



*Ninety-Seventh
Annual Commencement
June 14, 1991*

CALIFORNIA INSTITUTE OF TECHNOLOGY

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FRIDAY MORNING AT TEN O'CLOCK
JUNE FOURTEENTH, NINETEEN NINETY-ONE

Welcome to Caltech

"There is much that is pleasant and much that is sad in the exercises of commencement. With the congratulations, alas, there is too often the good-by." These sentiments are as true for this year's graduates as they were for the students for whom the words were written—the 10 men and 4 women who graduated from Throop Polytechnic Institute in 1897. Those graduates were part of one of the first classes to graduate from Caltech's forerunner. Today's graduates are a part of Caltech's yearlong centennial celebration.

The California Institute of Technology developed from a local school of arts and crafts founded by the Honorable Amos G. Throop, a prominent Pasadena businessman. Throop offered what was at that time a unique curriculum, emphasizing vocational and technical training. The school, located in part of the Green Hotel, opened its doors on November 1, 1891. Initially named Throop University, it was later renamed Throop Polytechnic Institute. It became the California Institute of Technology in 1921.

Today, Caltech is located on a 124-acre campus and operates seven off-campus astronomical, seismological, and marine biological facilities, as well as administering the Jet Propulsion Laboratory. Caltech has an enrollment of some 1,800 students, more than half of whom are in graduate studies. The faculty, consisting of about 275 professorial members and more than 425 research members, includes three Nobel laureates. Over the years, 21 Nobel Prizes have been awarded to Caltech faculty members and alumni. Thirty-three Caltech faculty members and alumni have received the National Medal of Science and three have won the National Medal of Technology, the nation's highest honors in science and technology.

The Institute is honored today to have President George Bush as its commencement speaker. However, President Bush is not the first U.S. president to attend a Caltech function. There have been five others—William Taft came while in office; Teddy Roosevelt and Herbert Hoover visited after leaving the Oval Office; Richard Nixon came when he was vice president; and Ronald Reagan spoke at a Caltech event as governor of California.

The visit that drew the most attention, as evidenced by the local newspapers, was Teddy Roosevelt's on March 21, 1911. He was touring southern California and stopped in Pasadena to give a lecture as a part of Throop's community lecture program. His talk, "A Zoological Trip Through Africa," was given in a 2000-seat amphitheater at the Hotel Maryland. Five dollars got a front-row seat; for one dollar you could stand in the back. Although the auditorium was reported to be full, it was not sold out.

Every minute of Roosevelt's visit was reported in detail in the local newspaper, the *Pasadena Star*, including instructions on which street corners various civic groups were supposed to meet in order to greet the former president's motorcade down Colorado Boulevard. During his tour of Pasadena, TR visited Throop Hall, where he had some kind words to say about Throop: "I believe that the most important work for us in America today, in the way of education, is to train our people vocationally."

William Taft's visit was much less elaborate than Roosevelt's. On October 16, 1911, Taft was being hurried to Los Angeles for an appointment. He took time out to give a brief speech to a group of students of Throop Polytechnic Institute who were assembled in Tournament Park. On the study of technical subjects Taft told the students, "Your



The 1917 commencement was held in front of the Throop's "new" building, Gates Laboratory of Chemistry, now Parsons-Gates Hall of Administration.

mental discipline will be just as good when derived from these practical subjects as if you secured your mental discipline the old-fashioned way." Taft continued, "I have no doubt that this will be a most successful institution and congratulate Pasadena upon having it within her walls."

Little did Taft know that only two years later Throop Polytechnic Institute would be renamed Throop College of Technology. By 1921 the name changed again, this time to the California Institute of Technology, and the Board of Trustees set the school's new course: to pursue scientific researches of the greatest importance and "to continue to conduct thorough courses in engineering and pure science, basing the work of these courses on exceptionally strong instruction in the fundamental sciences of mathematics, physics, and chemistry; broadening and enriching the curriculum by a liberal amount of instruction in such subjects as English, history, and economics; and vitalizing all the work of the Institute by the infusion in generous measure of the spirit of research."

Herbert Hoover came to campus on March 14, 1936—three years after he had left the White House. The occasion was the dedication of two buildings, North Mudd and Arms Laboratories. In reflecting on Caltech, Hoover said, "In the expansion of human understanding and the lift to the human mind comes the advancement of civilization."

Richard Nixon, on a five-day tour of California, visited the campus in February 1958, while he was vice president. He gave a speech to students and faculty in Tournament Park. Photographs show Nixon and Caltech President Lee DuBridge, talking to reporters and shaking hands with well-wishers.

Ronald Reagan is the only president of the five who did not set foot on campus. While governor of California, he was the keynote speaker at a gala dinner at the Ambassador Hotel in Los Angeles on November 8, 1967—the kickoff event of Caltech's development campaign, "Science for Mankind."

The students, faculty, and staff of Caltech are looking forward to welcoming President Bush in this, our centennial year.

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 master's, the doctor's 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 girls and choir boys 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, David B. Wales, Ph.D.

Caltech Student Color Guard

Assistant Marshals

Arden L. Albee, Ph.D.	Christopher E. Brennen, D.Phil.
Judith R. Goodstein, Ph.D.	Robert W. Oliver, Ph.D.
Ward Whaling, Ph.D.	David S. Wood, Ph.D.

Faculty Officers

Steven E. Koonin, Ph.D.	Daniel J. Kevles, 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 ENGINEER

CANDIDATES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

FACULTY OFFICERS

THE FACULTY

THE CHAIRMEN OF THE DIVISIONS

THE DEANS

THE PROVOST

THE TRUSTEES

THE COMMENCEMENT CHAPLAIN

THE PRESIDENT OF THE INSTITUTE

THE CHAIRMAN OF THE BOARD OF TRUSTEES

Program

ORGAN PRELUDE Leslie J. Deutsch, Ph.D.

PROCESSIONAL . . . The Caltech Convocations Brass and Percussion Ensemble
William Bing, M.M., Conductor

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

THE NATIONAL ANTHEM . . . The Caltech Glee Clubs, Caltech
Convocations Brass and Percussion Ensemble, and Organ
Lynda Anders, Soloist

INVOCATION Dr. Marguerite Shuster
Pastor, Knox Presbyterian Church

INTRODUCTION OF COMMENCEMENT SPEAKER . . Pete Wilson
Governor of the State of California

COMMENCEMENT ADDRESS George Bush
President of the United States

CHORAL SELECTION The Caltech Glee Clubs
Donald G. Caldwell, D.M.A., Conductor

“Hallelujah” from *Messiah*

George Frederick Handel

The audience will please rise during the singing of the “Hallelujah” chorus.

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 . Christopher E. Brennen, D.Phil.
Dean of Students

For the Degree of Master of Science Gary A. Lorden, Ph.D.
Vice President for Student Affairs

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

For the Degree of Doctor of Philosophy Dr. Albee

Biology John N. Abelson, Ph.D.
Division Chairman

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

Engineering and Applied Science . . . John H. Seinfeld, Ph.D.
Division Chairman

Geological and Planetary Sciences . . David J. Stevenson, Ph.D.
Division Chairman

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

Physics, Mathematics and Astronomy . Gerry Neugebauer, Ph.D.
Division Chairman

CONCLUDING REMARKS President Everhart

ALMA MATER The Caltech Glee Clubs

BENEDICTION Dr. Shuster

RECESSIONAL The Caltech Convocations Brass and
Percussion Ensemble

ORGAN POSTLUDE Dr. Deutsch

Candidates for Degrees

BACHELOR OF SCIENCE

Marc Wesley Abel *Pasadena, California* Engineering and Applied Science
Larry Eugene Ahle* *San Jose, California* Physics
Myron Donghyo Ahn* *Riverside, California* Engineering and Applied Science
Keith Takumi Akama *Los Angeles, California* Biology
Eric Ryan Anderson *Deming, Washington* Engineering and Applied Science
Imran Aziz *Karachi, Pakistan* Electrical Engineering
Joseph Bach *Haifa, Israel* Engineering and Applied Science
Francis Morgan Ball III* *Maplewood, Missouri* Physics
Boyd Roger Bangerter* *Danville, California* Electrical Engineering
Brandon Max Baumert* *Long Beach, California* Chemical Engineering
Golda Bernstein *Tucson, Arizona* Applied Mathematics
Sabeer Bhatia* *Bangalore, India* Electrical Engineering
Meeten Bhavsar* *Rancho Cucamonga, California* Electrical Engineering and Economics
Brian Lee Biswell *Olympia, Washington* Engineering and Applied Science
Seth Scott Bittker* *Scottsdale, Arizona* Mathematics
Charles Leroy Blake *Norwich, Connecticut* Physics
Brett Dana Bochner* *Brooklyn, New York* Physics
Kenneth Lee Campman* *Los Angeles, California* Physics
Chris James Campo *San Jose, California* Geophysics
Harry J. Catrakis* *Athens, Greece* Engineering and Applied Science
Alecia Juei-Hsia Chen *Providence, Rhode Island* Engineering and Applied Science
Leonard Peter Chen* *San Juan Capistrano, California* Electrical Engineering
Helen Hsin-I Cheng* *Cypress, California* Biology
Larry Cheng* *Cerritos, California* Engineering and Applied Science
Ajay Dinesh Chheda *Blairstown, New Jersey* Biology
Sylvia Pui Chee Chin* *Honolulu, Hawaii* Electrical Engineering
Tien-Yee Chiu *Columbia, Maryland* Mathematics
Mike Truan Chou* *Torrance, California* Physics
Jonathan Kwok-Ching Chow *Hong Kong, Hong Kong* Engineering and Applied Science
Charles Bryan Cook *Deckerville, Michigan* Engineering and Applied Science
Allen Michael Corcorran *Santa Ana, California* Engineering and Applied Science

