Critical Points of Poynting Vector Fields.

Ranajit Sahu (*Mechanical Engineering*) B.Tech., Indian Institute of Technology, Kharagpur 1983; M.S., California Institute of Technology 1984.

Thesis: On the Combustion of Bituminous Coal Chars.

Paul Wesley Smith, Jr. (*Applied Mechanics*) B.S., University of California, Santa Barbara 1972; M.S., 1973.

Thesis: Considerations for the Design of Gas-Lubricated Slider Bearings.

Patrick Joseph Smyth (*Electrical Engineering*) B.E., University College Galway 1984; M.S., California Institute of Technology 1985.

Thesis: The Application of Information Theory to Problems in Decision Tree Design and Rule-Based Expert Systems.

Frank Cheung Tao So (*Electrical Engineering*) B.Sc., University of Manchester 1982; M.S., California Institute of Technology 1983.

Thesis: Diffusion Barriers for VLSI Applications.

Moderag  Anthony Marius Waas (*Aeronautics and Applied Mathematics*) B.Sc., The Imperial College of Science and Technology 1982; M.S., California Institute of Technology 1983.

Thesis: Compression Failure of Fibrous Laminated Composites in the Presence of Stress Gradients: Experiment and Analysis.

Rueen-Fang Theresa Wang (*Environmental Engineering Science*) B.S., National Taiwan University 1980; M.S., California Institute of Technology 1982.

Thesis: Laboratory Analysis of Settling Velocities of Wastewater Particles in Seawater Using Holography.

Michael James Wengler (*Applied Physics*) B.A., Swarthmore College 1978.

Thesis: Heterodyne Detection with Superconducting Tunnel Diodes.

DOCTOR OF PHILOSOPHY — *Continued*

- Robert Gary Whirley (*Mechanical Engineering*) B.M.E., Georgia Institute of Technology 1983; M.S., California Institute of Technology 1984.
Thesis: Random Response of Nonlinear Continuous Systems.
- Ted Kirk Woodward (*Applied Physics*) B.S., The University of Texas at Austin 1983; M.S., California Institute of Technology 1985.
Thesis: Experimental Studies of Heterostructure Devices: Resonant Tunneling Transistors and GaAs/AlAs/GaAs Capacitors.
- Yu-Shu George Wu (*Applied Physics*) B.S., National Taiwan University 1980.
Thesis: Electronic Properties of II-VI Superlattices and III-V Tunnel Structures.
- Jeffrey Winston Yu (*Electrical Engineering*) B.S., California Institute of Technology 1983; M.S., 1984.
Thesis: Optical Processing Using Photorefractive Crystals.

DIVISION OF GEOLOGICAL AND PLANETARY SCIENCES

- Shih-Bin Robin Chang (*Geochemistry*) B.S., National Taiwan University 1979.
Thesis: Bacterial Magnetite in Sedimentary Deposits and its Geophysical and Paleoeological Implication.
- Richard Lawrence Edwards (*Geochemistry*) S.B., Massachusetts Institute of Technology 1976; M.S., University of Michigan 1981.
Thesis: High Precision Thorium-230 Ages of Corals and the Timing of Sea Level Fluctuations in the Late Quaternary.
- Phyllis Hang-Yin Ho-Liu (*Geophysics*) B.S., Virginia Polytechnic Institute and State University 1982; M.S., The Pennsylvania State University 1984.
Thesis: I. Attenuation Tomography. II. Modeling Regional Love Waves: Imperial Valley to Pasadena.
- Cathryn Clement Allen Manduca (*Geology*) B.A., Williams College 1980; M.S., California Institute of Technology 1982.
Thesis: Geology and Geochemistry of the Oceanic Arc-Continent Boundary in the Western Idaho Batholith Near McCall.
- Gregory W. Ojakangas (*Planetary Science and Geophysics*) B.S., University of Minnesota, Duluth 1982; M.S., California Institute of Technology 1985.
Thesis: I. Episodic Volcanism of Tidally Heated Satellites with Application to Io. II. Thermal State of an Ice Shell on Europa. III. Polar Wander of a Synchronously Rotating Satellite with Application to Europa.
- Lynn Alison Silver (*Geology*) A.B., University of California, Berkeley 1981; M.S., California Institute of Technology 1984.
Thesis: Water in Silicate Glasses.
- Christof Stork (*Geophysics*) S.B., Massachusetts Institute of Technology 1983.
Thesis: Ray Trace Tomographic Velocity Analysis of Surface Seismic Reflection Data.
- Robert Frederik Svendsen Jr. (*Geophysics*) B.S., Bradley University 1980; M.S., California Institute of Technology 1982.
Thesis: Optical Radiation from Shock-Compressed Materials.

