Eighty-First Annual Commencement

June 13, 1975

CALIFORNIA INSTITUTE OF TECHNOLOGY

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Eighty-First Annual Commencement

FRIDAY MORNING AT TEN-THIRTY O'CLOCK
JUNE THIRTEENTH, NINETEEN SEVENTY-FIVE

Academic Dress

The costume of those in the academic procession has a specific symbolism which dates back to at least the 14th century. While there have been many changes in the details, the meaning of the various parts of the costume continues to be the same. Academic institutions in the United States adopted a code of academic dress in 1895 which has been revised from time to time. The dress of institutions in other countries varies considerably, but the basic elements are present in all academic costumes.

GOWNS. The bachelor's gown has long, pointed sleeves; the master's gown has an oblong sleeve open at the wrists (or some older gowns may be open near the upper part of the arm); the doctor's gown is fuller than the others with velvet panels full length on the front and three velvet crossbars on each sleeve in black or in the color distinctive of the subject to which the owner's degree pertains. The gowns are always black except for the doctor's, which in a few instances is of a color representing the institution which conferred the degree.

HOODS. The hood, draped over the shoulders and down the back, indicates the subject to which the degree pertains and the university that conferred the degree. The level of the degree is indicated by the size of the hood. The hood for the bachelor's degree is three feet long; for the master's it is three-and-one-half feet long; and for the doctor's it is four feet long. The binding of the hood is of colored velvet designating the subject of the degree, and it is two inches, three inches, and five inches wide for the bachelor's, master's, and doctor's degrees, respectively. The colors associated with some of the subjects are as follows:

Arts, Letters, Humanities, *White*
Commerce, Accountancy, Business, *Drab*
Economics, *Copper*
Education, *Light Blue*
Engineering, *Orange*
Fine Arts, including Architecture, *Brown*
Law, *Purple*
Medicine, *Green*
Pharmacy, *Olive Green*
Philosophy, *Dark Blue*
Public Administration, including Foreign Service, *Peacock Blue*
Public Health, *Salmon Pink*
Science, *Golden Yellow*
Theology, *Scarlet*

The lining of the hood is of the color or colors of the institution conferring the degree. When two colors are used, they are usually arranged in a single chevron. The lining of the doctor's hood is revealed more than in the master's, and much less is revealed in the bachelor's hood.

CAPS. In the United States, the black mortarboard is most commonly used. The tassel fastened to the center of the cap is normally worn in the left front quadrant of the cap and is black, although it may be of the color appropriate to the subject of the degree. The tassel for a doctor's cap may be of gold thread.

Academic Procession

Chief Marshal, Jon Mathews, Ph.D.

Assistant Marshals

Arden L. Albee, Ph.D. Marshall Hall, Jr., Ph.D.

Robert W. Oliver, 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

THE FACULTY

THE CHAIRMEN OF DIVISIONS

THE DEANS

THE PROVOST

THE TRUSTEES

THE COMMENCEMENT CHAPLAIN

THE PRESIDENT

THE CHAIRMAN OF THE BOARD OF TRUSTEES

Program

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

ORGAN PRELUDE . . . . . Leslie J. Deutsch, Class of 1976

INSTRUMENTAL SELECTION . . . The Caltech Brass Quintet
Symphony in B♭ Minor, by Victor Ewald

AN INTRODUCTION TO COMMENCEMENT
David C. Elliot, Ph.D.
Secretary of the Faculty

PROCESSIONAL . . . The Convocation Brass Ensemble and Organ
James Rötter, M. M., Conductor

INVOCATION . . . . . Dr. Vahe Harold Simonian
Pasadena Presbyterian Church

COMMENCEMENT ADDRESS . . . "The Chemistry of Caltech"
Harry B. Gray, Ph.D.
Professor of Chemistry, Caltech

MUSICAL SELECTION . . . . . The Caltech Men's Glee Club
Olaf M. Frodsham, A.M., Director

Glory to God in the Highest, by Alexander Gretchaninoff

CONFERRING OF DEGREES

Harold Brown, Ph.D., D.Eng., LL.D., Sc.D.
President, California Institute of Technology