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*

David Ernest Coufal* *Colorado Springs, Colorado* Chemistry
Mark Norman Dailey *Portland, Oregon* Engineering and Applied Science
Ruchira Sreemati Datta *Pasadena, California* Mathematics
Michael William Deem* *Bernardsville, New Jersey* Chemical Engineering
Mark Andrew Dinan* *Alexandria, Virginia* Physics
Samuel Howard Dinkin *Fresno, California* Economics
Lindsey Norman Dubb *Belmont, California* Biology
Alexander Vladimirovich Dukhovny *San Francisco, California* Engineering and Applied Science
Pete Harry Dussin *Portland, Oregon* Engineering and Applied Science
Michael Dean Ehlers* *Lincoln, Nebraska* Chemistry
Gilad Israel Elbaz *Pasadena, California* Engineering and Applied Science and Economics
David Gary Emerson *Strathmore, California* Electrical Engineering
Thomas Michael Fiola* *Venice, Florida* Physics
Kim Dorian Flowers *Portland, Oregon* Engineering and Applied Science
Amar Suryakant Gandhi* *Rajkot, India* Engineering and Applied Science
Milind Mukund Gangal *La Crescenta, California* Biology
John Henry Gass* *New Llano, Louisiana* Electrical Engineering
David Francis Geraghty* *Iowa City, Iowa* Engineering and Applied Science
Jeffrey Peter Hagen *Shell Beach, California* Engineering and Applied Science
Curt Oliver Hagenlocher *Santa Rosa, California* Engineering and Applied Science
David Carlos Hall *Madrid, Spain* Engineering and Applied Science
Scott Raymond Harris *Costa Mesa, California* Engineering and Applied Science
Laura Juliet Hernandez* *Santa Monica, California* Biology and Engineering and Applied Science
Wendell Tate Hicken* *Whittier, California* Engineering and Applied Science
Jay Willard Higley *Magna, Utah* Applied Physics
Matt Saul Himmelstein *North Hollywood, California* Engineering and Applied Science
Jacqueline Marie Holmes *Titusville, Florida* Chemical Engineering
Gary Roger Holt* *Los Angeles, California* Biology
John Robert Hoskins *Gunnison, Colorado* Biology and Chemistry
Susan Rae Howard *Fair Oaks, California* Independent Studies Program
Mark Andrew Huie *San Francisco, California* Engineering and Applied Science
Stephen Victor Hwan* *San Carlos, California* Electrical Engineering
Michael Paul Ida *Honolulu, Hawaii* Physics and Applied Mathematics
Yayoi Izumi* *Tokyo, Japan* Electrical Engineering

BACHELOR OF SCIENCE—Continued

Sandeep Jain *New Delhi, India* Engineering and Applied Science
Gregory Alan James* *Mesa, Arizona* Engineering and Applied Science
Jun-Young Edwin Jeon *Los Angeles, California* Electrical Engineering
Jennifer J. Joh *Chatsworth, California* Electrical Engineering
Eric Charles Johnson *Palos Heights, Illinois* Engineering and Applied Science
Nikhil Ranjan Joshi *Palo Alto, California* Astronomy
Steve Jun *Franklin, Michigan* Electrical Engineering
Eric Michael Kassan *Los Angeles, California* Economics
Hemant Vasant Keny *La Palma, California* Biology
Zulfiqar Hameed Khan* *Lahore, Pakistan* Electrical Engineering
Thomas George Kiefer* *Torrance, California* Physics
Dong-Su Kim* *Seoul, Korea* Applied Physics
Jinha Kim* *Los Angeles, California* Physics
Adam Jack King *Santa Barbara, California* Engineering and Applied Science
Dimitri Jay Kirill *Dearborn, Michigan* Physics
Scott Robert Kister* *Columbus, Ohio* Engineering and Applied Science and Economics
Melinda Ann Knox *Littleton, Massachusetts* Biology and Engineering and Applied Science
Allen Ivar Knutson* *New York, New York* Mathematics
Daniel Sung Woon Ko* *Garden Grove, California* Applied Mathematics
Jeffrey Alan Koehler *Lakewood, Colorado* Chemical Engineering
Tanya Kristine Kurosky *Galveston, Texas* Physics
Michael Kwan* *San Francisco, California* Chemical Engineering
Janet Lai* *Hong Kong, Hong Kong* Chemical Engineering
Ngocdiep Thi Le* *Fountain Valley, California* Biology
Alice Chia-Ho Lee* *Irvine, California* Electrical Engineering
Anita Ka-Ying Lee* *Platteville, Wisconsin* Applied Physics
Kyung Woo Lee *Seoul, Korea* Engineering and Applied Science
Zhaohong Li* *Shanghai, China* Engineering and Applied Science
Ralph Shih-Ying Lin* *Rancho Palos Verdes, California* Biology
Robert Edmund Lister *Ottawa, Kansas* Engineering and Applied Science
Eugene Stephen Lit* *Waterloo, Ontario, Canada* Biology
Emily I-Ming Lo *Metairie, Louisiana* Engineering and Applied Science
Mitchell Edward Loeschner *Germantown, Tennessee* Chemical Engineering and Economics
Yun Fong Loh* *El Monte, California* Engineering and Applied Science
Dave Long *Cupertino, California* Geochemistry

BACHELOR OF SCIENCE — *Continued*

Robin Edward Luckey* *Billings, Montana* Engineering and Applied Science
Kevin Erick Luster* *Pasadena, California* Engineering and Applied Science
Quoc Thai An Luu *Ontario, California* Applied Physics
Thuan Phuong Luu *East Hartford, Connecticut* Engineering and Applied Science
Mark Thomas Lyttle *Atlanta, Georgia* Engineering and Applied Science
Bruce Clyde Macartney-Filgate *Raleigh, North Carolina* Physics
Raif Majeed *Frederick, Maryland* Physics
Russell Alan Manning* *Downers Grove, Illinois* Engineering and Applied Science
Mark Norman Markarian *Manteca, California* Engineering and Applied Science
J. Ben Masek *Reims, France* Engineering and Applied Science
Steven Andrew McLaughlin* *Bellevue, Washington* Economics and Biology
Timothy Ian Melbourne *La Cañada, California* Geophysics
Evangelos Metaxides *Thessaloniki, Greece* Engineering and Applied Science
Celina Jadwiga Mikolajczak* *Coronado, California* Engineering and Applied Science
Theodore John Mlynar *Pound Ridge, New York* Electrical Engineering
Peter George Morcos *Dallas, Pennsylvania* Engineering and Applied Science
David Harris Morton *Citrus Heights, California* Physics
Michael Paul Mossey* *Cincinnati, Ohio* Engineering and Applied Science
Ashoke Aditya Mukherji* *McMinnville, Tennessee* Economics
Christopher John Myers* *Billings, Montana* Electrical Engineering and History
Sandor Zoltan Nagy* *Concord, California* Engineering and Applied Science
Cass Keiji Nakasone *Honolulu, Hawaii* Engineering and Applied Science
Eric C. Newman* *Sharon, Massachusetts* Electrical Engineering
Jimmy King-Fung Ng *Fountain Valley, California* Engineering and Applied Science
Robert Joseph Padula *Mission Hills, Kansas* Electrical Engineering
Steven Leslie Palm* *Escondido, California* Engineering and Applied Science
Daniel B. Pang *San Jose, California* Engineering and Applied Science
Annetta Myrto Papadopoulos *Albuquerque, New Mexico* Engineering and Applied Science
David Joohyung Park *Glenview, Illinois* Engineering and Applied Science
David Mason Peterson *Summit, New Jersey* Physics
Hoang Xuan Pham *Fairbanks, Alaska* Engineering and Applied Science
Christopher Jan Pluhar *Norwood, Massachusetts* Geology
Harold Randolph Pollock *Bayside, New York* Engineering and Applied Science
Michael Dean Pottenger *Fair Oaks, California* Engineering and Applied Science
Jack Lawrence Prater *Houston, Texas* Physics
Mitchell Mirko Pravica *Des Plaines, Illinois* Applied Physics
Rajeev Jagga Ram *Bakersfield, California* Applied Physics

BACHELOR OF SCIENCE — *Continued*

Carlos Ernesto Ramirez *Sandy, Utah* Applied Physics
 Jinendra Kumar Ranka* *Poughkeepsie, New York* Electrical Engineering
 Joseph Kurth Reynolds* *Austin, Texas* Physics
 Michael Richard Ricci *Chatsworth, California* Engineering and Applied Science
 Atulya Risal *Kathmandu, Nepal* Electrical Engineering
 Michael Joseph Rozak* *East Aurora, New York* Engineering and Applied Science
 Erik Lee Russell *Westminster, California* Geophysics
 Behzad Sadeghi *Tehran, Iran* Mathematics
 Pongsorn Saipetch* *Bangkok, Thailand* Physics
 Michael Sergey Samoilov* *Moscow, USSR* Mathematics and Physics
 Lyle Nathan Scheer *Morristown, New Jersey* Engineering and Applied Science
 Mark Andrew Schmidt *Warsaw, Indiana* Biology
 Erich Russell Schneider *Lancaster, California* Engineering and Applied Science
 Keana Cecilia Kim Scott *Flushing, New York* Engineering and Applied Science
 Samantha Andrews Seaward* *Solana Beach, California* Biology
 Dylan Bernard Selegue* *Sepulveda, California* Mathematics
 Suresh Shanmugam* *Bangalore, India* Electrical Engineering
 Raymond Tei-Luen Shen* *Montebello, California* Electrical Engineering
 Brian Remy Shim* *Anaheim, California* Electrical Engineering
 Arthur Shmurun *San Mateo, California* Engineering and Applied Science
 Michael Forrest Simpson* *Tampa, Florida* Chemical Engineering
 Barry Cushing Stipe* *Bellingham, Washington* Physics
 Kurt Jonathan Storm *Collinswood, New Jersey* Geology
 Alexandre Borges Sugiyama *New York, New York* Economics
 Atul Suklikar* *Bombay, India* Electrical Engineering
 Patrick James Sullivan *Miami, Florida* Applied Mathematics
 William Joseph Swanson *Hastings, Minnesota* Engineering and Applied Science
 Hamilton Roger Tang* *Tempe, Arizona* Applied Physics
 David Marc Taub *Woodland Hills, California* Biology
 David Alan Townsend *Laguna Niguel, California* Physics and Geophysics
 Matthew Lamont Tyler* *Salt Lake City, Utah* Chemical Engineering
 Edward Case Vail* *Ann Arbor, Michigan* Electrical Engineering
 Mark John Vaughan* *Lomita, California* Electrical Engineering
 Mark Wesley Vermies *West Dundee, Illinois* Engineering and Applied Science
 Elizabeth Augusta Warner* *Willits, California* Chemistry and Geochemistry
 Alex Wein *New York, New York* Chemistry and History
 Robert Bernard Welstand *Pinole, California* Electrical Engineering
 John Alan Wendel* *Mason City, Iowa* Chemistry

