



*Ninety-First  
Annual Commencement  
June 14, 1985*

CALIFORNIA INSTITUTE OF TECHNOLOGY

*Ninety-First*  
*Annual*  
*Commencement*

FRIDAY MORNING AT TEN O'CLOCK  
JUNE FOURTEENTH, NINETEEN EIGHTY-FIVE

# 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*

## *Assistant Marshals*

Christopher E. Brennen, Ph.D.      Robert W. Oliver, Ph.D.  
Jenijoy La Belle, Ph.D.      Ward Whaling, Ph.D.  
David S. Wood, Ph.D.

## *Faculty Officers*

Donald S. Cohen, Ph.D.      B. Vincent McKoy, 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

CANDIDATES FOR THE DEGREE OF ENGINEER

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 Dean K. Thompson  
*Pasadena Presbyterian Church*

COMMENCEMENT ADDRESS . . . . . Ralph Landau, Sc.D.  
*Listowel Incorporated*  
*Trustee, California Institute of Technology*

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

CONFERRING OF DEGREES . . Marvin L. Goldberger, Ph.D., D.H.L.  
*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 . . . Stirling L. Huntley, Ph.D.  
*Associate Dean of Graduate Studies*

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

Biology . . . . . Leroy E. Hood, M.D., Ph.D.  
*Division Chairman*

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 . . . Peter J. Wyllie, Ph.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 Goldberger

BENEDICTION . . . . . Doctor Thompson

RECESSIONAL . . . . The Caltech Wind Ensemble Brass and Organ

ORGAN POSTLUDE . . . . . Leslie Deutsch

# Candidates for Degrees

## BACHELOR OF SCIENCE

Manuel Acevedo-Ruiz *North Bergen, New Jersey* Engineering and Applied Science  
Mark Steven Adams *Oakland, California* Engineering and Applied Science  
**Hojin Ahn** *South Pasadena, California* Engineering and Applied Science  
Kurt Kendall Andersen *Huntington Beach, California* Biology  
**Ian MacLean Anderson** *Simcoe, Ontario, Canada* Applied Physics  
Gary Everett Ansok *Saratoga, California* Chemistry  
**Lewis Bernard Aronson** *Harrisburg, Pennsylvania* Electrical Engineering  
**Creighton Satoshi Asato** *Torrance, California* Electrical Engineering  
**Praveen Asthana** *Agra, India* Electrical Engineering  
Michael James Barela *Boise, Idaho* Electrical Engineering  
Charles Rea Barrett, Jr. *Ojai, California* Engineering and Applied Science  
Paul A. Barros *Las Vegas, Nevada* Physics  
John Joseph Beahan, Jr. *Gillett, Pennsylvania* Engineering and Applied Science  
Stephen Mark Beccue *Oxnard, California* Mathematics and Engineering and Applied Science  
**Stan Berman** *Pittsburgh, Pennsylvania* Physics  
**Steven Stanley Bielfelt** *Sonoma, California* Electrical Engineering  
**Michael David Borland** *Spokane, Washington* Physics  
**Tim A. . . Brandon** *Portland, Oregon* Applied Physics and Mathematics  
Stephen Boutelle Brown *Granville, Ohio* Electrical Engineering  
Marc Buffet *Grenoble, France* Physics  
André C Burgoyne *Chicago, Illinois* Physics  
**Gregory Allan Burnett** *Anaheim, California* Physics  
**Brian William Bush** *Pacific Palisades, California* Physics  
William H. Butler *Epsom, New Hampshire* Physics  
**John Anthony Butman** *Pasadena, California* Applied Mathematics and Biology  
**William J. Callahan** *Newburgh, New York* Mathematics  
Kent James Cantwell *Paramount, California* Mathematics  
Edward James Casey *South Nyack, New York* Mathematics  
Kenneth T. Chan *Ventura, California* Electrical Engineering  
**Susanna Mink Chan** *Irvine, California* Biology  
Wen Teh Chang *Drexel Hill, Pennsylvania* Engineering and Applied Science  
Jim Chu-Lung Chen *Westlake Village, California* Engineering and Applied Science

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

BACHELOR OF SCIENCE—Continued

- Vincent Wei-Kang Chen** *Westlake Village, California* Electrical Engineering
- Yi-Hong Chen** *Beijing, China* Applied Physics
- Joe Kwok-Kay Cheng** *Los Angeles, California* Physics
- Phye Keng (Larry) Chew** *Penang, Malaysia* Engineering and Applied Science
- Gary Tze Hing Chow** *Solana Beach, California* Electrical Engineering
- Young Hoon Chung** *Garden Grove, California* Electrical Engineering
- Michael Suk-Young Chwe** *Tuscaloosa, Alabama* Economics
- Alaric Ivor John Clinton** *Palo Alto, California* Engineering and Applied Science
- Chris Robert Cotterel** *San Jose, California* Engineering and Applied Science
- Glen Dickson Crawford** *Los Altos, California* Physics
- James Brian Cser** *Dana Point, California* Applied Physics
- Edward Louis Cuellar** *Lakewood, Colorado* Physics
- Michael D. Curtin** *Milford, Michigan* Electrical Engineering
- Drew Cushman** *Portland, Oregon* Applied Physics
- Michael Lane DeKay** *Starkville, Mississippi* Chemistry
- Mark Steven Dombrowski** *Redlands, California* Engineering and Applied Science
- James Dunn** *Los Alamitos, California* Chemical Engineering and Biology
- Margaret Mary Farrell** *Brockton, Massachusetts* Physics
- Edward William Felten** *Madison, Wisconsin* Physics
- Rafael Timothy Pascual Fernando** *Pasadena, California* Mathematics
- Stefan Feuerabendt** *Corona del Mar, California* Engineering and Applied Science
- Paul Edward Filmer** *Bogotá, Colombia* Geophysics
- Frances Deborah Flam** *Long Beach, California* Geophysics
- Ron J Forni** *Lexington, Massachusetts* Engineering and Applied Science
- Jeffrey Todd Freymueller** *Alta Loma, California* Geophysics
- Tetsuo Fukuchi** *Tokyo, Japan* Physics
- Paul Matthew Furth** *Washington, D.C.* Electrical Engineering
- Brett T. Garrett** *Palos Verdes Estates, California* Applied Physics
- Anirvan Ghosh** *Kanpur, India* Physics
- James Michael Gibbs** *Harrogate, Tennessee* Physics
- Robert Edward Golden** *San Marino, California* Chemistry
- Judith Goldish** *Lakewood, California* Engineering and Applied Science
- Timothy Richard Gould** *San Anselmo, California* Engineering and Applied Science
- Leslie Roy Grate** *Pacific Grove, California* Engineering and Applied Science
- Paul Harvey Graven** *Golden Valley, Minnesota* Engineering and Applied Science  
and Economics
- Russell Walter Graymer** *El Cerrito, California* Geology