PRESENTATION OF CANDIDATES FOR DEGREES

For the Degree of Bachelor of Science . . . James J. Morgan, 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 Engineer . . . . . Cornelius J. Pings, Ph.D.
Dean of Graduate Studies

For the Degree of Doctor of Philosophy . . . . . Dean Pings

Biology . . . . . Robert L. Sinsheimer, Ph.D.
Division Chairman

Chemistry and Chemical Engineering John D. Baldeschwieler, Ph.D.
Division Chairman

Engineering and Applied Science . . Robert H. Cannon, Jr., Sc.D.
Division Chairman

Geological and Planetary Sciences . . . . Barclay Kamb, Ph.D.
Division Chairman

Physics, Mathematics and Astronomy . Robert B. Leighton, Ph.D.
Division Chairman

CONCLUDING REMARKS . . . . . President Brown

BENEDICTION . . . . . Dr. Simonian

RECESSIONAL . . . . The Convocation Brass Ensemble and Organ

Candidates for Degrees

BACHELOR OF SCIENCE

Ioannis Orestis Alevizos *Athens, Greece* Physics
Brenda Grant Aley *Oakland, California* Mathematics
Stephen B. Aley *Chesterfield, New Jersey* Biology
Claude Wilson Anderson III *Colonial Heights, Virginia* Mathematics
Peter Douglas Andriola *Orange, Connecticut* Engineering and Applied Science
David Blaine Atkinson *El Paso, Texas* Mathematics
Michael Eugene Bandhauer *Whittier, California* Chemistry
Gregory Walter Beall *Cincinnati, Ohio* Applied Physics
Marie Helen Beall *Palos Verdes Estates, California* Biology
David Peter Graydon Beatty *La Jolla, California* Engineering and Applied Science
Gerhard Werner Befeld *Anaheim, California* Economics
David Ingalls Bell *Walhalla, South Carolina* Mathematics
Eric M. Benjamin *Red Bluff, California* Engineering and Applied Science
Morris Moshe Berman *Covina, California* Mathematics
John Stewart Best *Bellevue, Washington* Physics
Alaudin Mohamedali Bhanji *Dar-es-Salaam, Tanzania* Engineering and Applied Science
Stephen Rudolph Bienz *Pullman, Washington* Chemistry
Michael Leo Blake *Mesa, Arizona* Mathematics-Physics
Wolfram Hans Walter Blume *Hampton, Virginia* Engineering and Applied Science
Jeffrey Lynn Borders *Solana Beach, California* Biology
Erik John Brune *Vancouver, British Columbia* Mathematics
Aubrey Lester Buck III *Brownsville, Texas* Physics
Bruce Alan Casner *Crestline, California* Engineering and Applied Science
Joseph Howard Catanzarite *Dayton, Ohio* Mathematics
James Robert Celoni *Torrance, California* Mathematics
Lim Hung Cheung *Hong Kong* Engineering and Applied Science
Gavin Donald Claypool *Long Beach, California* English
Ann Elizabeth Clemmens *St. Louis Park, Minnesota* Mathematics
Paula Jean Clendening *Corpus Christi, Texas* Chemistry
Robert Moorhouse Coleman, Jr. *Olympia, Washington* Independent Studies Program
Stephen Richard Colley *San Jose, 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.