DOCTOR OF PHILOSOPHY — *Continued*

- Jiajun Zhang (*Geophysics and Applied Mathematics*) Beijing University 1980;
M.A., University of Science and Technology of China 1981.
Thesis: Determination of Source Finiteness and Depth of Large Earthquakes.

DIVISION OF THE HUMANITIES AND SOCIAL SCIENCES

- Farid Gasmi (*Social Science*) Licence en Sciences Economiques, Université D'Alger
1981; M.S., California Institute of Technology 1984.

Thesis: Econometrics of Duopolistic Games in Prices and Advertising: The Case of
the U.S. Soft Drink Industry.

- Wendy Lynn Hansen (*Social Science*) B.A., Lawrence University 1983; M.S.,
California Institute of Technology 1985.

Thesis: Regulatory Theory and its Application to Trade Policy: A Study of ITC
Decision-making.

- Jean-Laurent Rosenthal (*Social Science*) B.A., Reed College 1984.

Thesis: The Fruits of Revolution; Property Rights, Litigation and French Agriculture
1700-1860.

DIVISION OF PHYSICS, MATHEMATICS AND ASTRONOMY

- Theodore John Allen (*Physics*) B.S., University of Wisconsin-Madison 1982; M.S.,
California Institute of Technology 1984.

Thesis: The Singular Mechanics of Particles and Strings.

- Wesley Boudville (*Physics*) B.Sc., The University of Western Australia 1982.

Thesis: Fluctuations Due to Object Discreteness.

- Samuel Leon Braunstein (*Physics*) B.Sc., University of Melbourne 1983; M.S.,
California Institute of Technology 1985.

Thesis: Novel Quantum States and Measurements.

- Malcolm Nicholas Butler (*Physics*) B.Sc., McMaster University 1983.

Thesis: Scaling Violations in Quasielastic Electron Scattering.

- James Michael Cline (*Physics*) B.S., Harvey Mudd College 1982; M.S., California
Institute of Technology 1985.

Thesis: Effective Lagrangians and Infinity Cancellations for Open String Theories.

- Michael Ronald Douglas (*Physics*) B.S., Harvard University 1983.

Thesis: G/H Conformal Field Theory.

- Mark Harold Finger (*Physics*) B.A. (Physics), University of Colorado at Boulder
1978; B.A. (Mathematics) 1978.

Thesis: The Imaging of Extra-Galactic Low-Energy Gamma-Ray Sources: Prospects,
Techniques, and Instrumentation.

- Peter H. Fisher (*Physics*) B.S., University of California, Berkeley 1983.

Thesis: A Search for Double Beta Decay in ^{70}Ge .