BACHELOR OF SCIENCE—Continued

- Susanna Jeannette Gross *Los Alamos, New Mexico* Geophysics  
**Kevin J. Gunning** *Colbert, Washington* Engineering and Applied Science  
Jennifer Susan Haase *Riverside, California* Geophysics  
**Paul Cordon Haase** *Bellevue, Washington* Geology  
Andrew Martin Hall *Pt. Arena, California* Electrical Engineering  
Chien-Wei Han *Adelphi, Maryland* Electrical Engineering  
Steven A. Havstad *Livonia, Michigan* Physics  
Steven Kaoru Hawes *Honolulu, Hawaii* Engineering and Applied Science  
**Catherine Kent Hayes** *Dallastown, Pennsylvania* Applied Mathematics  
**Robert Mark Henderson** *Rock Springs, Wyoming* Engineering and Applied Science  
**Jason J. Hickey** *Delano, California* Electrical Engineering  
**Uwe Hollerbach** *Fairbanks, Alaska* Physics  
Kenneth E. Hooper *Los Altos Hills, California* Engineering and Applied Science  
John Francis Houde *Rochester, New York* Electrical Engineering  
**Tony Tunglin Huang** *Shanghai, China* Applied Physics  
**Raymond Scott Hudson** *Pasadena, California* Engineering and Applied Science  
Keith Marshall Hughes *Sacramento, California* Engineering and Applied Science  
David Lawrence Hull *Blythe, California* Electrical Engineering  
Martin Miles Hunt *Bloomington, Indiana* Engineering and Applied Science  
**Catherine Kei Ifune** *Simi Valley, California* Biology  
**Pui-Tak Kan** *Hong Kong* Mathematics  
**Ting-Lin Kao** *Taipei, Taiwan* Chemistry  
**Eric Hitoshi Kawamoto** *Chicago, Illinois* Physics  
Brian Thomas Kenney *Poway, California* Electrical Engineering  
Eloise Cheng King *New York, New York* Chemistry  
**Rodney Michael Kinney** *Tucson, Arizona* Physics  
William Anthony Knowles *San Francisco, California* Engineering and Applied Science  
**Steven Hin-Chung Kong** *Northridge, California* Applied Physics and Applied Mathematics  
**Greg Alan Kopp** *Santa Fe, New Mexico* Physics  
**Stanley David Kuo** *Elkhart, Indiana* Physics  
Christos Kyriakakis *Thessaloniki, Greece* Engineering and Applied Science  
**James Norman Labrenz** *Thousand Oaks, California* Physics  
Ethan Lavan *Evanston, Illinois* Engineering and Applied Science  
Jonathan Patrick Leech *Aurora, Colorado* Engineering and Applied Science  
Kurt Thomas Lemke *Niles, Illinois* Engineering and Applied Science  
**Blake H. Lewis** *Montrose, California* Engineering and Applied Science  
Mark William Lewis *Lynnwood, Washington* Engineering and Applied Science

BACHELOR OF SCIENCE—Continued

- Phyllis Cha Li *La Jolla, California* Electrical Engineering  
**Boon-Khim Liew** *Kuala Lumpur, Malaysia* Electrical Engineering  
**Peter Jean-Woo Lim** *Seoul, South Korea* Electrical Engineering  
**Bradford Clark Lincoln** *Montrose, Colorado* Electrical Engineering  
Leslie A. Lippard *Westport, Connecticut* Physics  
Linda Hsiao Liu *Hacienda Heights, California* Chemical Engineering  
James Michael Lodman *Billings, Montana* Electrical Engineering  
Steven James Loyola *Northridge, California* Biology  
Bob Lee Mackey *Bloomington, Indiana* Chemistry  
Michelle Anne Mahowald *Minneapolis, Minnesota* Biology  
Brian Early Mapes *Boulder, Colorado* Chemistry  
Carl Scott Masser *Fair Oaks, California* Electrical Engineering  
Cinsy Charlotte McCalley *West Covina, California* Engineering and Applied Science  
John Francis McGowan III *Wilton, Connecticut* Physics  
Anthony Warren Miller *Flint, Michigan* Engineering and Applied Science  
Randal Charles Moore *Sun Valley, Idaho* Engineering and Applied Science  
Sean Farrell Moriarty *San Diego, California* Engineering and Applied Science  
**John Horton Morrison** *Rochester, Minnesota* Physics  
Robert Nico Mostert *Sacramento, California* Chemical Engineering  
**Richard Martin Murray** *El Paso, Texas* Electrical Engineering  
Glayde Allen Myers *Portland, Oregon* Chemical Engineering  
Charles Jacob Nainan *Decatur, Georgia* Mathematics  
Russell Lawrence Natter *Long Beach, California* Chemical Engineering and Engineering and Applied Science  
Roger Keng Po Ng *Locust Valley, New York* Applied Mathematics  
**Tan Dinh Ngo** *Bronx, New York* Electrical Engineering  
**Truong Quang Nguyen** *Anaheim, California* Electrical Engineering  
Steven Dale Nixon *Longmont, Colorado* Engineering and Applied Science  
**Michael Craig Nolan** *Worthington, Ohio* Chemistry  
Margaret Clare Olich *Aptos, California* Engineering and Applied Science  
Lisa Marie Payne *Balboa, California* Chemical Engineering  
**Mark Louis Pitt** *Great Falls, Montana* Physics  
**Stephen Lee Pitts** *Brunswick, Maine* Engineering and Applied Science and Economics  
Richard Thomas Premont *Houston, Texas* Biology and Chemistry  
**Charles Calvin Reel** *Beverly Hills, California* Biology  
Richard Francis Regan *Marblehead, Massachusetts* Applied Physics  
**Brenda J. Roder** *Cincinnati, Ohio* Electrical Engineering

BACHELOR OF SCIENCE—Continued

- Aaron Jay Roodman** *Ballwin, Missouri* Physics  
Steve Scot Roy *El Paso, Texas* Engineering and Applied Science  
Edward Rudman *Monroeville, Pennsylvania* Engineering and Applied Science  
David Jordan Ruhde *Marshfield, Wisconsin* Engineering and Applied Science  
Rajiv S Sahney *Bombay, India* Physics  
**Jeannine-Marie Saint Jacques** *Port Credit, Ontario, Canada* Mathematics  
Anne Irene Sauter *Seattle, Washington* Engineering and Applied Science  
**Koichi Sayano** *Montebello, California* Applied Physics  
Roderic Malcolm Schmidt *Carmel, California* Engineering and Applied Science  
Daniel Peter Schwartz *San Diego, California* Engineering and Applied Science  
Kurt Marshall Schwartz *La Mesa, California* Electrical Engineering  
**Ketan Kiran Hirji Maya Shah** *Nairobi, Kenya* Engineering and Applied Science  
John Robert Shannon *Malone, New York* Electrical Engineering  
Cathy Bess Shapiro *Venice, California* Biology  
William David Sharpe *Lathrup Village, Michigan* Chemistry  
Douglas Anthony Simons *Vero Beach, Florida* Astronomy  
Teresa Christine Solberg *Seattle, Washington* Chemistry  
Paul William Stankus *Pearl River, New York* Physics  
Douglas Allen Stohler *Tampa, Florida* Electrical Engineering  
**Kaveh Taleghani** *Teheran, Iran* Mathematics  
Rodrik Stanton Thompson *Bismarck, North Dakota* Engineering and Applied Science  
Christine Louise Tiller *St. Louis Park, Minnesota* Engineering and Applied Science  
**Steven Paul Trainoff** *Canoga Park, California* Physics  
Thanh-Van Tran-Nhut *Gray, France* Engineering and Applied Science  
Fu-Sheng Tsung *Las Vegas, Nevada* Engineering and Applied Science  
John Brickman Wall *Malibu, California* Biology  
**Michele Coleen Walters** *Hays, Kansas* Engineering and Applied Science  
**Rex Sze Yu Wang** *Foster City, California* Electrical Engineering  
**David P. Watkins** *Indianapolis, Indiana* Biology  
Jeanne Marie Weaver *Cherry Valley, California* Biology  
Jesse Wen *Gaithersburg, Maryland* Physics  
**Julian West** *Vancouver, British Columbia* Mathematics  
**Todd Hunter West** *Salisbury, Maryland* Physics  
**Karen Meng-Choo White** *San Diego, California* Mathematics  
**Tad Phillip White** *Ventura, California* Mathematics  
**Timothy Ralph White** *Wheaton, Illinois* Physics  
**Sven Andreas Wolf** *Castro Valley, California* Applied Mathematics  
**Frederic Y. Wong** *San Diego, California* Mathematics