Charles West Conner *Redding, California* Mathematics
Christopher L. Cooper *Fair Oaks, California* Applied Physics
William Marvin Coughran, Jr. *Fresno, California* Mathematics
Evangelos Athanassios Coutsias *Athens, Greece* Physics
Robert John Cowan *Woodland Hills, California* Chemical Engineering
Kathryn Dorinda Crossland *Reedley, California* Biology
James Weldon Demmel II *Pittsburgh, Pennsylvania* Mathematics
Bruce Hayes Denby *Cleveland, Ohio* Physics
John Stewart Denker *Tucson, Arizona* Engineering and Applied Science
Russell A. Desiderio *Fullerton, California* Chemistry
John Hook Dilles *Los Gatos, California* Geology
Clifford Ian Drowley *San Rafael, California* Applied Physics
David Steven Dummit *San Mateo, California* Mathematics
Alexander Chikezie Egwuatu *Enuguaboh-Ufuma, Nigeria* Engineering and Applied Science
Klaus Heinrich Engelhardt *El Paso, Texas* Physics
Timothy Eric Erickson *San Francisco, California* Astronomy
Joseph H. Fahle *San Diego, California* Mathematics
Raymond E. Feeney Engineering and Applied Science-English
Vincent Jerome Fratello *North Bend, Oregon* Applied Physics
John Robert Fritch *Carmichael, California* Chemistry
Ellen Alice Garber *Pittsburgh, Pennsylvania* Biology
Robert Rowell Gay *Redlands, California* Chemistry
Timothy James Gay *Dayton, Ohio* Physics
Stephen Lee Gillett *Las Vegas, Nevada* Geology
Paul David Goodson *Torrance, California* Chemical Engineering
Gregory Lee Griffin *Novato, California* Chemical Engineering
Peter John Groom *Woodland Hills, California* Chemistry
Richard Steven Gruner *Fresno, California* Applied Physics-History
Patrick Shawn Hagan *Portland, Oregon* Applied Mathematics
William George Haines *Cedar Rapids, Iowa* Engineering and Applied Science
Daniel Eugene Hale *La Puente, California* Applied Mathematics
Charles H. Hales *Ogden, Utah* Chemical Engineering
Eric William Hansen *Selma, California* Engineering and Applied Science
Gary Bruce Hansen *Englewood, Colorado* Engineering and Applied Science
Kip Harrington *San Diego, California* Engineering and Applied Science
Bruce Ira Harrow *Houston, Texas* Chemistry
Gary Alan Hayward *Huntington Beach, California* Physics

Ralph Robert Hayward III *Temple Hills, Maryland* Economics-Mathematics
Douglas Dwight Herbert *Los Angeles, California* Engineering and Applied Science
Donald R. Hiller *Ventura, California* Engineering and Applied Science
Junro Hiramatsu *Yokohama, Japan* Engineering and Applied Science
Wilson Ho *Daly City, California* Chemistry
Gregory Blair Hoit *Piedmont, California,* Independent Studies Program
Mark Robert Hueschen *Hales Corners, Wisconsin* Physics
Kenneth S. Jancaitis *Leominster, Massachusetts* Physics
Gary Janik *Worthington, Ohio* Applied Physics
Frances Ellen Janssen *Sherwood, Oregon* Biology
Cynthia Marilyn Jung *La Mirada, California* Mathematics
Richard Leslie Kahler *Springfield, Virginia* Physics
Dennis Barlow Keith *Peapack, New Jersey* Chemical Engineering
Jeffry Alan Kelber *Wheaton, Illinois* Chemistry
Ronald Lee Kinch *Seattle, Washington* Chemistry
Louise Kirkbride *Upper Darby, Pennsylvania* Engineering and Applied Science
Joseph Lynn Kirschvink *Phoenix, Arizona* Biology
James Ellis Kleckner *Pacific Palisades, California* Chemistry
Cheryl Louise Laffer *Chicago, Illinois* Biology
John Frederic Land *El Cajon, California* Independent Studies Program
Henry Herman Laxen *Marina, California* Mathematics-English
Roland Robert Lee *Palos Verdes Peninsula, California* Physics
Alexander Lidow *Los Angeles, California* Applied Physics
Robert Wai-Sui Lim *McMinnville, Oregon* Biology
Martin Wen-yu Lo *New York, New York* Mathematics
Bartholomew Nicholas Locanthi III *Altadena, California* Engineering and Applied Science
Brian Thomas Luke *Torrance, California* Biology-Chemistry
Donald Welton MacGlashan, Jr. *Timonium, Maryland* Biology-Chemistry
Daryl Philip Madura *Grants Pass, Oregon* Engineering and Applied Science
Daniel Margoliash *Glencoe, Illinois* Biology
Steven Paul Martinka *Morristown, New Jersey* Biology
Philip Louis Massey *Boca Raton, Florida* Astronomy
Ted Z. Michon *Cheshire, Connecticut* Engineering and Applied Science
Bruce Veblen Mickle *Davis, California* Economics
Ross Maurice Miller *Elizabeth, New Jersey* Mathematics-Social Science
Richard Neal Mitchell *Torrance, California* Chemistry
Carol Louise Moore *Salt Lake City, Utah* Mathematics
William C. Moss *Stamford, Connecticut* Physics