BACHELOR OF SCIENCE—*Continued*

Elizabeth Anne West *Doraville, Georgia* Mathematics
Allan Quon Wong *Los Angeles, California* Engineering and Applied Science
Peyjen Wu* *Taipei, Taiwan* Electrical Engineering
Su-Lin Wu* *Los Angeles, California* Engineering and Applied Science
Peter Scott Wyckoff* *Sidney, Ohio* Chemical Engineering
Anna Maria Yeakley *El Paso, Texas* Engineering and Applied Science
Julie Lee Yee *Sacramento, California* Mathematics
Linda Tak Pui Ying* *Hong Kong, Hong Kong* Electrical Engineering
Peter Ying *Forest Hills, New York* Engineering and Applied Science and Economics
Syed Hassan Yousaf *Lahore, Pakistan* Electrical Engineering
Michael Youssefmir* *Scottsdale, Arizona* Physics and Mathematics

MASTER OF SCIENCE

- Barry Edward Ambrose (*Electrical Engineering*) B.E., University College Cork 1986; M.Sc., Trinity College, Dublin 1990.
- Ariel David Anbar (*Geochemistry*) A.B., Harvard College 1989.
- Dimitrios Antsos (*Electrical Engineering*) B.S., California Institute of Technology 1990.
- Susan Apostolaki (*Biology*) Ptychio, National and Kapodistrian University of Athens 1989.
- Mohammad Azeem (*Electrical Engineering*) B.A., Reed College 1990; B.S., California Institute of Technology 1990.
- Shawn Joseph Beard (*Aeronautics*) B.S., University of Washington 1990.
- David Patrick Berners (*Electrical Engineering*) S.B., Massachusetts Institute of Technology 1990.
- Antoine Bodet (*Aeronautics*) Diplôme d'Ingénieur, Ecole Centrale des Arts et Manufactures 1990.
- Louis John Boschelli (*Chemical Engineering*) B.S., University of Illinois at Urbana-Champaign 1987.
- John Murray Bowen (*Aeronautics*) B.S., University of California, Berkeley 1989.
- Richard Dean Braatz, Jr. (*Chemical Engineering*) B.S., Oregon State University 1988.
- Laura Lynn Brockman (*Biology*) B.A., University of California, Berkeley 1989.
- Todd Andrew Brun (*Physics*) A.B., Harvard College 1989.
- Jon Alan Brunetti (*Electrical Engineering*) B.S., Colorado State University 1985.
- Yu Cao (*Physics*) B.S., University of Science and Technology of China 1989.
- Joseph E. Cates (*Aeronautics*) B.S., University of Alabama 1990.
- Harry J. Catrakis (*Aeronautics*) B.S., California Institute of Technology 1991.
- Benjamin In-ning Chang (*Social Science*) B.A., National Taiwan University 1979; M.A., University of Oregon 1984.
- Chong Chen (*Computation and Neural Systems*) B.S., Xiamen University 1982; M.S., University of Rhode Island 1985.
- Guangqing Chen (*Physics*) B.S., Peking University 1989.
- Xiaodong Chen (*Civil Engineering*) B.S., Tongji University 1983; M.S., 1986.
- Celia Hui Ping Chiang (*Aeronautics*) B.S., University of California, Los Angeles 1989.
- Jung-Chih Chiao (*Electrical Engineering*) B.S., National Taiwan University 1988.
- Howard Marc Choset (*Mechanical Engineering*) B.S.E. (Computer Science), University of Pennsylvania 1990; B.S. (Economics), 1990.
- Vassilis Christophilos (*Mechanical Engineering*) B.S., National Technical University of Athens 1990.
- Thomas Wright Cooley (*Electrical Engineering*) B.S., Rensselaer Polytechnic Institute 1988.
- Edward Timothy Croke III (*Applied Physics*) B.S., Cornell University 1986.

MASTER OF SCIENCE—*Continued*

- Kaustuv Mukul Das (*Mathematics*) B.A., Vassar College 1989.
- Romeel S. Davé (*Physics*) B.A., University of California, Berkeley 1989.
- Jay Walter Dawson (*Applied Physics*) B.S., Carnegie-Mellon University 1988.
- Michael Peter De Lisio, Jr. (*Electrical Engineering*) B.S.E., The University of Michigan 1990.
- Neilay N. Dedhia (*Chemical Engineering*) B.Tech., Indian Institute of Technology, Kanpur 1989.
- Robert Francis Denkewalter (*Electrical Engineering*) B.S. (Electrical Engineering), Rose-Hulman Institute of Technology 1989; B.S. (Physics), 1989.
- Chariklia Economou (*Chemical Engineering*) Diploma, University of Patras 1988.
- Gamze Erten (*Electrical Engineering*) B.S., Stanford University 1985.
- Hinrich Eylers (*Environmental Engineering Science*) Diplom, Technische Universität München 1990.
- Wen-Hsiu Fan (*Environmental Engineering Science*) Beijing University.
- John Jay Feiler (*Physics*) S.B. (Chemistry), Massachusetts Institute of Technology 1986; S.B. (Mathematics), 1986.
- Michael Joseph Flanagan (*Electrical Engineering*) B.E., Stevens Institute of Technology 1990.
- Alan Joel Frankel (*Chemistry*) B.S., Yale University 1988.
- William Everett Fulcher (*Applied Mechanics*) B.S., Virginia Polytechnic Institute 1978; M.D., University of California, San Diego 1987.
- Stewart Craik Gallocher (*Applied Mechanics*) M.Eng., University of Glasgow 1989.
- Haiyan Gao (*Physics*) B.S., Tsinghua University 1988.
- Kelly Dee Goodwin (*Environmental Engineering Science*) B.S., University of Florida 1988.
- Vidyabhusan Gupta (*Electrical Engineering*) B.S., University of California, Berkeley 1989.
- Michael Patrick Hannigan (*Environmental Engineering Science*) B.S., Southern Methodist University 1990.
- David Ryan Haub (*Electrical Engineering*) B.S., Rose-Hulman Institute of Technology 1990.
- Árni Hauksson (*Mechanical Engineering*) B.S., University of Iceland 1990.
- Kent Lewis Heady (*Applied Physics*) B.S., Kansas State University 1988.
- Scott Craig Heifetz (*Aeronautics*) B.S.E., The University of Michigan 1990.
- Thomas Scott Hemphill (*Computer Science*) B.S., California Institute of Technology 1987.
- Harm Peter Hofstee (*Computer Science*) B.Sc., University of Groningen 1983; M.Sc., 1988.
- Gregory James Holk (*Geology*) B.S., Arizona State University 1989.
- Danny Dwyane Howard (*Aeronautics*) B.S., Mississippi State University 1990.

MASTER OF SCIENCE—Continued

- Zhen Hu (*Physics*) B.S., Fudan University 1989.
- Mei-Jiau Huang (*Mechanical Engineering*) B.S., National Taiwan University 1989.
- John Michael Iannelli (*Applied Physics*) B.S., Rensselaer Polytechnic Institute 1987.
- Katsumi Iijima (*Electrical Engineering*) B.E., Hokkaido University 1983; M.E., 1985.
- Kosta Ilić (*Electrical Engineering*) B.S., University of Beograd 1990.
- Mohit Kumar Jain (*Materials Science*) B.Tech., Indian Institute of Technology, Kanpur 1989.
- Sameer Madhav Jalnapurkar (*Electrical Engineering*) B.Tech., Indian Institute of Technology, Bombay 1990.
- Wen Jiang (*Physics*) B.S., Beijing University 1988.
- Craig Tsung-Wei Jin (*Applied Physics*) B.S., Stanford University 1989.
- Robert David Johnson (*Chemical Engineering*) B.S., Cornell University 1988.
- Lawrence Aston Jones (*Physics*) B.A., Magdalen College, University of Oxford 1989.
- Karen Rae Jonscher (*Applied Physics*) B.S., University of Colorado at Boulder 1989.
- Ketan Padmakar Joshi (*Electrical Engineering*) B.E., University of Poona 1990.
- Ararat Kapouytian (*Electrical Engineering*) B.S., University of Southern California 1990.
- Daniel John Kennefick (*Physics*) B.Sc., University College Cork 1987; M.Sc., 1989.
- Shaun Kevin Kirby (*Physics*) B.S.E., Princeton University 1989.
- Atsuko Kobayashi Kirschvink (*Environmental Engineering Science*) B.E., Doshisha University 1976.
- David William Koerner (*Planetary Science*) B.S., California State University, Long Beach 1989.
- Nataša Kovačević (*Mathematics*) B.S., University of Belgrade 1986.
- Ushma Kriplani (*Physics*) B.Sc., St. Xavier's College 1986; M.Sc., Indian Institute of Technology, Bombay 1988.
- Yan P. Kuhn De Chizelle (*Mechanical Engineering*) Ingenieur, Ecole Polytechnique De Lausanne 1988.
- Ming-Chieh Lee (*Electrical Engineering*) B.S., National Taiwan University 1988.
- Stacey Sookyoung Lee (*Social Science*) B.A., University of Southern California 1987.
- Alexander Abraham Lesin (*Mathematics*) M.S. (Applied Mathematics), Moscow Institute of Gas and Oil 1987; M.S. (Computer Science), 1987.
- Peng Lian (*Social Science*) B.S., Xiamen University 1984; M.A., 1987.
- Duo-min Lin (*Engineering Science*) B.S., University of Science and Technology of China 1986; M.E., 1988.
- Gary Hung-Hsin Lin (*Mechanical Engineering*) B.S., University of California, Irvine 1990.
- Chang Liu (*Electrical Engineering*) B.E., Tsinghua University 1990.
- Jianqiang Liu (*Electrical Engineering*) B.S., Nanjing University 1983; M.S., 1986.
- Rongzhi Liu (*Physics*) B.S., University of Science and Technology of China 1986.