BACHELOR OF SCIENCE—*Continued*

**Hsi-Cheng Wu** *Monterey Park, California* Electrical Engineering

**Lily Wu** *Forest Hills, New York* Engineering and Applied Science

**Christopher Yo** *San Gabriel, California* Biology

**Minami Yoda** *Madison, Wisconsin* Engineering and Applied Science

**Christine Hsiu-Hua Yu** *Palo Alto, California* Engineering and Applied Science

**Gerald Anton Zeininger** *Cerritos, California* Chemical Engineering

**Craig Allen Zupke** *Cypress, California* Chemical Engineering

## MASTER OF SCIENCE

- Yasser Abdelaziz Abdelrazek (*Electrical Engineering*) B.Sc., Ain Shams University 1981; M.Sc., 1984.
- Pascal Adam (*Electrical Engineering*) Diplôme d'Ingénieur, Ecole Supérieure d'Ingénieurs en Electronique et Electrotechnique 1985.
- Carl Richard Anderson (*Electrical Engineering*) B.S., Drexel University 1984.
- Philip Douglas Askenazy (*Applied Physics*) A.B., Harvard College 1983.
- Eric Richard Aslakson (*Physics*) S.B., Massachusetts Institute of Technology 1982.
- Françoise Jeanne Badiou (*Electrical Engineering*) Diplôme d'Ingénieur, Ecole Supérieure d'Ingénieurs en Electronique et Electrotechnique 1984.
- Denice Ball (*Chemistry*) B.A., Macalester College 1982.
- Nelson Benitez-Ruiz (*Electrical Engineering*) B.S.E.E., Universidad de Puerto Rico 1982.
- Bradford Joseph Boehm (*Civil Engineering*) B.S., University of Southern California 1984.
- David Dicran Bogosian (*Civil Engineering*) B.S., University of California, Los Angeles 1984.
- Riccardo Bonazza (*Aeronautics*) Laurea in Ingegneria Meccanica, Università Degli Studi di Ancona 1983.
- Susan Quin Boundy (*Geology*) B.S., Hope College 1982.
- Richard Harry Brandwein (*Electrical Engineering*) B.S.E.E., University of Pennsylvania 1984; B.S.Econ., 1984.
- Samuel Leon Braunstein (*Physics*) B.Sc., University of Melbourne 1983.
- Martin Brouillette (*Aeronautics*) B.Eng., McGill University 1984.
- Gregory Paul Brown (*Electrical Engineering*) B.S., University of California, Irvine 1984.
- Jerry Robert Burch (*Computer Science*) B.S., California Institute of Technology 1984.
- Vince Ryo Butsumyo (*Electrical Engineering*) A.B., Occidental College 1984.
- Sean Macauley Callahan (*Physics*) B.S., University of Washington 1983.
- Roberto Alfredo Camassa (*Engineering Science*) Laurea in Fisica, Università Degli Studi di Milano 1982.
- Janet Carol Campagna (*Social Science*) B.S., Northeastern University 1980.
- Jose Edgardo Lopez Campos (*Social Science*) A.B., Ateneo de Manila University 1974; M.S., University of Minnesota 1980.
- Gregory Errol Chamitoff (*Aeronautics*) B.S., California Polytechnic State University, San Luis Obispo 1984.
- Keming Chen (*Electrical Engineering*) B.Eng., Beijing Institute of Aeronautics and Astronautics 1984.
- Michael Pin-Li Chen (*Electrical Engineering*) B.S., Harvey Mudd College 1984.

## MASTER OF SCIENCE — Continued

- Kar-Ming Cheung (*Electrical Engineering*) B.S.E., University of Michigan, Ann Arbor 1984.
- Eric Richard Christian (*Physics*) B.A., University of Pennsylvania 1982.
- Siew Kiat Chua (*Aeronautics*) B.E.Sc., University of Western Ontario 1984.
- James Michael Cline (*Physics*) B.S., Harvey Mudd College 1982.
- Jeffrey Lee Collett, Jr. (*Environmental Engineering Science*) S.B., Massachusetts Institute of Technology 1984.
- Patrick Bernard Cooke (*Civil Engineering*) B.S., Loyola Marymount University 1984.
- David Dale Crouch (*Electrical Engineering*) B.S., University of California, Davis 1983.
- Russell Lane Dailey (*Electrical Engineering*) B.S., California Institute of Technology 1980.
- Alberto Dalla Torre (*Chemical Engineering*) Laurea in Ingegneria Chimica, Università Degli Studi di Trieste 1981.
- Nancy Anderson Da Silva (*Chemical Engineering*) B.S., University of Massachusetts 1982.
- Bruce Channing Daube, Jr. (*Mechanical Engineering*) B.S., Worcester Polytechnic Institute 1984.
- Xiaomin Deng (*Applied Mechanics*) B.S., Beijing Institute of Aeronautics and Astronautics 1982.
- Pamela L. Derry (*Applied Physics*) B.S., Rensselaer Polytechnic Institute 1983.
- Michel Louis Doffagne (*Electrical Engineering*) Diplôme d'Ingénieur, Ecole Nationale Supérieure des Techniques Industrielles et des Mines d'Als 1983.
- Zinnur Doğanata (*Electrical Engineering*) B.Sc., Middle East Technical University 1981; M.Sc., 1984.
- Luc Elman (*Electrical Engineering*) Diplôme d'Ingénieur, Ecole Supérieure d'Ingénieurs en Electronique et Electrotechnique 1984.
- John Edward Eng (*Electrical Engineering*) B.S., California Institute of Technology 1984.
- Ruth Ann Erlanson (*Electrical Engineering*) B.S., George Mason University 1984.
- Thomas Frank Fric (*Aeronautics*) B.S., Cornell University 1984.
- Richard Joseph Gilbrech (*Aeronautics*) B.S., Mississippi State University 1984.
- Philippe Gindre (*Aeronautics*) Diplôme d'Ingénieur, Ecole Centrale de Lyon 1984.
- David Benjamin Goldstein (*Aeronautics*) B.S.E., Princeton University 1984.
- Andres Carlos Gonzalez III (*Electrical Engineering*) B.S., University of Texas at El Paso 1984.
- Charles Edward Goodhart (*Applied Mathematics*) B.S., California Institute of Technology 1980.
- Sheldon I. Green (*Mechanical Engineering*) B.A.Sc., University of Toronto 1984.
- Ann Jocelyn Gretzula (*Electrical Engineering*) B.S., Bucknell University 1984.
- Jeffery Lawrence Hall (*Aeronautics*) B.A.Sc., University of Toronto 1984.

## MASTER OF SCIENCE — *Continued*

- Hee Han (*Electrical Engineering*) B.S., Korea Military Academy 1977; M.S., Yonsei University 1981.
- Donald Hanks (*Electrical Engineering*) B.S., University of California, Los Angeles 1982.
- Betty Jane Miller Hannoun (*Electrical Engineering*) B.S., Cornell University 1982.
- Wendy Lynn Hansen (*Social Science*) B.A., Lawrence University 1983.
- Catherine Marie Helm (*Geophysics*) B.A., Northwestern University 1983.
- Kenneth Edward Herkenhoff (*Geology*) A.B., University of California, Berkeley 1981.
- Enrique José Hernández Valencia (*Electrical Engineering*) Ingeniero Electrónico, Universidad Simón Bolívar 1982.
- Corinne Marie Holmes (*Electrical Engineering*) B.S., Boston University 1984.
- Zhikun Hou (*Civil Engineering*) M.S., Tongji University 1982.
- Ken-Yuh Hsu (*Electrical Engineering*) B.S., National Chiao Tung University 1973; M.S., 1975.
- Kung-Shiuh Huang (*Electrical Engineering*) B.S., National Taiwan University 1982.
- Gary Lasson Hurst (*Civil Engineering*) B.S., Utah State University 1984.
- Kayo Ide (*Aeronautics*) B.E., Nagoya University 1984.
- Craig Charles Jahnke (*Aeronautics*) B.S.M.E., Milwaukee School of Engineering, Inc. 1984.
- Kenneth Guy Jordan (*Chemical Engineering*) B.S., University of California, Berkeley 1983.
- Thales Karagounis (*Aeronautics*) B.Sc., Imperial College of Science and Technology 1984.
- Karim Fahmi Karagulla (*Civil Engineering*) B.S., California Institute of Technology 1984.
- Lambros Solon Katafygiotis (*Civil Engineering*) Diploma, National Technical University of Athens 1983.
- Dilip Mulchand Khatri (*Civil Engineering*) B.S., California State University, Los Angeles 1983.
- Winghung Ki (*Electrical Engineering*) B.S., University of California, San Diego 1984.
- James Robert Killory (*Chemical Engineering*) B.S. (Biology), Syracuse University 1975; B.S. (Chemical Engineering), 1979.
- Ravinder David Koilpillai (*Electrical Engineering*) B.Tech., Indian Institute of Technology, Madras 1984.
- James Brian Kolhoff (*Electrical Engineering*) B.E.E., GMI Engineering and Management Institute 1984.
- Julia Ann Kornfield (*Chemical Engineering*) B.S., California Institute of Technology 1983.
- Karen Ann Kozlowski (*Aeronautics*) B.S., St. Louis University 1984.
- Daniel John Krasinski (*Electrical Engineering*) B.S., University of Illinois at Urbana-Champaign 1984.