BACHELOR OF SCIENCE—*Continued*

Susan Sayeko Murakami *Los Angeles, California* Biology
Eugene W. Myers, Jr. *Kansas City, Kansas* Mathematics
Kent Nakamoto *El Cerrito, California* Chemistry
Mamoru Nakatsui *Los Angeles, California* Biology-Chemistry
Janice Ann Nicklas *Woodland Hills, California* Biology
Michael Lester Norman *Timonium, Maryland* Astronomy
David Brian Novikoff *Granada Hills, California* Physics-Mathematics
Phillip K. Nygren *Winnetka, Illinois* Physics
James George Ogg *Ft. Collins, Colorado* Geology
Mary Beth Ogilvie *Ann Arbor, Michigan* Engineering and Applied Science
William Franklin O'Meara *Chinook, Washington* History
Peggy Matsue Otsubo *Los Angeles, California* Mathematics
Mark Dominic Parisi *Wilmette, Illinois* Engineering and Applied Science
Pierre Marcel Pastor *Clermont-l'Hérault, France* Physics
George Attila Pavlath *Oakland, California* Physics
Mark Anthony Pickar *Rantoul, Illinois* Physics
Anton Emil Pietsch *Phoenix, Arizona* Engineering and Applied Science-Chemistry
Steven Pohorsky *Saratoga, California* Mathematics
Joseph Gerard Polchinski *Tucson, Arizona* Physics
Chi-Ngong Pow *Hong Kong* Engineering and Applied Science
Victoria Anne Roberts *Seattle, Washington* Geochemistry
Mark Robert Rodgers *Carson City, Nevada* Applied Physics
Alonzo Milton Rollinson *Rome, Georgia* Chemical Engineering
Louis Anthony Romero *Seattle, Washington* Applied Mathematics
Douglas William Rothnie *Downey, California* Biology
Kevin Thomas Ruddell *Vancouver, British Columbia* Physics
Douglas Allen Schaefer *Elgin, Illinois* Chemistry
Douglas Lee Schladweiler *Sioux Falls, South Dakota* Chemistry
Bruce Ralph Schupler *West Palm Beach, Florida* Astronomy
William James Sharman *San Diego, California* Applied Physics
Jeffrey B. Shellan *Renton, Washington* Physics
Alan Mark Shiller *Downey, California* Chemistry
Jack S. Shlachter *Morton Grove, Illinois* Physics
Gregory Leon Simay *Burbank, California* Applied Physics
David Alan Smallberg *Sherman Oaks, California* Mathematics
Susan Patricia Smith *Denver, Colorado* Biology
Anthony Albert Stark *Port Washington, New York* Astronomy-Physics
John Stager Stemple *Falls Church, Virginia* Physics

John Arthur Steubs *Minneapolis, Minnesota* Biology
Robert Emmett Sullivan III *La Marque, Texas* Physics
Bruce Ryan Tasker *San Bernardino, California* English
Gregory Karoly Taylor *Palm Springs, California* Biology
John David Tristano *Bayshore, New York* Engineering and Applied Science-Economics
Armen Varjabedian Physics
Eric Nelson Vella *Honolulu, Hawaii* Physics
Steven Bruce Vik *Aberdeen, South Dakota* Chemistry
Diane C. Vogel *Monterey Park, California* Biology
Robert Edward Walkup *Palestine, Texas* Chemistry
James Christopher Weatherall *San Antonio, Texas* Astronomy
Helen Elizabeth Wheelock *Thousand Oaks, California* Biology
Kenneth Wiener *New York, New York* Chemistry
Eric Devon Williams *Los Angeles, California* Mathematics
Mark Edwards Wilson *Pleasantville, New York* Biology
See Cheong Young *Hong Kong* Applied Mathematics
William A. Zajc *Brookfield, Wisconsin* Physics