MASTER OF SCIENCE—Continued

- Zhenhuan Liu (*Mechanical Engineering*) B.S., University of Science and Technology of China 1988.
- Hoi-Kwong Lo (*Physics*) B.A., Trinity College, Cambridge University 1989.
- Phillip Michael Lovalenti (*Chemical Engineering*) B.S., University of Akron 1988.
- Michael Jay Malak (*Physics*) S.B., Massachusetts Institute of Technology 1989.
- Ronald Richard Marquardt (*Applied Physics*) S.B., Massachusetts Institute of Technology 1989.
- Ricardo Martinez-Lagunes (*Civil Engineering*) Licenciatura, Universidad Nacional Autónoma de México 1989.
- David Solomon Marx (*Electrical Engineering*) B.S.E., University of Pennsylvania 1986.
- James Lawrence Maxwell (*Mechanical Engineering*) B.S., Brigham Young University 1989.
- Mark Bradley Milam (*Electrical Engineering*) S.B., Massachusetts Institute of Technology 1988.
- Robert Joseph Miles (*Applied Physics*) B.S., United States Naval Academy 1982; M.S., Rensselaer Polytechnic Institute 1989.
- Jeffrey Franklin Morris (*Chemical Engineering*) B.Ch.E., Georgia Institute of Technology 1989.
- Bryon Alan Mueller (*Physics*) B.S., University of Minnesota 1989.
- Jones Maxime Murphy, Jr. (*Physics*) The City College of The City University of New York.
- Elizabeth Ann Nagy (*Geology*) B.A., University of Colorado 1989.
- Lim Nguyen (*Electrical Engineering*) S.B. (Electrical Engineering), Massachusetts Institute of Technology 1983; S.B. (Mathematics), 1984.
- Scott Robert Olson (*Applied Physics*) B.S., University of California, Irvine 1988.
- Kazuyuki Orita (*Electrical Engineering*) B.E., Kyoto University 1981; M.E., 1983.
- James Patrick Ostrowski (*Mechanical Engineering*) Sc.B., Brown University 1990.
- Panayiotis Nikolaos Pantzicas (*Chemical Engineering*) Diploma, University of Patras 1987.
- Michal Leah Peri (*Physics*) B.A., University of California, San Diego 1986.
- Edward Elisha Pesulima (*Electrical Engineering*) B.S., Florida Atlantic University 1987; M.S., 1990.
- Petr Pich (*Applied Mechanics*) Ing., České Vysoké Učení Technické 1988.
- Deborah Jenne Primeau (*Physics*) B.S., Rensselaer Polytechnic Institute 1989.
- Alice Claire Quillen (*Physics*) A.B., Harvard College and Radcliffe College 1984.
- Roopa Ramamoorthi (*Chemical Engineering*) B.Tech., Indian Institute of Technology, Bombay 1989.
- Kannan Rangaramanujam (*Chemical Engineering*) B.E., Birla Institute of Technology and Science 1988; M.S., Pennsylvania State University 1989.
- Sanjeev K. Rao (*Physics*) B.Sc., Regional College of Education 1986; M.Sc., Indian Institute of Technology, Kanpur 1988.

MASTER OF SCIENCE — *Continued*

- Paul Shelton Ray (*Physics*) B.A., University of California, Berkeley 1989.
- Daniel Seymour Reed (*Physics*) B.S., University of Missouri-Columbia 1989.
- Anna M. Rhee (*Mechanical Engineering*) B.S., University of California, Berkeley 1989.
- Patrick E. Riviere (*Electrical Engineering*) Diplôme d'Ingénieur, Ecole Supérieure d'Ingénieurs en Electrotechnique et Electronique 1991.
- Mark Sanford Robins (*Electrical Engineering*) B.S., Cornell University 1990.
- Philip Jeffrey Rosenthal (*Physics*) B.S., Yale University 1988.
- Todd Michael Rossi (*Applied Physics*) B.S., State University of New York at Buffalo 1986; M.S., 1988.
- Joshua Roth (*Astronomy*) B.A., University of California, Berkeley 1984.
- Randal Anthony Salvatore (*Electrical Engineering*) B.S.E., The University of Michigan 1990.
- Linda Salzhauser (*Electrical Engineering*) A.B., Dartmouth College 1989.
- Umberto Santoni (*Electrical Engineering*) B.S., Arizona State University 1990.
- Kate Scholberg (*Physics*) B.Sc., McGill University 1989.
- Tim R. Shippert (*Physics*) S.B., Massachusetts Institute of Technology 1989.
- Deborah Rebecca Shnek (*Chemical Engineering*) S.B., Massachusetts Institute of Technology 1989.
- Ronald Lyn Siefert (*Environmental Engineering Science*) B.Ch.E., University of Minnesota 1990.
- Julia Dusk Smith (*Physics*) B.S., University of Arkansas 1989.
- Kelly S. Smith (*Environmental Engineering Science*) B.S., Michigan State University 1989.
- Paul Andrew Smith (*Chemistry*) A.B., Harvard College 1981.
- Xiaodong Song (*Geophysics*) B.S., University of Science and Technology of China 1986.
- Adam Diedrich Steltzner (*Applied Mechanics*) B.S., University of California, Davis 1990.
- Tab Allen Stephens (*Materials Science*) B.S., Texas A&M University 1990.
- Kristin Erica Szakaly (*Social Science*) B.A., University of California, Berkeley 1989.
- Paul James Tackley (*Geophysics*) B.A., Trinity College, Cambridge University 1987.
- Toshiko Takata (*Planetary Science*) B.S., Nagoya University 1985.
- Jorge Enrique Tierno (*Electrical Engineering*) Ingeniero Electricista, Universidad de la República Oriental del Uruguay 1989.
- Shubha Padmakar Tole (*Biology*) B.Sc., St. Xavier's College 1987.
- Mark Edward Tomusiak (*Chemical Engineering*) B.S., University of Saskatchewan 1987.
- Grace Pei-Ying Tsang (*Electrical Engineering*) S.B., Massachusetts Institute of Technology 1984.

MASTER OF SCIENCE — *Continued*

- Michael Tsapatsis (*Chemical Engineering*) Diploma, University of Patras 1988.
- Richard Mikio Tsuyuki (*Aeronautics*) B.Sc., The University of Manitoba 1990.
- Sophie J. Valcke (*Environmental Engineering Science*) B.Eng., University of Sherbrooke 1990.
- Siddhartha Valluri (*Aeronautics*) B.Tech., Indian Institute of Technology, Kanpur 1990.
- Lara Louise Van Nostrand (*Mechanical Engineering*) B.S., Polytechnic University 1990.
- James Lee Veal, Jr. (*Mechanical Engineering*) S.B., Massachusetts Institute of Technology 1989.
- Peter K. Vedder (*Civil Engineering*) B.S. (Civil Engineering), Northwestern University 1990; B.S. (Applied Mathematics), 1990.
- Benoist Yvan Marie Vercherin (*Electrical Engineering*) Diplôme, Grenoble University 1987; Diplôme d'Ingénieur, Ecole Supérieure d'Ingénieurs en Electrotechnique et Electronique 1991.
- Roger Anton Vreugdenhil (*Civil Engineering*) B.E., University of Canterbury 1990.
- Matthew Thomas Wallace (*Electrical Engineering*) B.S., United States Naval Academy 1984.
- Christopher William Walter (*Physics*) B.A., University of California, Santa Cruz 1989.
- Mark Eugene Walter (*Mechanical Engineering*) Sc.B., Brown University 1990.
- Michael Wei-Ching Wang (*Applied Physics*) B.E., University of Saskatchewan 1989.
- Yiu-Fai Isaac Wong (*Computation and Neural Systems*) B.S., California Institute of Technology 1986; M.S., 1987.
- David Judson Wood (*Geology*) B.S.E., Princeton University 1986.
- Kazunori Yasuda (*Electrical Engineering*) B.E., University of Tokyo 1984.
- Chris Yu Fai Yiu (*Electrical Engineering*) B.S., Wayne State University 1989.
- Cecilia Ngai-Sze Yu (*Electrical Engineering*) B.S., University of California, Berkeley 1990.
- Zheng Zeng (*Electrical Engineering*) B.E., Tsinghua University 1988.
- Yongfang Zhang (*Electrical Engineering*) B.S., Northwest University 1982; M.S., Huazhong University of Science and Technology 1984.
- Jian Zhu (*Biology*) B.S., Fudan University 1986.

ENGINEER

- Guillaume Georges Gavillet (*Mechanical Engineering*) Diploma of Engineer, Ecole Nationale Supérieure d'Electrotechnique, d'Electronique, d'Informatique et d'Hydraulique 1988.
- Lada Popovic (*Electrical Engineering*) B.S., University of Belgrade 1986.