MASTER OF SCIENCE — *Continued*

- Sonya Maria Kreidenweis (*Chemical Engineering*) B.E., Manhattan College 1983.
- Byung Sung Kwak (*Chemical Engineering*) B.S., Columbia University 1982.
- Kikis Michael Kyriacou (*Electrical Engineering*) B.S., Tufts University 1984.
- Gary Richard Lapidus (*Chemical Engineering*) B.S., University of Massachusetts 1984.
- Daniel Lee Laughlin (*Chemical Engineering*) B.S., University of Minnesota 1983.
- Derek Scott Lillie (*Electrical Engineering*) B.S., California Institute of Technology 1981.
- Vincent Cheng-Teh Liu (*Electrical Engineering*) B.E., State University of New York at Stony Brook 1984.
- Pedro Wing Cheung Lo (*Electrical Engineering*) B.S., University of California, San Diego 1984.
- Giancarlo Losi (*Aeronautics*) Laurea in Ingegneria Aeronautica, Politecnico di Torino 1983.
- Roya Maboudian (*Applied Physics*) B.E.E., Catholic University of America 1982.
- Nadim Ilyas Maluf (*Electrical Engineering*) B.E., American University of Beirut 1984.
- Robert Ezell Marks, Jr. (*Electrical Engineering*) B.S., Duke University 1984.
- Christopher Gerald Matthews (*Physics*) B.Sc., University of Waterloo 1983.
- Jonathan Paul McIntosh (*Electrical Engineering*) B.S., University of Nebraska 1984.
- David Glenn Mehuys (*Electrical Engineering*) B.A.Sc., University of Toronto 1984.
- Edward James Meseck (*Aeronautics*) B.S., Texas A&M University 1984.
- Diane Vera Michelangeli (*Planetary Sciences*) B.Sc., McGill University 1983.
- Cristine Rae Morris (*Chemical Engineering*) B.S., California Institute of Technology 1980.
- Michael Scott Morris (*Physics*) B.S., Purdue University 1982.
- Scott Anthony Mullin (*Mechanical Engineering*) B.S., University of Texas at El Paso 1983.
- Jonathan David Nagler (*Social Science*) A.B., Harvard College 1982.
- Jay Randall Neumann (*Mechanical Engineering*) B.S., Purdue University 1984.
- Michael O. Newton (*Computer Science*) B.S., California Institute of Technology 1981.
- James Kwok-Keung Ng (*Electrical Engineering*) B.S., University of Washington 1984.
- Quyen Dinh Nguyen (*Electrical Engineering*) B.S.E.E., University of Akron 1984; B.S.C.S., 1984.
- Bridget Mary O'Callaghan (*Physics*) B.Sc., University College Cork 1981; M.Sc., 1983.
- Gregory Wayne Ojakangas (*Geophysics*) B.S., University of Minnesota, Duluth 1982.
- Sverrir 'Olafsson (*Electrical Engineering*) B.S., California Institute of Technology 1984.



## MASTER OF SCIENCE — *Continued*

- Rémy Pache (*Electrical Engineering*) Diplôme d'Ingénieur Electricien, Ecole Polytechnique Fédérale de Lausanne 1982.
- Konstantinos Mattheos Papadimitriou (*Applied Mechanics*) Diploma, University of Patras 1984.
- Cheol Hoon Park (*Electrical Engineering*) B.S., Seoul National University 1984.
- William Manson Pegram (*Social Science*) B.A., Stanford University 1973; M.B.A., 1977.
- Francois Pepin (*Aeronautics*) Bachelier en Ingénierie, Ecole Polytechnique de Montreal 1984.
- John Carlton Platt (*Computer Science*) B.S., California State University, Long Beach 1982.
- Donna Laurie Post (*Aeronautics*) B.S., Rutgers University 1984.
- Stephen David Prowse (*Social Science*) B.A., University of Cambridge 1982.
- Paul K. Pun (*Electrical Engineering*) B.Sc., Council of Engineering Institute 1978; M.S., University of Manchester Institute of Science and Technology 1980.
- Gerard Joseph Quenneville (*Electrical Engineering*) B.S., University of Massachusetts 1980.
- Shamin Aejaz Rahman (*Aeronautics*) B.S., Texas A&M University 1984.
- Robert Lowell Ripperdan (*Geology*) B.S., The University of Iowa 1983.
- Nabeel Agha Riza (*Electrical Engineering*) B.S., Illinois Institute of Technology 1984.
- Alfredo Romero (*Electrical Engineering*) B.S., Worcester Polytechnic Institute 1984.
- Norio Sakazume (*Aeronautics*) B.Eng., University of Tokyo 1975; M.Eng., 1977.
- Cristiano Sala (*Applied Physics*) B.A., Oxford University 1983.
- Mark Alan Schalit (*Applied Physics*) A.B., Occidental College 1981.
- Barbara Elisabeth Schneider (*Aeronautics*) S.B., Massachusetts Institute of Technology 1982.
- Brent Howard Shanks (*Chemical Engineering*) B.S., Iowa State University 1983.
- Sy Ross Shimabukuro (*Applied Mechanics*) B.S., University of Hawaii at Manoa 1984.
- Anthony Skjellum (*Chemical Engineering*) B.S., California Institute of Technology 1984.
- Michel Jacques Slupowski (*Electrical Engineering*) Diplôme d'Ingénieur, Ecole Nationale Supérieure des Télécommunications 1985.
- Sheryl Leigh Smith (*Physics*) B.S., University of California, Los Angeles 1983.
- Padhraic Joseph Smyth (*Electrical Engineering*) B.E., University College Galway 1984.
- Robert Nathan Soderblom (*Electrical Engineering*) B.S., University of Texas at Austin 1983.
- Eric John Soderstrom (*Physics*) B.A., University of Minnesota, Duluth 1982.
- Ian Maxwell Standley (*Electrical Engineering*) B.A., University of Cambridge 1981; M.Sc., University of London 1983.

## MASTER OF SCIENCE—Continued

- Craig Stanley Steele (*Computer Science*) A.B., Harvard College 1974.
- Edmond Khentir Tajirian (*Electrical Engineering*) B.S.E., University of Michigan, Ann Arbor 1982; M.S.E.E., University of Southern California 1984.
- James Theiler (*Physics*) S.B. (Physics), Massachusetts Institute of Technology 1981; S.B. (Mathematics), 1981.
- Ravi Shanker Thyagarajan (*Applied Mechanics*) B.Tech., Indian Institute of Technology, Madras 1984.
- Stephen John Valeri (*Electrical Engineering*) B.S., Michigan State University 1984.
- Joseph John Vallino (*Chemical Engineering*) B.S., University of California, Berkeley 1983.
- Cornelis Johan Van Der Linden (*Mechanical Engineering*) Diplôme d'Ingénieur, Ecole Centrale des Arts et Manufactures 1984.
- Cynthia Cheryl Walker (*Electrical Engineering*) B.S., Howard University 1983.
- Robert Christian Walker (*Physics*) B.S., University of Wisconsin-Madison 1984.
- King Chen Wang (*Electrical Engineering*) B.S.E., University of Michigan, Ann Arbor 1984.
- Johann Carl Weber (*Social Science*) B.A., University of Rochester 1982.
- Andrew James Weir (*Physics*) B.A., Oxford University 1983.
- Junshan Wen (*Geochemistry*) B.S., University of Science and Technology of China 1982.
- Gregoire Winckelmans (*Aeronautics*) Ingénieur Civil Mécanicien, Université Catholique de Louvain 1983.
- Ted Kirk Woodward (*Applied Physics*) B.S., University of Texas at Austin 1983.
- Dolly Wu (*Physics*) A.B., Columbia University 1983.
- Hubert Toyochi Yamada (*Physics*) B.S., University of Hawaii at Manoa 1983.
- Kenton Kung-Chiu Yee (*Physics*) S.B., Massachusetts Institute of Technology 1984.
- Satoshi Yoshizawa (*Mechanical Engineering*) B.S., California Institute of Technology 1984.
- Michael Edward Zucker (*Physics*) B.S., University of Rochester 1983.