MASTER OF SCIENCE

Ervin Adler *(Mechanical Engineering)* A.A., Los Angeles City College 1973; B.S., California Institute of Technology 1974.
Jon Elling Ahlquist *(Planetary Science)* B.A., University of Northern Iowa 1974.
Victor R. Aklyas *(Physics)* B.A., M.S., University of Chicago 1973.
John Arao *(Applied Mathematics)* A.B., Harvard College 1973.
Allen Alexander Arata *(Aeronautics)* B.S., University of California, Los Angeles 1974.
John Chen Wei Au Yeung *(Electrical Engineering)* S.B., Massachusetts Institute of Technology 1974.
Robert Joseph Axelrad *(Civil Engineering)* B.S., University of Utah 1974.
Bertrand Charles Barrois *(Physics)* S.B., Massachusetts Institute of Technology 1973.
Kenneth Edward Bencala *(Chemical Engineering)* B.S., Harvey Mudd College 1973.
Gary Wayne Bogan *(Chemistry)* B.S., Texas A & M University 1972.
John Richard Bond *(Physics)* B.Sc., University of Toronto 1972.

MASTER OF SCIENCE—*Continued*

William Matthew Bowser *(Applied Physics)* B.S., Case Western Reserve University 1973.

David Miner Braisted *(Applied Mechanics)* B.S., Michigan State University 1974.

Roger D. Brum *(Mechanical Engineering)* B.S.M.E., Ohio State University 1974.

Douglas Peter Burum *(Applied Physics)* B.S., Harvey Mudd College 1974.

Dennis Vern Calhoun *(Mechanical Engineering)* B.S., Pennsylvania State University 1974.

Alan Lee Cassel *(Electrical Engineering)* S.B., Massachusetts Institute of Technology 1974.

James Robert Celoni *(Mathematics)* B.S., California Institute of Technology 1975.

Man-Kin Chan *(Engineering Science)* B.S., Illinois Institute of Technology 1974.

Bruce Hodgson Chapman *(Applied Mathematics)* B.Sc., University of British Columbia 1971.

Jing-Chang Chen *(Civil Engineering)* B.S., National Taiwan University 1972.

Mary Ellen Close *(Environmental Engineering Science)* A.B., Oberlin College 1970.

Robert William Collier *(Environmental Engineering Science)* S.B., Massachusetts Institute of Technology 1974.

James Carl Conwell *(Physics)* B.S., University of Nebraska 1972.

William Marvin Coughran, Jr. *(Mathematics)* B.S., California Institute of Technology 1975.

Kurt Ogden Cozens *(Materials Science)* B.S., University of California, Los Angeles 1974.

Micheal Irvin Daily *(Geochemistry)* B.S., University of Houston 1972; M.S., 1973.

John A. Dentinger, Jr. *(Mathematics)* B.A., University of Wisconsin 1972.

Raymond Joseph Dever, Jr. *(Environmental Engineering Science)* A.B., Sc.B., Brown University 1973.

David Steven Dummit *(Mathematics)* B.S., California Institute of Technology 1975.

John Eugene Dutra IV *(Chemical Engineering)* B.S., Princeton University 1974.

Daniel Dzurisin *(Planetary Science)* B.S., University of Notre Dame 1973.

Bruce Scott Eisenhart *(Electrical Engineering)* B.S., California Institute of Technology 1973.

Norman Coleman Elfer *(Mechanical Engineering)* B.S., Louisiana State University 1974.

Manuel Ramón Florez *(Chemical Engineering)* B.S., University of Puerto Rico 1972.

Cynthia L. Friedman *(Biology)* B.A., Bryn Mawr College 1972.

Freddy Gelbard *(Chemical Engineering)* S.B., Massachusetts Institute of Technology 1974.

Robert James Geller *(Geophysics)* B.S., California Institute of Technology 1973.