DOCTOR OF PHILOSOPHY

DIVISION OF BIOLOGY

- Elliot Charles Altman (*Biology*) B.S., Texas A&M University 1979; B.S., 1980.
Thesis: Characterization of the SecB Protein, a Chaperone that Facilitates Protein Secretion in *Escherichia coli*.
- John Lincoln Bowman (*Biology*) B.S., University of Illinois at Urbana-Champaign 1986.
Thesis: Molecular Genetics of Flower Development in *Arabidopsis thaliana*.
- Stephen Paul DeWeerth (*Computation and Neural Systems*) B.A., Wartburg College 1985; M.S., California Institute of Technology 1987.
Thesis: Analog VLSI Circuits for Sensorimotor Feedback.
- Michael Roy Emerling (*Biology*) B.A., University of California, Berkeley 1983.
Thesis: Enzymatic Hydrolysis of the Amide Bond: Mutagenic Studies of the Mechanisms of α -Lytic Protease and β -Lactamase.
- John Gregory Harris (*Computation and Neural Systems*) S.B., Massachusetts Institute of Technology 1983; M.S., 1986.
Thesis: Analog Models for Early Vision.
- Paul Kenneth Herman (*Molecular Biology and Biochemistry*) B.Sc., University of Manitoba 1981.
Thesis: Protein Sorting in the Eukaryotic Secretory Pathway: An Essential Role for a Novel Yeast Protein Kinase.
- Jan Håkan Hoh (*Cellular Biology and Biophysics*) B.S., Illinois State University 1983.
Thesis: Studies on the Structure and Molecular Diversity of the Gap Junction.
- James Julius Knierim (*Neurobiology*) B.A., Haverford College 1983.
Thesis: Neural Responses to Texture Patterns in Area V1 of the Alert Monkey.
- Michael Alan Lochrie (*Biology*) B.A., University of Colorado 1983.
Thesis: Molecular Biology of G Protein Alpha Subunits from Bovine Photoreceptors and the Nematode *Caenorhabditis elegans*.
- Nagesh Kalyana Mahanthappa (*Neurobiology*) B.A. (Chemistry), University of Colorado 1985; B.A. (Biology), 1985.
Thesis: Functional and Biochemical Studies on Neuronal Thy-1.
- Kenneth John McCormack (*Neurobiology*) B.A., University of California, Santa Cruz 1985.
Thesis: Structure-Function Studies of *Drosophila Shaker* Potassium Channels.
- Jeffrey H. Miner (*Molecular Biology and Biochemistry*) B.A., Northwestern University 1985.
Thesis: Factors Regulating Skeletal Muscle Development: Cell Culture and Transgenic Mouse Studies.

When more than one field of study is listed, in the Division of Biology it indicates a dual major; in other divisions the first is the major and the second and others are minors.

DOCTOR OF PHILOSOPHY — *Continued*

Sean Stuart Molloy (*Biology*) B.A., Reed College 1984.

Thesis: A Study of the Type II Ca^{2+} /Calmodulin-Dependent Protein Kinase in Hippocampal Neurons.

Richard Daniel Mooney (*Biology*) B.S., Yale University 1981.

Thesis: The Development of Connectivity and the Nature of Synaptic Transmission between Avian Song Control Nuclei.

Bruce Lowell Patton (*Neurobiology*) B.A. (Biology), Brandeis University 1984; B.A. (Chemistry), 1985.

Thesis: Autophosphorylation Sites of the Type II Ca^{2+} /Calmodulin-Dependent Protein Kinase: Identification, Regulation of Kinase Activity, and Site-Specific Antibodies.

Mahendra S. Rao (*Biology*) M.B.B.S., Grant Medical College 1985.

Thesis: Comparison of the Immunological, Biochemical and Biological Properties of Cholinergic Differentiation Factors and Their Possible Role In Vivo.

Jane Suzanna Robinson (*Biology*) B.A., Trinity College 1983; M.Sc., 1984.

Thesis: Genetic, Molecular and Biochemical Studies of Vacuole Biogenesis and Maintenance in the Yeast *Saccharomyces cerevisiae*.

Michael Paul Strathmann (*Biology*) B.S., The University of Michigan 1985.

Thesis: G Protein Diversity.

Kang-Sheng Wang (*Biology*) B.S., National Chung-Hsing University 1978; M.S., University of California, Riverside 1983.

Thesis: Molecular Characterization of the Receptor for the Togavirus Sindbis Virus.

Matthew Alden Wilson (*Computation and Neural Systems*) B.S., Rensselaer Polytechnic Institute 1983; M.S., University of Wisconsin-Madison 1986.

Thesis: An Analysis of Olfactory Cortical Behavior and Function Using Computer Simulation Techniques.

DIVISION OF CHEMISTRY AND CHEMICAL ENGINEERING

David Neil Blauch (*Chemistry*) B.S., Lebanon Valley College 1984.

Thesis: Part I. Improvements in the Rotation-Rate Step Experiment for the Evaluation of Diffusion Coefficients at Rotating Disk Electrodes. Part II. Ion-Pairing and Electric Field Effects on Electron Hopping in the Nafion-Tris(2,2'-Bipyridine) Osmium(3+/2+) System.

Roger Temor Bonnecaze (*Chemical Engineering*) B.S., Cornell University 1985; M.S., California Institute of Technology 1987.

Thesis: Macroscopic Properties of Electrically Interacting Suspensions.

Clifford Russell Bowers (*Chemistry*) B.A., Bowdoin College 1985.

Thesis: Parahydrogen and Synthesis Allow Dramatically Enhanced Nuclear Alignment.

DOCTOR OF PHILOSOPHY — *Continued*

Matthew Braunstein (*Chemistry*) B.A., Wesleyan University 1985.

Thesis: Photoionization Dynamics and Ion State Distributions in Single-Photon and Resonance Enhanced Multiphoton Ionization of Molecules.

John Charles Brewer (*Chemistry*) B.Sc., University of Toronto 1985.

Thesis: Syntheses, Characterization and Reactivity of *trans*-Dioxorhenium (V) and -(VI) Complexes.

Thomas Kyu-Young Chang (*Chemistry*) A.B., Columbia College 1983.

Thesis: Gene Synthesis, Expression, and Mutagenesis of Azurin.

Ivan Lode André Maria Claeys (*Chemical Engineering and Chemistry*) M.S., Catholic University of Leuven 1986; M.S., California Institute of Technology 1988.

Thesis: Hydrodynamic Transport Properties of Suspensions of Non-Brownian Prolate Spheroids.

Steven Andrew Cuccaro (*Chemistry*) B.S., Michigan State University 1983.

Thesis: Ab Initio Three-Dimensional Atom-Diatom Reaction Cross Sections Using Hyperspherical Coordinates and Variational Surface Functions.

Marcos Dantus (*Chemistry*) B.A., M.A., Brandeis University 1985.

Thesis: Femtosecond Transition-State Spectroscopy of Chemical Reactions.

Francis Joseph Doyle III (*Chemical Engineering*) B.S.E., Princeton University 1985.

Thesis: Robustness Properties of Nonlinear Process Control and Implications for the Design and Control of a Packed Bed Reactor.

Ramy Samir Farid (*Chemistry*) B.S., University of Rochester 1986.

Thesis: Electron Transfer in Rigid and Semi-Rigid Iridium d⁸-d⁸ Donor-Spacer-Acceptor Complexes.

Eric Jay Ginsburg (*Chemistry*) S.B., Massachusetts Institute of Technology 1986.

Thesis: Soluble Polyacetylenes by the Ring-Opening Metathesis Polymerization of Substituted Cyclooctatetraenes.

Roger A. Hart (*Chemical Engineering and Chemistry*) B.E., University of New Mexico 1985.

Thesis: Characterization of *Vitreoscilla* Hemoglobin Inclusion Bodies Produced in *Escherichia coli*.

Diane Louise Hollenbaugh (*Chemistry*) B.S., University of Washington 1985.

Thesis: Specificity Determinants of the Class A β -Lactamase RTEM-1.

Robin Scott Horrell (*Chemical Engineering*) B.S., University of Colorado 1985; M.S., California Institute of Technology 1987.

Thesis: Aspects of Atmospheric Transport and Dispersion Within an Air Basin.

David Da-Teh Huang (*Chemical Engineering and Applied Physics*) B.S., National Cheng Kung University 1983; M.S., California Institute of Technology 1987.

Thesis: Aerosol Coagulation and Nucleation.

DOCTOR OF PHILOSOPHY — *Continued*

- Karl Kensuke Mason Irikura (*Chemistry*) A.B., Harvard College 1984.
Thesis: Gas-Phase Chemistry of Organotransition Metal Ions.
- Bradley Anson Jacobs (*Chemistry*) B.S., The College of William and Mary 1986.
Thesis: Preparation, Characterization, and Intramolecular Electron Transfer in Pentaammineruthenium-Modified Derivatives of Cytochrome b_5 and Azurin.
- Christopher James Koh (*Chemical Engineering*) B.S., University of California, Davis 1985.
Thesis: Experimental and Theoretical Studies on Two-Phase Flows.
- Jong Sung Koh (*Chemistry*) B.S., Seoul National University 1979; M.S., Korea Advanced Institute of Science and Technology 1981.
Thesis: Design of Novel Bases for Recognition of GC Base Pairs by Oligonucleotide-Directed Triple Helix Formation.
- Michael John Kosinski (*Chemical Engineering and Biology*) B.S., Carnegie-Mellon University 1985.
Thesis: Degradation Kinetics of an Abnormal β -Galactosidase in *Escherichia coli*.
- Marc Robert Labgold (*Chemistry*) B.A., New York University 1986.
Thesis: Novel Biological Catalysts: Mutagenesis of RTEM β -Lactamase to Alter Substrate and Catalytic Specificity.
- Lionel Laroche (*Chemical Engineering*) B.S., Academie de Paris, Lycee Renoir 1981; Diplome d'Ingenieur, Ecole Polytechnique 1986.
Thesis: Homogeneous Azeotropic Distillation: Entrainer Selection.
- Jay Hyung Lee (*Chemical Engineering*) B.S., University of Washington 1986.
Thesis: Robust Inferential Control: A Methodology for Control Structure Selection and Inferential Control System Design in the Presence of Model/Plant Mismatch.
- David M. Long (*Chemistry*) B.S., The Pennsylvania State University 1986.
Thesis: Structure and Mechanism of RTEM-1 β -Lactamase: The Role of Lysine 234.
- David Phillip Mack (*Chemistry*) B.A., Washington University 1985.
Thesis: Design and Chemical Synthesis of Sequence Specific DNA Cleaving Metalloproteins.
- Janet Elizabeth Nelson (*Chemistry*) B.A., Carleton College 1986.
Thesis: Synthetic, Structural, and Mechanistic Studies in Early Transition Metal and Actinide Chemistry.
- Spyros N. Pandis (*Chemical Engineering*) Diploma, University of Patras 1986; M.S., California Institute of Technology 1988.
Thesis: Studies of Physicochemical Processes in Atmospheric Particles and Acid Deposition.
- Lawrence Weimin Peng (*Chemistry*) B.S., Purdue University 1984.
Thesis: Reactions in Small Clusters Studied by Time-Resolved Laser Spectroscopy.