## DOCTOR OF PHILOSOPHY

### DIVISION OF BIOLOGY

- Stuart Kilsu Kim (*Biology*) B.A., Dartmouth College 1979.  
Thesis: Antibody Genes, Oncogenes and Antisense Genes.
- David E. Levy (*Molecular Biology*) B.A., University of Tennessee 1974.  
Thesis: Expression of Endogenous Retroviruses in Inbred Mice: Coordinate Regulation and Structure of Multiple Transcription Units.
- Richard Sheridan Lewis (*Neurobiology*) B.S., Yale University 1978.  
Thesis: The Ionic Basis of Frequency Selectivity in Hair Cells of the Bullfrog's Sacculus.
- Donna Lucy Livant (*Biology*) B.A., Johns Hopkins University 1978.  
Thesis: The Size of a Murine Heavy Chain Variable Region Gene Family: Implications for the Magnitude and Evolution of the  $V_H$  Locus in Mouse.
- Jeffrey Nelson Masters (*Molecular Biology*) B.S., University of Utah 1978.  
Thesis: The Organization and Expression of the Human Dihydrofolate Reductase Gene in Methotrexate-Resistant and Methotrexate-Sensitive Cell Lines.
- Vann Phillips Parker (*Biology*) B.S., Duke University 1977.  
Thesis: Studies of Gene Structure: I. Expression of Human  $\alpha$ -Globin Genes in COS Cells. II. Isolation and Characterization of the Myosin Light Chain Genes from *Drosophila melanogaster*.
- Arthur Henry Roach (*Biology*) B.Sc.(Honours), Queen's University 1979.  
Thesis: The Genes for Myelin Basic Protein in Normal and Shiverer Mutant Mice.
- Jeffrey Edward Segall (*Biophysics*) B.A., Harvard College 1979.  
Thesis: Chemotaxis of *Escherichia coli* Studied Using Ionophoretic Stimulation.
- Beverly Taylor Sher (*Biology*) B.A., University of Colorado 1979.  
Thesis: Studies of Class I Genes in the Major Histocompatibility Complex of the BALB/c Mouse.

### DIVISION OF CHEMISTRY AND CHEMICAL ENGINEERING

- Janet Noel Allison (*Chemistry*) B.S., California State University, Los Angeles 1979.  
Thesis: Theoretical Studies of Heterogeneous Catalysis of Molybdates.
- Roger Bennett Baar (*Chemistry*) B.S., Stanford University 1977.  
Thesis: Synthesis and Characterization of a Ruthenium-edta Dimer by Spectral and Electrochemical Techniques.

*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*

- Samir E. Barudi (*Chemical Engineering*) B.E., American University of Beirut 1975;  
M.S. (Chemical Engineering), California Institute of Technology 1976; M.S. (Social  
Science) 1980.  
Thesis: An Experimental Investigation of Steady and Pulsatile Flow in a Glass Model  
of an Artery Bifurcation.
- Barry Jerome Bentley (*Chemical Engineering*) B.Ch.E., University of Delaware 1978;  
M.S., California Institute of Technology 1980.  
Thesis: Drop Deformation and Burst in Two-Dimensional Flows.
- John James Boland (*Chemistry*) B.Sc., University College 1979.  
Thesis: Experimental and Theoretical Developments in Extended X-ray Absorption  
Fine Structure (EXAFS) Spectroscopy.
- Karl Kho-Chung Chang (*Chemical Engineering*) B.S., Rice University 1978.  
Thesis: Calcium-Ion Exchange of Coal for Retention of Sulfur During Combustion.
- Thomas Smith Coolbaugh (*Chemistry*) B.A., Amherst College 1980.  
Thesis: Nucleophilic Activation of Carbon Monoxide: Synthesis, Characterization  
and Reactivity of Intramolecular Group VI Metalloesters.
- Gloria Dalbadie-McFarland (*Chemistry*) Bioquímica, Universidad de Chile 1973.  
Thesis: Structural Requirements for Protein Function Studied by In Vitro Mutagenesis  
on Beta-Lactamase.
- Brian Henry Davison (*Chemical Engineering*) B.S.E., University of Rochester 1979.  
Thesis: Dynamics and Coexistence of Microbial Mixed Cultures.
- Pauline Mavis Doran (*Chemical Engineering*) B.E., University of Queensland 1978;  
M.S., California Institute of Technology 1982.  
Thesis: Effects of Immobilization on the Metabolism of Yeast.
- Joseph John Falke (*Chemistry*) B.A., Earlham College 1978.  
Thesis: The Behavior and Structure of the Band 3 Anion Transport Site: A  $^{35}\text{Cl}$  and  
 $^{37}\text{Cl}$  NMR Study.
- Peter Mark Felker (*Chemistry*) B.S., Union College 1979.  
Thesis: Picosecond Dynamics of Intramolecular Vibrational-Energy Redistribution  
(IVR) in Jet-Cooled Molecules.
- Dorothy Jean Flanagan (*Chemistry*) A.B., Smith College 1977.  
Thesis: The Angular Resolved Photoelectron Spectroscopy of Various Polyatomic  
Molecular Systems.
- James F. Garvey (*Chemistry*) B.S., M.S., Georgetown University 1978.  
Thesis: The Production and Characterization of an Intense Hyperthermal Beam of  $\text{H}_3$   
and of H Atoms.
- Maureen Alice Hanratty (*Chemistry*) B.S., University of Houston 1979.  
Thesis: Investigations of the Mechanisms and Energetics of Transition Metal Ion  
Mediated Reactions.

DOCTOR OF PHILOSOPHY — *Continued*

- William Samson Kalema (*Chemical Engineering*) B.A., Emmanuel College,  
University of Cambridge 1973; Part II, 1974.  
Thesis: A Study of Coal Oxidation.
- Charles Frederick Koerting (*Chemistry*) B.S., Andrews University 1979.  
Thesis: Variable-Angle Electron Spectroscopic Studies of Various Polyatomic  
Molecular Systems.
- Terry Edward Krafft (*Chemistry*) B.A., University of Northern Colorado 1980.  
Thesis: The Design of Multianionic Chelating Ligands for the Production of Inorganic  
Oxidizing Agents. Synthesis, Structure and Reactivity of Osmium Complexes  
Derived from a Tetradentate Tetraanionic Ligand.
- Ronald Robert Lagnado (*Chemical Engineering*) B.S., University of Illinois, Urbana  
1979; M.S., California Institute of Technology 1981.  
Thesis: The Stability of Two-Dimensional Linear Flows.
- Joseph A. Leone (*Chemical Engineering*) B.E., Youngstown State University 1979;  
M.S., California Institute of Technology 1981.  
Thesis: Studies in Photochemical Smog Chemistry: I. Atmospheric Chemistry of  
Toluene. II. Analysis of Chemical Reaction Mechanisms for Photochemical Smog.
- John James Low (*Chemistry*) B.S., State University of New York, Stony Brook 1979.  
Thesis: Theoretical Studies of Oxidative Addition and Reductive Elimination.
- Edward Douglas Lynch (*Chemical Engineering*) B.S.E., Princeton University 1979;  
M.S., California Institute of Technology 1982.  
Thesis: Sedimentation in Quiescent and Sheared Suspensions.
- Craig Timothy Martin (*Chemistry*) B.A., University of California, San Diego 1979.  
Thesis: The Structures of  $\text{Cu}_X$  and Cytochrome  $a$  in Cytochrome  $c$  Oxidase.
- David John Mathre (*Chemistry*) B.S., Eckerd College 1979.  
Thesis: I. The Diastereoselective Alkylation of Chiral 2-Oxazolidinone Imide  
Enolates. II. Efforts Directed Toward the Enantioselective Total Synthesis of  
Ferensimycin B.
- Christine McDade (*Chemistry*) A.B., Dartmouth College 1980.  
Thesis: Synthetic, Kinetic and Mechanistic Studies in Early Transition Metal Systems.  
I.  $\alpha$ - and  $\beta$ -Hydrogen Elimination in Derivatives of Permethyltitanocene,  
-Zirconocene, and -Hafnocene. II. The Reactions of Aluminum Alkyls with  
Derivatives of Permethylniobocene.
- Daniel Word Norbeck (*Chemistry*) B.S., Wheaton College 1980.  
Thesis: Progress Toward the Total Synthesis of Polyether Ionophore Antibiotics.
- Pavin Pichaichanarong (*Chemical Engineering*) A.B., Harvard College 1979; M.S.,  
California Institute of Technology 1982.  
Thesis: Reactions of Phenoxy Radicals Under Coal Liquefaction Conditions.
- Maile Elizabeth Smith (*Chemistry*) B.S., Louisiana State University 1979.  
Thesis: The Schwinger Variational Principle Applied to Molecular Photoionization.