DOCTOR OF PHILOSOPHY — *Continued*

- Clemens H. Glaffig (*Mathematics*) Diplom-Vorprüfung., Albert-Ludwigs-Universität 1983; M.S., Oregon State University 1985.
Thesis: Smoothness of the Integrated Density of States for Random Schrödinger Operators on Multidimensional Strips.
- Erich Nathan Grossman (*Physics*) B.A., Harvard College 1980.
Thesis: A Far-Infrared Heterodyne Spectrometer for Airborne Astronomy.
- Askell Hardarson (*Mathematics*) B.S., University of Iceland 1981.
Thesis: Doublewell Tunneling via Feynman-Kac Formula.
- Gregory J. Hungerford (*Mathematics*) B.S., California Institute of Technology 1980.
Thesis: Boundaries of Smooth Sets and Singular Sets of Blaschke Products in the Little Bloch Class.
- Barton Duane Huxtable (*Physics*) B.S., University of Delaware 1982.
Thesis: Absence of a Scott Correction for the Total Binding Energy of Noninteracting Fermions in a Smooth Potential Well.
- Elias B. Kiritsis (*Physics*) Diploma, National Technical University of Athens 1984; M.S., California Institute of Technology 1986.
Thesis: Topics in Conformal Field Theory.
- Pawan Kumar (*Astronomy*) B.Sc., Gorakhpur University 1976; M.Sc., Indian Institute of Technology, Kanpur 1979; M.Tech., 1981.
Thesis: Excitation and Damping of Solar P-Modes.
- Charles E. Lane (*Physics*) B.S., Indiana University-Bloomington 1981; M.S., California Institute of Technology 1984.
Thesis: GUT Monopole Detection with Scintillator.
- Gang Liu (*Physics*) B.S., University of Science and Technology of China 1981.
Thesis: In Search of Slow-moving Ionizing Massive Particles.
- Hong Ma (*Physics*) B.S., Fudan University 1983.
Thesis: Experimental Tests of Electroweak Theory with $\mu^+\mu^-$ and $\mu^+\mu^- \gamma$ Final States from e^+e^- Annihilation.
- Ivan J. Matus Bloch (*Physics*) B.S., Universidad de Chile 1979; M.S., 1980.
Thesis: Models for the Avoidance Response in *Phycomyces*.
- James K. McCarthy (*Astronomy*) B.S. (Astronomy), The Pennsylvania State University 1982; B.S. (Physics) 1982.
Thesis: Échelle Spectroscopy of the Central Stars of Planetary Nebulae.
- Michael Scott Morris (*Physics*) B.S., Purdue University 1982; M.S., California Institute of Technology 1985.
Thesis: The $R + \xi R^2$ Cosmology.
- Michael Steven Pettersen (*Physics*) B.A., Harvard University 1980.
Thesis: Melting of Methane Adsorbed on Graphite Studied by Nuclear Magnetic Resonance.
- Alain Cheyney Porter (*Astronomy*) A.B., Harvard College 1980; A.M., Harvard University 1980.
Thesis: Isophotometry of Brightest Elliptical Galaxies in Rich Clusters.

DOCTOR OF PHILOSOPHY — *Continued*

Soo-Jong Rey (*Physics*) B.S., Seoul National University 1982; Sc.M., Brown University 1983; M.S., California Institute of Technology 1986.

Thesis: On the BRST Invariance of String Theory.

Sheryl Leigh Smith (*Physics*) B.S., University of California, Los Angeles 1983; M.S., California Institute of Technology 1985.

Thesis: A Search for Gravitational Waves from Coalescing Binary Stars Using the Caltech 40 meter Gravity Wave Detector.

Howard D. Stone (*Physics*) B.A., Lincoln College, University of Oxford 1982; M.S., California Institute of Technology 1984.

Thesis: Experimental Tests of QCD and Fragmentation Models in Electron-Positron Annihilation.

James Theiler (*Physics*) S.B. (Physics), Massachusetts Institute of Technology 1981; S.B. (Mathematics) 1981; M.S., California Institute of Technology 1985.

Thesis: Quantifying Chaos: Practical Estimation of the Correlation Dimension.

Haimin Wang (*Astronomy*) B.S., Nanking University 1982.

Thesis: Magnetic Fields and Supergranule Velocity Fields on the Quiet Sun.

Michael Jeffrey Ward (*Applied Mathematics*) B.Sc., The University of British Columbia 1983.

Thesis: Asymptotic Methods in Semiconductor Device Modeling.

Ren-Feng Yuan (*Physics*) Tsing Hua University 1966; Graduate School, University of Science and Technology of China 1980.

Thesis: $^{18}\text{O} + ^{18}\text{O}$ 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.

THE MILTON AND FRANCIS CLAUSER DOCTORAL PRIZE

Awarded to the Ph.D. candidate whose research is judged to exhibit the greatest degree of originality as evidenced by its potential for opening up new avenues of human thought and endeavor as well as by the ingenuity with which it has been carried out.

Recipient to be announced at Commencement.

THE WILLIAM F. BALLHAUS PRIZE

Awarded to aeronautics students for outstanding doctoral dissertations.

Moderagé Anthony Marius Waas

MABEL BECKMAN PRIZE

Awarded to a woman student upon completion of her junior or senior year in recognition of demonstrated academic and personal excellence, contributions to the Institute community, and outstanding qualities of character and leadership.

Nicole P. Vogt

ERIC TEMPLE BELL UNDERGRADUATE MATHEMATICS RESEARCH PRIZE

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

Laura M. Anderson; Eric K. Babson

CALTECH PRIZE SCHOLARSHIPS AND CARNATION SCHOLARSHIPS

Each year Caltech awards these prizes for academic excellence. They are based solely on merit (selection is made on the basis of grades, faculty recommendations, and demonstrated research productivity) with no consideration given to need or

Prizes and awards are listed only for those students awarded degrees in 1988, and include prizes and awards received by them in previous years.