DOCTOR OF PHILOSOPHY — *Continued*

- Pamela Joy Shapiro (*Chemistry*) S.B., Massachusetts Institute of Technology 1985.
Thesis: Part I. Scandium Hydride and Alkyl Complexes with a Linked Monocyclopentadienyl-Amido Ligand-Framework: Single Component Catalysts for the Polymerization of α -Olefins. Part II. Hydrazido(1-) and 2,2-Dimethylhydrazido(1-) Derivatives of Permethylscandocene. Preparation and Structural Characterization of Their Products from Reactions with Acetonitrile.
- Bruce John Tufts (*Chemistry*) B.S., University of California, Davis 1983.
Thesis: Electrochemical and Surface Chemical Studies of n-GaAs Photoanodes.
- LeRoy Louis Whinnery, Jr. (*Chemistry*) B.A., Ithaca College 1985.
Thesis: Synthesis, Characterization and Reactivity of Some Permethyltantalocene Alkylidenes and Unusually Stable Metallaioxetanes.

DIVISION OF ENGINEERING AND APPLIED SCIENCE

- Amir Atiya (*Electrical Engineering*) B.Sc., Cairo University 1982; M.Sc., 1985.
M.S., California Institute of Technology 1986.
Thesis: Learning Algorithms for Neural Networks.
- Gang Bai (*Applied Physics*) B.S., Yunan University 1982; M.S., 1985.
Thesis: I. Heteroepitaxy on Si. II. Ion Implantation in Si and Heterostructures.
- Robert Teran Beck (*Civil Engineering and Geophysics*) B.S., Brown University 1982; M.S., 1984.
Thesis: Fundamental Problems in the Application of Structural Identification Procedures to Damage Detection.
- Timothy X Brown (*Electrical Engineering*) B.S., The Pennsylvania State University 1986; M.S., California Institute of Technology 1987.
Thesis: Neural Network Design for Switching Network Control.
- Steven Morgan Burns (*Computer Science*) B.A., Pomona College 1984; M.S., California Institute of Technology 1987.
Thesis: Performance Analysis and Optimization of Asynchronous Circuits.
- Edward Timothy Croke III (*Applied Physics*) B.S., Cornell University 1986; M.S., California Institute of Technology 1991.
Thesis: Growth and Characterization of Si-Based Electronic Materials for Novel Device Applications.
- Guy Dumas (*Mechanical Engineering*) B.Sc., Université Laval 1983; M.Sc., 1986.
Thesis: Study of Spherical Couette Flow via 3-D Spectral Simulations: Large and Narrow-Gap Flows and Their Transitions.
- Lounette M. Dyer (*Computer Science*) B.S., Western Michigan University 1982; M.S., California Institute of Technology 1987.
Thesis: An Object-Oriented Real-Time Simulation of Music Performance Using Interactive Control.

DOCTOR OF PHILOSOPHY — *Continued*

- Alexander Hewgill Elliott (*Environmental Engineering Science*) B.Sc., University of Auckland 1986; M.S., California Institute of Technology 1988.
Thesis: Transfer of Solutes into and out of Streambeds.
- Ruth Ann Erlanson (*Electrical Engineering*) B.S., George Mason University 1984; M.S., California Institute of Technology 1985.
Thesis: Soft-Decision Decoding of a Family of Nonlinear Codes Using a Neural Network.
- Eliot Fried (*Applied Mechanics*) B.A., University of California, Berkeley 1981; M.S., California Institute of Technology 1989.
Thesis: Aspects of the Morphological Character and Stability of Two-Phase States in Non-Elliptic Solids.
- Richard Joseph Gilbrech (*Aeronautics and Planetary Science*) B.S., Mississippi State University 1984; M.S., California Institute of Technology 1985.
Thesis: An Experimental Investigation of Chemically-Reacting, Gas-Phase Turbulent Jets.
- Rajiv Gupta (*Computer Science*) B.Tech., Indian Institute of Technology, Kharagpur 1984; M.S., California Institute of Technology 1987.
Thesis: Compiler Optimization of Data Storage.
- Jeffery Lawrence Hall (*Aeronautics and Astronomy*) B.A.Sc., University of Toronto 1984; M.S., California Institute of Technology 1985.
Thesis: An Experimental Investigation of Structure, Mixing and Combustion in Compressible Turbulent Shear Layers.
- Larry Glenn Hill (*Aeronautics*) B.S.Ae.E., The University of Michigan 1983; M.S., California Institute of Technology 1984.
Thesis: An Experimental Study of Evaporation Waves in a Superheated Liquid.
- Dana Hobson (*Applied Mathematics*) B.S., Harvey Mudd College 1985.
Thesis: Point Vortex Models for Modon Dynamics.
- Raymond Scott Hudson (*Electrical Engineering*) B.S., California Institute of Technology 1985; M.S., California Institute of Technology 1986.
Thesis: Radar Imaging for Aircraft Identification and Planetary Astronomy.
- Michael Kevin Jackson (*Applied Physics*) B.Sc., University of Alberta 1985; M.S., California Institute of Technology 1987.
Thesis: Optical Studies of Semiconductor Heterostructures: Measurements of Tunneling Times, and Studies of Strained Superlattices.
- Lambros Solon Katafygiotis (*Civil Engineering*) Diploma, National Technical University of Athens 1983; M.S., California Institute of Technology 1985.
Thesis: Treatment of Model Uncertainties in Structural Dynamics.
- Jorge Adrian Kittl (*Applied Physics*) Licenciado, Universidad de Buenos Aires 1985; M.S., California Institute of Technology 1987.
Thesis: Growth and Characterization of Y-Ba-Cu-O High- T_c Superconductor Thin Films.

DOCTOR OF PHILOSOPHY — *Continued*

- Ravinder David Koilpillai (*Electrical Engineering*) B.Tech., Indian Institute of Technology, Madras 1984; M.S., California Institute of Technology 1985.
Thesis: Design Issues in Multirate Digital Filter Banks, Including Transmultiplexers.
- Kathleen Ann Kramer (*Electrical Engineering*) B.S., Loyola Marymount University 1986; M.S., California Institute of Technology 1987.
Thesis: Large Operand Division and an Asynchronous Approach to Fault Detection.
- Barry Robert Kreuger (*Materials Science*) B.S.E., University of Pennsylvania 1987; M.S., California Institute of Technology 1989.
Thesis: Shock-Wave Processing of Powder Mixtures.
- Victor Leyva (*Applied Physics*) B.S., California Institute of Technology 1986; M.S., 1987.
Thesis: Investigations of the Photorefractive Effect in Potassium Tantalum Niobate.
- Paul Lewis Miller (*Applied Physics and Aeronautics*) B.S.E., Princeton University 1985; M.S., California Institute of Technology 1987.
Thesis: Mixing in High Schmidt Number Turbulent Jets.
- James Henry Morehart (*Mechanical Engineering*) B.S., University of Maryland 1986; M.S., California Institute of Technology 1987.
Thesis: Species Produced in Fires Burning in Two-Layered and Homogeneous Vitiated Environments.
- Vidyadhar Yogeshwar Mudkavi (*Applied Mathematics*) B.Tech., Indian Institute of Technology, Kanpur 1983; M.E., Indian Institute of Technology, Bangalore 1985.
Thesis: Numerical Studies of Nonlinear Axisymmetric Waves on Vortex Filaments.
- Andrew Howard Mutz (*Applied Physics*) B.S. (Mechanical Engineering), Massachusetts Institute of Technology 1984; B.S. (Physics), 1984; M.S., California Institute of Technology 1986.
Thesis: Heterogeneous Shock Energy Deposition in Shock Wave Consolidation of Metal Powders.
- Mark A. Neifeld (*Electrical Engineering*) B.E.E., Georgia Institute of Technology 1985; M.S., California Institute of Technology 1987.
Thesis: Optical Memory Disks in Optical Pattern Recognition Systems.
- Michael Avery Newkirk (*Applied Physics*) B.A., Williams College 1983.
Thesis: Investigations of Semiconductor Laser Modulation Dynamics and Field Fluctuations.
- Konstantinos Papadimitriou (*Applied Mechanics*) Diploma, University of Patras 1984; M.S., California Institute of Technology 1985.
Thesis: Stochastic Characterization of Strong Ground Motion and Applications to Structural Response.
- Suzanne Elizabeth Paulson (*Environmental Engineering Science*) B.A., University of Colorado at Boulder 1983; M.S., University of Illinois at Urbana-Champaign 1986; M.S., California Institute of Technology 1987.
Thesis: Contributions of Biogenic and Anthropogenic Hydrocarbons to Photochemical Smog Formation.