## DOCTOR OF PHILOSOPHY — *Continued*

George Harlan Spies (*Chemistry*) B.S., Ohio State University 1980.

Thesis: I. Studies on the Coordination of Bis-hydroxybenzamido Chelating Ligations to Chromium, Iron, and Osmium. II. A Survey of the Organometallic Chemistry of Osmium Tetraoxide.

Phillip David Szuromi (*Chemistry*) B.S., Harvey Mudd College 1979.

Thesis: Studies of Hydrocarbon Reactions on Low-Index Iridium and Platinum Surfaces.

Yu-Min Tsou (*Chemistry*) B.S., National Tsing-Hua University 1975; M.S., National Taiwan University 1979.

Thesis: Thermodynamic and Kinetic Studies of Redox Reactions within Polyelectrolyte Coatings on Electrodes.

Theresa Ann Weston (*Chemical Engineering*) S.B., Massachusetts Institute of Technology 1980; M.S., California Institute of Technology 1983.

Thesis: The Regeneration of High Temperature Sulfur Dioxide Sorbents: The CO Reduction of Supported Alkali Sulfates.

Jarosław W. Winniczek (*Chemistry*) B.A., Case Western Reserve University 1977.

Thesis: Anisotropic Interaction Potentials between He and Linear Molecules from Crossed Beam Experiments.

Seung-Man Yang (*Chemical Engineering*) B.S., Seoul National University 1976; M.S., Korea Advanced Institute of Science 1978.

Thesis: Hydrodynamics and Brownian Motion of Small Particles Near a Fluid-Fluid Interface.

Thomas Christopher Zietlow (*Chemistry*) B.A., Kalamazoo College 1980.

Thesis: Photophysics and Electrochemistry of  $d^4$  Metal Clusters.

Jennifer Joanne Zinck (*Chemistry*) B.Sc., University of Guelph 1977.

Thesis: A Study of the Dynamics of the Interaction of  $CH_4$  with the (111) Surface of Rh and the (110) Surface of Ir.

## DIVISION OF ENGINEERING AND APPLIED SCIENCE

Kim Maynard Aaron (*Aeronautics*) B.Eng., McGill University 1979; M.S., California Institute of Technology 1980.

Thesis: Edgetones and Acoustic Resonances in a Duct.

Roger C. Bales (*Environmental Engineering Science*) B.S., Purdue University 1974; M.S., University of California, Berkeley 1975; M.S., California Institute of Technology 1984.

Thesis: Surface Chemical and Physical Behavior of Chrysotile Asbestos in Natural Waters and Water Treatment.

## DOCTOR OF PHILOSOPHY — Continued

- Pratim Biswas (*Mechanical Engineering*) B.Tech., Indian Institute of Technology, Bombay 1980; M.S., University of California, Los Angeles 1981.  
Thesis: Impactors for Aerosol Measurements: Developments and Sampling Biases.
- Elliott R. Brown (*Applied Physics*) B.S., University of California, Los Angeles 1979; M.S., California Institute of Technology 1981.  
Thesis: Investigation of Bulk Indium Antimonide as a Heterodyne Detector for the Submillimeter Wavelength Region.
- Kasivisvanathan Chelvakumar (*Mechanical Engineering*) B.Sc., University of Sri Lanka 1980; M.S., California Institute of Technology 1981.  
Thesis: A Simple Strain-Space Plasticity Model for Clays.
- Arturo O. Cifuentes (*Applied Mechanics*) Ingeniero Civil, Universidad de Chile 1977; M.S., California Institute of Technology 1981.  
Thesis: System Identification of Hysteretic Structures.
- Reuben Theodore Collins (*Applied Physics*) B.A., University of Northern Iowa 1979; M.S., California Institute of Technology 1980.  
Thesis: Electronic Properties of Heterostructures and Defects in Compound Semiconductors.
- Werner Johann Anton Dahm (*Aeronautics*) B.S.E., University of Alabama in Huntsville 1979; M.S., University of Tennessee Space Institute 1980.  
Thesis: Experiments on Entrainment, Mixing and Chemical Reactions in Turbulent Jets at Large Schmidt Number.
- Simon Henry Richard Davies (*Environmental Engineering Science*) B.Sc., Monash University 1973; M.App.Sc., Caulfield Institute of Technology 1979.  
Thesis: Mn(II) Oxidation in the Presence of Metal Oxides.
- Benjamin Paul Dolgin (*Applied Physics*) M.S., Leningrad Electrotechnical Institute 1975; M.S., California Institute of Technology 1981.  
Thesis: Kinetics of the Formation of an Amorphous Layer During a Solid State Reaction.
- Dov Elyada (*Aeronautics*) B.Sc., Technion, Israel Institute of Technology 1970; M.Sc., 1978.  
Thesis: Structural Analysis of Imperfect Three-Legged Truss Columns for Large Space Structures Applications.
- Bruce Charles Faust (*Environmental Engineering Science*) B.C.E., University of Minnesota 1979.  
Thesis: Photo-Induced Reductive Dissolution of Hematite ( $\alpha$ -Fe<sub>2</sub>O<sub>3</sub>) by S(IV) Oxyanions.
- Jeffrey Michael Fier (*Applied Mathematics*) B.S., California Institute of Technology 1979.  
Thesis: Part I: Fold Continuation and the Flow Between Rotating, Coaxial Disks. Part II: Equilibrium Chaos. Part III: A Mesh Selection Algorithm for Two-Point Boundary Value Problems.

DOCTOR OF PHILOSOPHY — *Continued*

- Eric Donald Fredrickson (*Applied Physics*) B.S., University of Minnesota 1977.  
Thesis: An Experimental and Theoretical Investigation of a Finite Beta Modified Drift Wave.
- David Lawrence Frost (*Aeronautics*) B.A.Sc., The University of British Columbia 1981; M.S., California Institute of Technology 1982.  
Thesis: Effects of Ambient Pressure on the Instability of a Liquid Boiling Explosively at the Superheat Limit.
- Lowell Eugene Hazelton (*Applied Physics*) B.S., Walla Walla College 1976.  
Thesis: A Study of Hydrogen Mobility in Glassy  $Zr_2Pd$  Using Internal Friction.
- William Douglas Henshaw (*Applied Mathematics*) B.Math., University of Waterloo 1981.  
Thesis: Part I: The Numerical Solution of Hyperbolic Systems of Conservation Laws; Part II: Composite Overlapping Grid Techniques.
- James Carl Hermanson (*Aeronautics*) B.S., University of Washington 1977; M.S., California Institute of Technology 1980.  
Thesis: Heat Release Effects in a Turbulent, Reacting Shear Layer.
- Daniel James Jacob (*Environmental Engineering Science*) M.S., California Institute of Technology 1981.  
Thesis: The Origins of Inorganic Acidity in Fogs.
- Garrett Duane Jeong (*Applied Mechanics*) B.S., University of Southern California 1978; M.S., California Institute of Technology 1979.  
Thesis: Cumulative Damage of Structures Subjected to Response Spectrum Consistent Random Processes.
- Prakash Kasiraj (*Applied Physics*) B.S., Texas A&M University 1978; M.S., California Institute of Technology 1980.  
Thesis: Shock-Wave Consolidation of Metallic Powders.
- Elizabeth Ann Kendall (*Mechanical Engineering*) S.B., Massachusetts Institute of Technology 1978; M.S., California Institute of Technology 1982.  
Thesis: Range Dependent Signals and Maximum Entropy Methods for Underwater Acoustic Tomography.
- Daniel Bernard Lang (*Applied Physics*) B.S., California Institute of Technology 1976; M.S., 1977.  
Thesis: Laser Doppler Velocity and Vorticity Measurements in Turbulent Shear Layers.
- Seung-Joon Lee (*Engineering Science*) B.S., Seoul National University 1974; M.S., 1976.  
Thesis: Generation of Long Water Waves by Moving Disturbances.
- Chuen-Der Lien (*Electrical Engineering*) B.S., National Taiwan University 1978; M.S., California Institute of Technology 1981.  
Thesis: Thin Film Silicide Formation by Thermal Annealing: Study of Kinetics, Moving Species, Impurity Effect, and Electrical Properties.