Stephen Lee Gillett *(Geology)* B.S., California Institute of Technology 1975.

Ari Glezer *(Aeronautics)* B.Sc., Tel-Aviv University 1974.

Derek Garard Goring *(Environmental Engineering Science)* B.E., University of Canterbury, New Zealand 1970.

William Mark Grossman *(Applied Physics)* B.S., Case Western Reserve University 1974.

John Charles Hammar *(Chemical Engineering)* B.S., University of Michigan 1974.

Calvin Dean Harr *(Aeronautics)* B.S., Purdue University 1973.

Jean Howard Ho *(Electrical Engineering)* Higher National Certificate, Stretford Technical College 1970; B.Sc., University of Manchester, England 1973.

Wilson Ho *(Chemistry)* B.S., California Institute of Technology 1975.

John Greg Hoessel *(Astronomy)* B.A., University of Wisconsin 1972.

John Lucke Holmquist *(Aeronautics)* B.S., Loyola University, Los Angeles 1974.

Yupai Hsu *(Physics)* B.S., National Taiwan University 1971.

Steven Thomas Huff *(Physics)* B.S., Hampden-Sydney College 1973.

Gerhard Huhn *(Aeronautics)* Dipl. Ing., Technische Universität München 1973.

Tsutomu Imai *(Electrical Engineering)* B.Eng., Musashi Institute of Technology 1968.

Clarence Burdett Jacobs *(Mechanical Engineering)* B.S., Cornell University 1974.

Sylvan Arnold Jacques, Jr. *(Physics)* B.S., University of California, Los Angeles 1969.

Ravi Jain *(Chemical Engineering)* B.Sc. I, University of Indore 1969; B. Tech., Indian Institute of Technology 1974.

C Jayaprakash *(Physics)* B.Sc., Loyola College, Madras 1971; M.Sc., Indian Institute of Technology 1973.

John Hallock Jerman *(Electrical Engineering)* B.S., California Institute of Technology 1974.

Jonathan Daniel Katz *(Applied Physics)* B.S., University of California, Los Angeles 1973.

Michael Joseph Kavaya *(Electrical Engineering)* B.S., Purdue University 1974.

Diane Jacalyn Kent *(Chemistry)* B.Sc., University of British Columbia 1973.

Joseph Lynn Kirschvink *(Geology)* B.S., California Institute of Technology 1975.

Dennis George Kuba *(Chemical Engineering)* B.S., Pennsylvania State University 1974.

Donald L. Kuehne *(Chemical Engineering)* B.S., Cornell University 1973.

Henry Herman Laxen *(Mathematics)* B.S., California Institute of Technology 1975.

Vincent K. Leung *(Chemical Engineering)* B.S., University of Minnesota 1973.

James Tse-ming Lin *(Physics)* S.B., Massachusetts Institute of Technology 1971.

Daniel George Marks *(Mathematics)* B.S., California Institute of Technology 1974.

Patrick Henry Souza Martin *(Chemistry)* Industrial Chemist, Federal University of Rio de Janeiro 1968.

Joseph Richard Marx *(Geochemistry)* B.S., Georgetown University 1973.

MASTER OF SCIENCE—*Continued*

Alfred Barr Mason *(Applied Mechanics)* B.S., Case Western Reserve University 1974.

Philip Louis Massey *(Astronomy)* B.S., California Institute of Technology 1975.

Brian Michael McKenna *(Aeronautics)* B.S., University of Michigan 1974.

Pamela Schain McMurry *(Environmental Engineering Science)* B.A., University of Pennsylvania 1969.

Gregory John McRae *(Environmental Engineering Science)* B.E., Monash University 1973.

Carl Joseph Meade *(Electrical Engineering)* B.S., University of Texas, Austin 1973.

Barry Joel Moss *(Chemistry)* B.S., University of Miami 1972.

Stephen Taylor Neely *(Electrical Engineering)* B.S., Ottawa University 1974.

David Lee Nelson *(Geology)* B.Sc., Southern Illinois University 1973.