DOCTOR OF PHILOSOPHY — *Continued*

- Richard David Pfaff (*Aeronautics*) B.S., University of Washington 1979; M.S., California Institute of Technology 1982.
Thesis: Three-Dimensional Effects in Nonlinear Fracture Explored with Interferometry.
- Thu Pham (*Applied Mathematics*) B.S., The University of Texas at Austin 1985; M.S., California Institute of Technology 1989.
Thesis: Numerical Studies of Incompressible Richtmyer-Meshkov Instability in a Stratified Fluid.
- Yasantha N. Rajakarunanayake (*Applied Physics*) B.S.E., Princeton University 1985; M.S., California Institute of Technology 1986.
Thesis: Optical Properties of Si-Ge Superlattices and Wide Band Gap II-VI Superlattices.
- Steven Nicholas Rogak (*Environmental Engineering Science*) B.A.Sc., The University of British Columbia 1986; M.S., California Institute of Technology 1987.
Thesis: Aerosol Dynamics of Agglomerates.
- Kenneth Rose (*Electrical Engineering*) B.S., Tel Aviv University 1986; M.S., 1987.
Thesis: Deterministic Annealing, Clustering, and Optimization.
- Vinay Padmakar Sathe (*Electrical Engineering*) B.Tech., Indian Institute of Technology, Bombay 1986; M.S., California Institute of Technology 1987.
Thesis: Multirate Adaptive Filtering Algorithms: Analysis and Applications.
- Carl Robert Schultheisz (*Aeronautics*) B.S., University of Maryland 1982; M.S., California Institute of Technology 1983.
Thesis: Comparison of Experimental and Computational Crack-Tip Deformations Using Moire Interferometry and Finite Elements.
- David Lawrence Schweizer (*Computer Science*) B.S., Yale College 1984; M.S., California Institute of Technology 1986.
Thesis: Combinatorial Design of Fault-Tolerant Communication Structures, with Applications to Non-Blocking Switches.
- Michael James Scott (*Environmental Engineering Science and Geochemistry*) B.A., Rice University 1985; M.S., California Institute of Technology 1986.
Thesis: Kinetics of Adsorption and Redox Processes on Iron and Manganese Oxides: Reactions of As(III) and Se(IV) at Goethite and Birnessite Surfaces.
- Sy R. Shimabukuro (*Applied Mechanics*) B.S., University of Hawaii at Manoa 1984; M.S., California Institute of Technology 1985.
Thesis: Stress Assisted Diffusion in Polymers.
- Massimo Antonio Sivilotti (*Computer Science*) B.S., Queen's University 1983; M.S., California Institute of Technology 1986.
Thesis: Wiring Considerations in Analog VLSI Systems, with Application to Field-Programmable Networks.
- Keyue Ma Smedley (*Electrical Engineering*) B.S., Zhejiang University 1982; M.S., 1985; M.S., California Institute of Technology 1987.
Thesis: Control Art of Switching Converters.

DOCTOR OF PHILOSOPHY — *Continued*

- John Michael Snyder (*Computer Science*) B.S., Clarkson University 1984; M.S., California Institute of Technology 1987.
Thesis: Generative Modeling: An Approach to High Level Shape Design for Computer Graphics and CAD.
- Jeffrey Aaron Stern (*Applied Physics*) B.S., Rensselaer Polytechnic Institute 1983.
Thesis: Fabrication and Testing of NbN/MgO/NbN Tunnel Junctions for Use as High-Frequency Heterodyne Detectors.
- Ichiro Sugioka (*Aeronautics*) B.S., California Institute of Technology 1983; S.M., Massachusetts Institute of Technology 1985.
Thesis: Particle Transport by Rapid Vaporization of Superheated Liquid.
- Phillip Takeo Tokumaru (*Aeronautics*) B.S.E., University of Pennsylvania 1985; M.S., California Institute of Technology 1986.
Thesis: Active Control of the Flow Past a Cylinder Executing Rotary Motions.
- Alexander F. Vakakis (*Applied Mechanics*) Diploma, University of Patras 1984; M.Sc., Imperial College 1986.
Thesis: Analysis and Identification of Linear and Nonlinear Normal Modes in Vibrating Systems.
- Ian Anton Waitz (*Aeronautics*) B.S., The Pennsylvania State University 1986; M.S., George Washington University 1988.
Thesis: An Investigation of Contoured Wall Injectors for Hypervelocity Mixing Augmentation.
- Shih-Chen Wang (*Environmental Engineering Science and Chemical Engineering*) B.S., National Taiwan University 1982; M.S., 1984.
Thesis: Aerosol Formation and Growth in Atmospheric Organic/NO_x Systems.
- Scott William Wedge (*Electrical Engineering*) B.S., California State Polytechnic University 1983; M.S., University of Illinois at Urbana-Champaign 1986.
Thesis: Computer-Aided Design of Low Noise Microwave Circuits.
- Anthony Stein Wexler (*Mechanical Engineering*) B.S., University of California, Berkeley 1976; M.S., Massachusetts Institute of Technology 1978.
Thesis: Inorganic Components of Atmospheric Aerosols.
- Brian Alan Wong (*Environmental Engineering Science and Chemistry*) B.S., Harvey Mudd College 1974; M.S., California Institute of Technology 1984.
Thesis: The Oxidation of Individually Levitated Char Particles.
- Joseph Yang (*Mechanical Engineering*) B.S., California Institute of Technology 1986; M.S., 1987.
Thesis: An Analytical and Computational Investigation of Shock-Induced Vortical Flows with Applications to Supersonic Combustion.
- Edward Tsu-Wei Yu (*Applied Physics*) A.B., Harvard College 1986; A.M., 1986.
Thesis: Physics and Applications of Semiconductor Heterostructures. I. Measurement of Band Offsets in Semiconductor Heterojunctions. II. Theoretical and Experimental Studies of Tunneling in Semiconductor Heterostructure Devices.

DOCTOR OF PHILOSOPHY — *Continued*

DIVISION OF GEOLOGICAL AND PLANETARY SCIENCES

- Yigal Erel (*Geochemistry and Environmental Engineering Science*) B.Sc., Hebrew University 1984; M.Sc., 1985.
Thesis: Transport of Natural Lead and Cadmium in Rivers: Global Flux Implications.
- Mark Allen Fahnestock (*Geology*) B.S., University of Rochester 1984.
Thesis: Hydrologic Control of Velocity in Two Alaskan Glaciers: Observation and Theory.
- Robert Wilson Graves (*Geophysics*) B.S., University of California, Riverside 1984; M.S., California Institute of Technology 1988.
Thesis: Modeling Seismic Wave Propagation Using Paraxial Extrapolators.
- Lorraine Joyce Hwang (*Geophysics*) B.A., University of California, Berkeley 1985; M.S., California Institute of Technology 1988.
Thesis: Teleseismically Determined Source Parameters of Several Large Collision-Zone Earthquakes.
- Philip Dean Ihinger (*Geology*) B.S., Pomona College 1983; M.S., California Institute of Technology 1988.
Thesis: An Experimental Study of the Interaction of Water with Granitic Melt.
- Walter Scott Kiefer (*Planetary Science and Geophysics*) B.S., Texas Christian University 1984; M.S., California Institute of Technology 1986.
Thesis: Models for the Formation of Highland Regions on Venus.
- Scott David King (*Geophysics*) B.A., The University of Chicago 1985.
Thesis: The Interaction of Subducting Slabs and the 670 Kilometer Discontinuity.
- Shawn Christian Larsen (*Geophysics*) B.S., California Institute of Technology 1982; M.S., Cornell University 1985.
Thesis: Geodetic Measurement of Deformation in Southern California.
- Julianne Ives Moses (*Planetary Science and Geophysics*) A.B., Cornell University 1985; M.S., California Institute of Technology 1987.
Thesis: I. Phase Transformations and the Spectral Reflectance of Solid Sulfur: Possible Metastable Sulfur Allotropes in Io's Surface. II. Photochemistry and Aerosol Formation in Neptune's Atmosphere.
- David Alan Pickett (*Geology*) B.A., Rice University 1982; M.S., California Institute of Technology 1984.
Thesis: An Isotopic and Petrologic Study of an Exposure of the Deep Sierra Nevada Batholith, Tehachapi Mountains, California.
- Charles Martin Rubin (*Geology*) B.S., University of Montana 1974; M.S., 1980.
Thesis: Structural, Stratigraphic, and Geochronologic Analysis of the Alexander-Taku Terrane Boundary and the Overlapping Upper Jurassic to Lower Cretaceous Gravina Sequence, Southeast Alaska.
- Philip John Shaller (*Geology*) A.B., Occidental College 1983; M.S., Montana College 1985.
Thesis: Analysis and Implications of Large Martian and Terrestrial Landslides.

DOCTOR OF PHILOSOPHY — *Continued*

- Francis H. Webb (*Geology*) B.A., University of California, Santa Barbara 1984;
M.S., California Institute of Technology 1989.
Thesis: Geodetic Measurement of Deformation in the Offshore of Southern California.

DIVISION OF HUMANITIES AND SOCIAL SCIENCES

- Richard T. Boylan (*Social Science*) B.A., Pitzer College 1986; M.S., California
Institute of Technology 1988.
Thesis: The Analysis of Repeated Games through Evolution and Learning.
- Shawn Everett Kantor (*Social Science*) B.A., University of Rochester 1987; M.S.,
California Institute of Technology 1988.
Thesis: Property Rights and Dynamics of Institutional Change: The Closing of the
Georgia Open Range, 1870-1900.
- Arthur William Lupia, Jr. (*Social Science*) B.A., University of Rochester 1986; M.S.,
California Institute of Technology 1988.
Thesis: The Effect of Political Information on Direct Democracy Strategies and
Outcomes.
- Mark Allen Olson (*Social Science*) B.A., University of Arizona 1977; M.S., 1980.
Thesis: The Assignment Problem: Theory and Experiments.