DOCTOR OF PHILOSOPHY — *Continued*

Sheue-Ling Chang Lien (*Computer Science*) B.S., National Taiwan University 1979;  
M.S., California Institute of Technology 1982.  
Thesis: Combining Computation with Geometry.

Tzu-mu Lin (*Computer Science*) B.S., National Taiwan University 1978; M.S.,  
California Institute of Technology 1981.  
Thesis: A Hierarchical Timing Simulation Model for Digital Integrated Circuits and  
Systems.

Emmanuel Maragakis (*Civil Engineering*) Diploma, National Technical University  
of Athens 1980; M.S., California Institute of Technology 1981.  
Thesis: A Model for the Rigid Body Motions of Skew Bridges.

Eric F. Matthys (*Mechanical Engineering*) Mechanical and Electrical Engineer,  
Brussels University, 1978; M.S., California Institute of Technology 1980.  
Thesis: An Experimental Study of Convective Heat Transfer, Friction, and Rheology  
for Non-Newtonian Fluids: Polymer Solutions, Suspensions of Fibers, and  
Suspensions of Particulates.

Madhav Mehra (*Materials Science*) B.Tech., Indian Institute of Technology, Kanpur  
1980; M.S., California Institute of Technology 1981.  
Thesis: Atomic Structure of Some Metallic Glasses and the Influence of the  
Preparation Technique on the Amorphous State.

Ronald Y. S. Pak (*Applied Mechanics*) B.Eng., McMaster University 1979; M.S.,  
California Institute of Technology 1980.  
Thesis: Dynamic Response of a Partially Embedded Bar under Transverse Excitations.

James Scott Patton (*Mechanical Engineering*) B.M.E., Georgia Institute of  
Technology 1979; M.S., California Institute of Technology 1980.  
Thesis: Experimental Study of Shear Flows and Convective Heat Transfer  
Characteristics of Granular Materials.

Arati Prabhakar (*Applied Physics*) B.S., Texas Tech University 1979; M.S.,  
California Institute of Technology 1980.  
Thesis: Investigations of Deep Level Defects in Semiconductor Material Systems.

Fredrick A. Roberts (*Aeronautics*) B.S., Illinois Institute of Technology 1975; M.S.,  
California Institute of Technology 1976.  
Thesis: Effects of a Periodic Disturbance on Structure and Mixing in Turbulent Shear  
Layers and Wakes.

Thomas Rösgen (*Aeronautics*) Diplom-Ingenieur, Technische Universitaet, Berlin  
1979.  
Thesis: Second Sound Scattering in Superfluid Helium.

Armistead Goode Russell (*Mechanical Engineering*) B.S., Washington State  
University 1979; M.S., California Institute of Technology 1980.  
Thesis: Formation and Control of Atmospheric Aerosol Nitrate and Nitric Acid.

## DOCTOR OF PHILOSOPHY — *Continued*

- Duane A. Smith (*Mechanical Engineering*) B.S., Purdue University 1978; M.S., California Institute of Technology 1980.  
Thesis: An Experimental Study of Acoustically Excited, Vortex Driven, Combustion Instability within a Rearward Facing Step Combustor.
- Kenneth Scott Smith (*Applied Mechanics*) B.S., California Institute of Technology 1980; M.S., 1982.  
Thesis: Stochastic Analysis of the Seismic Response of Secondary Systems.
- Peter Ping Tak Tong (*Electrical Engineering*) B.S., University of Hawaii at Manoa 1980; M.S., California Institute of Technology 1981.  
Thesis: Millimeter-Wave Integrated-Circuit Antenna Arrays.
- Kerry John Vahala (*Applied Physics*) B.S., California Institute of Technology 1980; M.S., 1981.  
Thesis: Dynamic and Spectral Features of Semiconductor Lasers.
- Jason Masao Wakugawa (*Applied Mechanics*) B.S.E., Princeton University 1981; M.S., California Institute of Technology 1982.  
Thesis: On the Existence and Uniqueness of the Solution to the Small-Scale Nonlinear Anti-Plane Shear Crack Problem in Finite Elastostatics.
- Daniel S. Whelan (*Computer Science*) B.S., California Institute of Technology 1979; M.S., 1981.  
Thesis: ANIMAC: A Multiprocessor Architecture for Real-Time Computer Animation.
- Douglas Lee Whiting (*Computer Science*) B.S., California Institute of Technology 1980; M.S., 1981.  
Thesis: Bit-Serial Reed-Solomon Decoders in VLSI.
- Telle Elizabeth Whitney (*Computer Science*) B.S., University of Utah 1978; M.S., California Institute of Technology 1981.  
Thesis: Hierarchical Composition of VLSI Circuits.
- Chu Ryang Wie (*Applied Physics*) B.S., Chonnam National University 1980; M.S., Seoul National University 1982.  
Thesis: Effects Produced in GaAs by MeV Ion Bombardment.

## DIVISION OF GEOLOGICAL AND PLANETARY SCIENCES

- James Louis Conca (*Geochemistry*) Sc.B., Brown University 1979; M.S., California Institute of Technology 1981.  
Thesis: Differential Weathering Effects and Mechanisms.
- Thomas Martin Hearn (*Geophysics*) B.S., University of California, Riverside 1978; M.S., California Institute of Technology 1981.  
Thesis: Crustal Structure in Southern California from Array Data.

## DOCTOR OF PHILOSOPHY — *Continued*

- Eugene D. Humphreys (*Geophysics*) B.S., University of California, Riverside 1974; M.S., 1978.  
Thesis: Studies of the Crust-Mantle System Beneath Southern California.
- Ronan Le Bras (*Geophysics*) Ingénieur Civil, Ecole Nationale Supérieure des Mines de Paris 1979; M.S., California Institute of Technology 1981.  
Thesis: Methods of Multiparameter Inversion of Seismic Data Using the Acoustic and Elastic Born Approximations.
- Jonathan Irving Lunine (*Planetary Science*) B.S., University of Rochester 1980; M.S., California Institute of Technology 1983.  
Thesis: Volatiles in the Outer Solar System: I. Thermodynamics of Clathrate Hydrates; II. Ethane Ocean on Titan; III. Evolution of Titan Atmosphere.
- Stephanie Margaret Mattson (*Geochemistry*) B.S., University of Minnesota 1978.  
Thesis: Optical Expressions of Ion-Pair Interactions in Minerals.
- David Abbey Paige Jr. (*Planetary Science*) B.S., University of California, Los Angeles 1979.  
Thesis: The Annual Heat Balance of the Martian Polar Caps from Viking Observations.
- Patricia Frances Scott (*Geophysics*) B.A., Princeton University 1976; M.S., California Institute of Technology 1980.  
Thesis: Applications of the Kirchhoff-Helmholtz Integral to Problems in Body Wave Seismology.
- Michael Earl Summers (*Planetary Science*) B.A., Murray State University 1976; M.S., The University of Texas at Dallas 1978.  
Thesis: Theoretical Studies of Io's Atmosphere.

## DIVISION OF THE HUMANITIES AND SOCIAL SCIENCES

- Rodney Douglas Fort (*Social Science*) B.S., Utah State University 1978; M.S., Montana State University 1980.  
Thesis: Theory and Practice in the Analysis of Futures Price Distributions.
- James Michael Gerard (*Social Science*) B.A. (Honours), Northwestern University 1977; M.S., California Institute of Technology 1983.  
Thesis: Three Essays on Markets with Imperfect Information.
- James Millett Snyder, Jr. (*Social Science*) A.B., Duke University 1981.  
Thesis: Political and Market Equilibria with Income Taxes.

## DIVISION OF PHYSICS, MATHEMATICS AND ASTRONOMY

- Johan Lambert Bijmens (*Physics*) Licentiaat, Katholieke Universiteit Leuven 1982; M.S., California Institute of Technology 1984.  
Thesis: Chiral Perturbation Theory and the Weak Interaction.