PRIZES AND AWARDS — *Continued*

any other nonacademic criteria. Listed below are graduating seniors who have been recipients of these prizes.

<i>Jinane Abounadi</i>	<i>Kenneth De Lay Haynes</i>	<i>Marios-Christos</i>
<i>Laura Marie Anderson</i>	<i>Francis Ho</i>	<i>Papaefthymiou</i>
<i>Eric Kendall Babson</i>	<i>Kent David Irwin</i>	<i>Michael George Pravica</i>
<i>Leland Frank Brown</i>	<i>Randall David Kamien</i>	<i>William Barrett Slate</i>
<i>Terry Fu</i>	<i>Ali Reza Lashgari</i>	<i>Alejandro Szabo</i>
<i>Eric J. Gaidos</i>	<i>Lushalan Boy-Yu Liao</i>	<i>Christopher Bruce</i>
<i>David Alan Gates</i>	<i>Windsor Wen-Hsiang Lin</i>	<i>Umminger</i>
<i>Adam Kalmon Greenblatt</i>	<i>Ignacio Sean McQuirk</i>	<i>Nicole Paula Vogt</i>

THE W. P. CAREY & CO., INC., PRIZE IN APPLIED MATHEMATICS

Awarded to a student receiving a Doctor of Philosophy degree for an outstanding doctoral dissertation in applied mathematics.

Robert W. Cox; Michael J. Ward

RICHARD BRUCE CHAPMAN MEMORIAL AWARD

Awarded to a graduate student in hydrodynamics who has distinguished himself or herself in research in the Division of Engineering and Applied Science.

Sheldon I. Green

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.

1987 Eric G. Scharin; Robert W. Soderbery

DEANS' CUP AND MASTERS' CUP

Two awards, selected by the Deans and Masters respectively, presented to undergraduates whose concern for their fellow students has been demonstrated by persistent efforts to improve the quality of undergraduate life and by effective communication with members of the faculty and administration.

1987 David J. Bruning, Deans' Cup

1988 Richard M. Arrieta, Deans' Cup

1987 Ralph C. Wolf, Masters' Cup

PRIZES AND AWARDS—*Continued*

LAWRENCE L. AND AUDREY W. FERGUSON PRIZE

Awarded to the graduating Ph.D. candidate in biology who has produced the outstanding Ph.D. thesis for the past year.

Chang Soo Hahn

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.

1987 David A. Gates

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.

1987 Randall D. Kamien

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.

1987 Michael G. Pravica

ARTUR MAGER PRIZE IN ENGINEERING

Awarded to a senior in engineering who has shown excellence in scholarship and the promise of an outstanding professional career.

Christopher B. Umminger

THE HERBERT NEWBY MCCOY AWARD

Awarded to chemistry doctoral students for outstanding contributions to the science of chemistry.

1987 Mickey ChienTsung Hu

1988 Timothy M. Swager

MARY A. EARL MCKINNEY PRIZE IN LITERATURE

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

1987 Jerome E. Lengyel

1987 Tung Yin

1988 Peter J. Hughes; Christopher S. Nolle

PRIZES AND AWARDS — *Continued*

ROBERT L. NOLAND LEADERSHIP SCHOLARSHIP

Awarded to students who exhibit qualities of outstanding leadership, which is most often expressed as personal actions that have helped other people and that have inspired others to fulfill their capabilities.

Andrew J. Huntington; David H. Lipin

HERBERT J. RYSER MEMORIAL SCHOLARSHIPS

Awarded to undergraduate students for academic excellence, preferably in mathematics.

1987 Laura M. Anderson; Joel D. Hamkins

RICHARD P. SCHUSTER MEMORIAL PRIZE

Awarded to one or more juniors or seniors in chemistry or chemical engineering on the basis of financial need and academic promise.

Eric G. Scharin

THE ERNEST E. SECHLER MEMORIAL AWARD IN AERONAUTICS

Awarded to an aeronautics student who has made the most significant contribution to the teaching and research efforts of GALCIT (Graduate Aeronautical Laboratories of the California Institute of Technology). Preference is given to students working in structural mechanics.

1987 Sotirios Natsiavas

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.

1987 James D. Roberts

SIGMA XI AWARD

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

Randall D. Kamien

THE MORGAN WARD PRIZE

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

1987 Eric K. Babson