DIVISION OF PHYSICS, MATHEMATICS AND ASTRONOMY

- Charles Glenn Boyd (*Physics*) B.S., State University of New York at Stony Brook
1986.
Thesis: Aspects of Heavy Quark Physics.
- Martin A. Bucher (*Physics*) B.A., University of California, Berkeley 1986; M.S.,
California Institute of Technology 1990.
Thesis: On the Theory of Non-Abelian Vortices and Cosmic Strings.
- David Paul Carico (*Physics*) B.S., University of California, Berkeley 1983; M.S.,
California Institute of Technology 1988.
Thesis: Properties of Infrared-Luminous Galaxies.
- Yih-Yuh Chen (*Physics*) B.S., National Taiwan University 1982.
Thesis: Effects of Boundaries on Rayleigh-Benard Convection.
- Paolo Severo Coppi (*Physics*) A.B., Harvard College 1985.
Thesis: Radiative Processes in Active Galactic Nuclei.
- David A. DeLatte (*Mathematics*) B.S. (Mathematics), University of New Orleans
1985; B.S. (Physics), 1985.
Thesis: Nonstationary Normal Forms for Anosov Diffeomorphisms and Hyperbolic
Skew Products.

DOCTOR OF PHILOSOPHY — *Continued*

- Dawei Dong (*Physics and Biology*) B.S., Peking University 1985.
Thesis: Dynamic Properties of Neural Networks.
- Matthew J. Gursky (*Mathematics*) B.S., The University of Michigan 1986.
Thesis: Compactness of Conformal Metrics with Integral Bounds on Curvature.
- Mingsheng Han (*Astronomy*) B.S., Beijing Normal University 1983.
Thesis: The I-Band Tully-Fisher Relation and Large-Scale Motions in the Universe.
- Sidney Chunping Kan (*Physics*) B.S., Chinese University of Hong Kong 1985.
Thesis: Physics and Applications of Resonant Tunneling Devices.
- James Morris Kaufman (*Physics*) B.A., University of California, Berkeley 1982;
M.S., California Institute of Technology 1984.
Thesis: Frequencies and Amplitudes of High-Degree Solar Oscillations.
- Kihong Kim (*Physics*) B.S., Seoul National University 1985; M.S., California
Institute of Technology 1987.
Thesis: Quantum Critical Phenomena in Superfluids and Superconductors.
- Miloje S. Makivić (*Physics*) B.S., University of Belgrade 1983; M.S., California
Institute of Technology 1987.
Thesis: Monte Carlo Studies of Two-Dimensional Quantum Spin Systems.
- Moya Michelle Mazorow (*Mathematics*) B.S., California State University,
Northridge 1985.
Thesis: Extremal Problems in Codes, Finite Sets and Geometries.
- Jonathan Miller (*Physics*) B.S., Yale College 1982; Ph.D., Cambridge University
1986.
Thesis: Statistical Mechanics of Two-Dimensional Euler Equations and Jupiter's Great
Red Spot.
- Zhengwei Peng (*Physics*) B.Sc., Peking University 1983.
Thesis: Quantum Study of the H_3 System.
- Alain Picard (*Astronomy*) B.Sc., McGill University 1985.
Thesis: The Large Scale Structure of the Universe.
- Eric Jay Raiten (*Physics*) S.B., Massachusetts Institute of Technology 1986; M.S.,
California Institute of Technology 1988.
Thesis: Applications of Current Algebra in Conformal Field Theory.
- Richard J. Rand (*Astronomy*) B.A., University of California, Berkeley 1985.
Thesis: The Relationship Between the Density Wave, Molecular Gas and Star
Formation in M51.
- Gil Rivlis (*Physics*) B.Sc., The Hebrew University of Jerusalem 1986; M.S.,
California Institute of Technology 1987.
Thesis: Two Topics in 2D Quantum Field Theory.
- John K. Salmon (*Physics*) S.B., Massachusetts Institute of Technology 1977; M.S.,
University of California, Berkeley 1983.
Thesis: Parallel Hierarchical N-Body Methods.

DOCTOR OF PHILOSOPHY — *Continued*

Tanchu Shih (*Mathematics*) B.S., University of Hawaii at Manoa 1984.

Thesis: Bounds of Fixed Point Ratios of Permutation Representations of $GL_n(q)$ and Groups of Genus Zero.

Eric John Soderstrom (*Physics*) B.A., University of Minnesota, Duluth 1982; M.S., California Institute of Technology 1985.

Thesis: A Search for Heavy Stable Charged Particles Produced in Pairs in the Decay of the Neutral Intermediate Vector Boson Z .

Roxanne Patricia Springer (*Physics*) B.A., Rice University 1985.

Thesis: QCD Effects in Weak Radiative β -Meson Decays.

Karl Roald Stapelfeldt (*Astronomy and Planetary Science*) B.S., Princeton University 1984.

Thesis: A Multiwavelength Observational Investigation of Herbig-Haro Objects and Their Exciting Stars.

Henry Tsz-King Wong (*Physics*) B.A., Wadham College, Oxford University 1984.

Thesis: A Search for Double Beta Decay in ^{136}Xe with a Time Projection Chamber.

Tinju Yen (*Physics*) B.S., University of California, Los Angeles 1984; M.S., California Institute of Technology 1987.

Thesis: Strings, Two-Dimensional Gravity, and Matrix Models.

Chengbo Yue (*Mathematics*) B.S., Beijing University 1985; M.S., 1987.

Thesis: Rigidity of Three Measure Classes on the Ideal Boundary of Manifolds of Negative Curvature.

Xiao-Dong Zhang (*Mathematics*) B.S., Zhangshan University 1985; M.Phil., The Chinese University of Hong Kong 1987.

Thesis: On Spectral Properties of Positive Operators.

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.

Jack L. Prater

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.

Guy Dumas

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.

1990 Golda Bernstein

1991 Elizabeth A. Warner

ERIC TEMPLE BELL UNDERGRADUATE MATHEMATICS RESEARCH PRIZE

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

Allen I. Knutson

ROLF BUHLER AWARD

Awarded to an aeronautics student for outstanding academic achievement in the Master's program.

Harry J. Catrakis

Prizes and awards are listed only for those students awarded degrees in 1991, and include prizes and awards received by them in previous years.

PRIZES AND AWARDS—Continued

FRITZ B. BURNS PRIZE IN GEOLOGY

Awarded to a junior or senior who has demonstrated academic excellence and the greatest promise of future contributions in the fields represented by the Division of Geological and Planetary Sciences.

Timothy I. Melbourne

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>Sabeer Bhatia</i>	<i>Michael D. Ehlers</i>	<i>Ashoke A. Mukherji</i>
<i>Meeten Bhavsar</i>	<i>Thomas M. Fiola</i>	<i>Christopher J. Myers</i>
<i>Seth S. Bittker</i>	<i>David F. Geraghty</i>	<i>Pongsorn Saipetch</i>
<i>Kenneth L. Campman</i>	<i>Laura J. Hernandez</i>	<i>Michael S. Samoilov</i>
<i>Harry J. Catrakis</i>	<i>Gary R. Holt</i>	<i>Dylan B. Selegue</i>
<i>Leonard P. Chen</i>	<i>Dong-Su Kim</i>	<i>Barry Cushing Stipe</i>
<i>Helen Hsin-I Cheng</i>	<i>Jinha Kim</i>	<i>Matthew L. Tyler</i>
<i>Sylvia Pui Chee Chin</i>	<i>Janet Lai</i>	<i>Mark J. Vaughan</i>
<i>Mike Truan Chou</i>	<i>Eugene S. Lit</i>	<i>Michael Youssefmir</i>
<i>Michael W. Deem</i>	<i>Russell A. Manning</i>	

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.

Alexander H. Elliott

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.

1990 David F. Geraghty; Su-Lin Wu

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.

1990 Jack L. Prater, Masters' Cup

1991 Mark A. Dinan, Deans' 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.

John L. Bowman

HAREN LEE FISHER MEMORIAL AWARD IN JUNIOR PHYSICS

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

1990 Pongsorn Saipetch

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.

1990 Harry J. Catrakis

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.

1990 Leonard P. Chen

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.

1990 Michael W. Deem

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.

Harry J. Catrakis

THE HERBERT NEWBY McCOY AWARD

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

1990 John C. Brewer

PRIZES AND AWARDS—*Continued*

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.

1989 *Brandon M. Baumert*

1990 *Brett D. Bochner*

1991 *Michael D. Pottenger*

ROBERT L. NOLAND LEADERSHIP SCHOLARSHIP

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

William J. Swanson

THE RODMAN W. PAUL HISTORY PRIZE

Awarded to a graduating senior who has displayed unusual interest in and talent for history.

Christopher J. Myers; Alex Wein

HERBERT J. RYSER MEMORIAL SCHOLARSHIPS

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

1989 *Seth S. Bittker*

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.

1990 *Michael D. Ehlers*

1991 *Matthew L. Tyler*

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 GALT (Graduate Aeronautical Laboratories of the California Institute of Technology). Preference is given to students working in structural mechanics.

1990 *Richard D. Pfaff*

PRIZES AND AWARDS—*Continued*

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 *Gregory A. James*

1989 *Marc W. Abel*

1990 *Mark T. Lyttle; Christopher J. Pluhar*

1991 *Sabeer Bhatia; Tien-Yee Chiu*

SIGMA XI AWARD

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

Michael W. Deem

JOHN STAGER STEMPLE MEMORIAL PRIZE IN PHYSICS

Awarded to a graduate student in physics for outstanding progress in research as demonstrated by an excellent performance on the oral Ph.D. candidacy examination.

1989 *Jonathan Miller*

THE MORGAN WARD PRIZE

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

1988 *Allen I. Knutson*

1989 *Russell A. Manning*

CIT ALMA MATER

by Manton Barnes (BS '21 EE)

*In southern California with grace and splendor bound,
Where the lofty mountain peaks look out to lands beyond,
Proudly stands our Alma Mater, glorious to see;
We raise our voices proudly, hailing, hailing thee.
Echoes ringing while we're singing over land and sea,
The halls of fame resound thy name, noble CIT.*