DOCTOR OF PHILOSOPHY — *Continued*

- Mario Blaum (*Mathematics*) Licenciado en Matemáticas, Universidad de Buenos Aires 1978; M.Sc., Technion, Israel Institute of Technology 1981.  
Thesis: Error-Correcting Codes for Computer Memories.
- Hugh Herbert Breneman III (*Physics*) B.S., Harvey Mudd College 1978.  
Thesis: Solar Photospheric and Coronal Abundances from Solar Energetic Particle Measurements.
- Ariel Caticha (*Physics*) B.Sc., Universidade Estadual de Campinas 1976; M.Sc., 1979.  
Thesis: Changes of Variables and the Renormalization Group.
- Nestor Caticha Alfonso (*Physics*) B.Sc., Universidade Estadual de Campinas 1978.  
Thesis: Limit Theorems for Classical Spin Systems with an Abelian Discrete Symmetry.
- Mark Crawshaw (*Mathematics*) B.A. (Honours), Oxford University 1980.  
Thesis: Explicit Formulas for the Jump of Q-Degrees.
- Charles David Edwards, Jr. (*Physics*) A.B., Princeton University 1979; M.S., California Institute of Technology 1981.  
Thesis: A Study of Exclusive Final States in Radiative  $\psi$  Decays.
- James Arthur Fillmore (*Astronomy*) A.B., Dartmouth College 1980.  
Thesis: A Study on the Formation and Dynamics of Galaxies.
- Jay Hauser (*Physics*) B.S., University of Michigan 1978; M.S., California Institute of Technology 1982.  
Thesis: A Systematic Study of the Decays of Charmed D Mesons.
- Michael E. Henderson (*Applied Mathematics*) B.S., Pennsylvania State University 1980.  
Thesis: Complex Bifurcation.
- Lars Eric Hernquist (*Physics*) B.A., Cornell University 1977.  
Thesis: Thermal and Magnetic Properties of Neutron Stars.
- Ivo Klemes (*Mathematics*) B.Sc., University of Toronto 1982.  
Thesis: I. Idempotent Multipliers of  $H^1$  on the Circle. II. A Mean Oscillation Inequality for Rearrangements.
- Koon H. Lau (*Physics*) B.S., A.B., University of California, Berkeley 1978; M.S., California Institute of Technology 1981.  
Thesis: A Cerenkov -  $\Delta E$  - Cerenkov Detector for Measuring High Energy Heavy Cosmic Ray Isotope and Studies of Fragmentation of  $^{40}\text{Ar}$  and  $^{56}\text{Fe}$ .
- Michael Robert Lewy (*Mathematics*) A.B., University of California, Berkeley 1980.  
Thesis: The Indecomposables of Rank 3 Permutation Modules.
- Narayan K. Mahale (*Physics*) B. Tech., Indian Institute of Technology, Bombay 1969; M.S., California Institute of Technology 1970; Ae.E., 1973.  
Thesis: Monte Carlo Calculation of Three-Body Scattering.

DOCTOR OF PHILOSOPHY — *Continued*

- John Kevin Markey (*Physics*) B.S., California State University, San Diego 1975;  
M.S., California Institute of Technology 1978.  
Thesis: Transverse Polarization of Beta Particles from Polarized Nuclei.
- Richard Gerard Milner (*Physics*) B.Sc. (Honours), University College 1978; M.Sc.,  
1979.  
Thesis: A Search for Fractionally Charged Particles.
- Charles T. Molloy (*Applied Mathematics*) B.S., California Institute of Technology  
1967.  
Thesis: Contributions to the Kinetic Theory of Traffic Flow with Queuing.
- Jeffrey David Richman (*Physics*) B.S., Yale University 1979; M.S., California  
Institute of Technology 1982.  
Thesis: A Study of the Iota in Radiative J/PSI Decays.
- Larry James Romans (*Physics*) B.S., University of California, Davis 1979.  
Thesis: Supergravity Theory from Ten Dimensions.
- Raghvendra Sahai (*Astronomy*) M.Sc., Indian Institute of Technology, Kanpur 1978;  
M.S., California Institute of Technology 1981.  
Thesis: Circumstellar Shells of Late-Type Stars—A Study at Millimeter and Infrared  
Wavelengths.
- Bonny Laura Schumaker (*Physics*) M.S., California Institute of Technology 1981.  
Thesis: Theoretical Investigations in Nonlinear Quantum Optics, Theory of  
Measurement, and Pulsations of General Relativistic Models of Neutron Stars.
- Robert Thomas Skelton (*Physics*) B.S., Auburn University 1971; M.S., 1977; M.S.,  
California Institute of Technology 1980.  
Thesis: The  $^{26}\text{Mg}(p,n)^{26}\text{Al}$  and  $^{23}\text{Na}(\alpha,n)^{26}\text{Al}$  Reactions.
- Hidehiko Sonoda (*Physics*) B.S., University of Tokyo 1981.  
Thesis: Chiral Anomalies and the Chiral Lagrangian.
- Elizabeth Ann Stanley (*Applied Mathematics*) B.S., University of Arizona 1979.  
Thesis: Diffusion in Glassy Polymers.
- Wai Mo Suen (*Physics*) B.S., The Chinese University of Hong Kong 1978; M.S., 1980.  
Thesis: Dynamical Electromagnetic Fields Near Black Holes and Multipole Moments  
of Stationary, General Relativistic Systems.
- Gayle Sugiyama (*Physics*) B.S., University of Wisconsin, Madison 1977.  
Thesis: Auxiliary Field Monte Carlo for Quantum Many-Body Systems.

# 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.

*Werner Johann Anton Dahm, David Lawrence Frost,  
Daniel Bernard Lang*

## ERIC TEMPLE BELL UNDERGRADUATE MATHEMATICS RESEARCH PRIZE

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

*Charles Jacob Nainan, senior*

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

<i>Hojin Ahn</i>	<i>James Dunn</i>	<i>Catherine Kei Ifune</i>
<i>Praveen Asthana</i>	<i>Rafael Timothy Pascual</i>	<i>Eric Hitoshi Kawamoto</i>
<i>William J. Callahan</i>	<i>Fernando</i>	<i>Blake H. Lewis</i>
<i>Susanna Mink Chan</i>	<i>Ron J. Forni</i>	<i>Timothy Ralph White</i>
<i>Michael Suk-Young Chwe</i>	<i>Anirvan Ghosh</i>	<i>Frederic Y. Wong</i>
<i>Glen Dickson Crawford</i>	<i>Tony Tunglin Huang</i>	<i>Christopher Yo</i>
<i>Edward Louis Cuellar</i>		

*\*The names of students who have received prizes or awards in previous years, but who are graduating in 1985, are also listed.*

## PRIZES AND AWARDS — *Continued*

### 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.

*Michael Edwin Henderson, William Douglas Henshaw*

### 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.

*Seung-Joon Lee*

### 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.

*1985 Timothy P. Allen, junior; Johannes P. Schmidt, junior*

*1984 Praveen Asthana,\* Richard M. Murray\**

### HAREN LEE FISHER MEMORIAL AWARD IN JUNIOR PHYSICS

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

*1985 Taylor W. Lawrence*

*1984 Eric H. Kawamoto\**

### 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.

*1985 Myles A. Sussman, junior*

*1984 Hojin Ahn\**

### 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.

*1985 James T. Liu*

*1984 James Dunn\**

## PRIZES AND AWARDS — *Continued*

### 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.

1985 *Edward W. Felten, senior; John T. Fourkas, junior*

1984 *Catherine K. Ifune\**

### 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.

1985 *Robin K. Wilson, junior*

1984 *David P. Watkins\**

### INSTITUTE FOR THE ADVANCEMENT OF ENGINEERING AWARD

Awarded to a student who exhibits a professional attitude toward engineering by a leadership role in the student chapter of a professional organization, such as the IEEE, ASCE, ASME.

*Boon-Khim Liew, senior*

### DAVID JOSEPH MACPHERSON PRIZE IN ENGINEERING

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

*Bradford C. Lincoln*

### 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.

*Thanh-Van Tran-Nhut, senior*

### 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.

1985 *Tammy I. Choy, junior; Richard M. Murray, senior;*

*Behzad Sadeghi, senior*

1984 *Paul E. Filmer\**



## PRIZES AND AWARDS — *Continued*

### 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.

*Praveen Asthana*

### 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.

1985 *Jurgen Johannes Giezen*

1984 *Dov Elyada\**

### 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.

1985 *Edmund J. Llewellyn, sophomore; Brian D. Metscher, junior*

1984 *Thanh-Van Tran-Nhut\**

### SIGMA XI AWARD

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

*James Dunn*

### THE MORGAN WARD PRIZE

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

*George Chen, sophomore; David E. Long, sophomore*