LeRoy Ernest Nelson *(Social Science)* B.S., California Institute of Technology 1969; M.A.T., Occidental College 1970.

Barbara Jean Noyes *(Geochemistry)* B.S., University of Wisconsin 1973.

James George Ogg *(Planetary Science)* B.S., California Institute of Technology 1975.

George Edward Pashel *(Environmental Engineering Science)* B.S., University of Notre Dame 1974.

John Paul Pelegano *(Aeronautics)* Sc.B., Brown University 1974.

Steven Pohorsky *(Mathematics)* B.S., California Institute of Technology 1975.

Robert William Prindle *(Civil Engineering)* B.S., Loyola University 1974.

David Wayne Quance *(Mechanical Engineering)* B.S., California State Polytechnic College 1973.

Ram Rao *(Engineering Science)* B.S., California Institute of Technology 1974.

Michael David Rourke *(Electrical Engineering)* B.S.E.E., University of Nebraska 1973.

Stanley Paul Sander *(Environmental Engineering Science)* B.A., Pomona College 1974.

William Stapf Sargent *(Aeronautics)* B.S.E., Princeton University 1974.

Omer Savas *(Aeronautics)* B.S., Middle East Technical University 1974.

Louis Kossuth Scheffer *(Electrical Engineering)* B.S., California Institute of Technology 1974.

Barry Schneidman *(Mechanical Engineering)* B.S., University of Miami 1973.

David Carl Sherman *(Mechanical Engineering)* B.S., University of California, Santa Barbara 1971.

Yoji Shibato *(Mechanical Engineering)* B.S., Nihon University 1966.

John William Snyder *(Environmental Engineering Science)* B.S., Pennsylvania State University 1971.

Yasuo Soeda *(Mechanical Engineering)* B.E., University of Tokyo 1968.

Michael Joe Sollenberger *(Chemistry)* B.A., Occidental College 1973.

Paul Lewis Springer *(Mathematics)* B.S., Wheaton College 1973.

MASTER OF SCIENCE—*Continued*

Douglas Michael Storsved *(Aeronautics)* B.Aero., University of Minnesota 1973.

Joseph Eugene Sweeney *(Aeronautics)* B.S.A.E., United States Naval Academy 1974.

William Allan Symington *(Mechanical Engineering)* B.E., Cooper Union 1974.

Robert Michael Szejn *(Applied Mathematics)* B.S., Harvey Mudd College 1971.

Choon Sooi Tan *(Aeronautics)* B.Sc., University of Manchester, England 1974.

Timothy James Thurgate *(Applied Physics)* A.B., University of California, Berkeley 1974.

Timothy Neal Turner *(Aeronautics)* B.A., Occidental College 1974.

John Reinhold Valainis *(Physics)* B.S., Butler University 1973.

Ramon del C. Varela Morales *(Engineering Science)* Licenciate, University of Panama 1972.

Kadri Vural *(Electrical Engineering)* B.S., Middle East Technical University 1973.

Bruce Donald Westermo *(Applied Mechanics)* B.S., Illinois Institute of Technology 1974.

David Richmond Witwer *(Environmental Engineering Science)* B.A., Dickinson College 1971.

Pochi A. Yeh *(Physics)* B.S., National Taiwan University 1971.

Paul Jerome Yoder *(Applied Mechanics)* B.E., McGill University 1973.

Tetsushi Yoshida *(Mechanical Engineering)* B.S., Kanagawa University 1973.

Stephen Nelson Young *(Mechanical Engineering)* B.S., West Chester State College 1962; B.S., California State Polytechnic College 1972.

James R. Zagel *(Electrical Engineering)* A.A., Wilbur Wright College 1972; B.S., Northwestern University 1974.

James Zivic *(Mechanical Engineering)* B.S., Case Western Reserve University 1973.

ENGINEER

David Franklin Bremmer *(Aeronautical Engineer)* B.S., University of California, Los Angeles 1971; M.S., California Institute of Technology 1973.

Pieter Wilhelm Stoker *(Mechanical Engineer)* B.Sc., University of Pretoria 1972; M.S., California Institute of Technology 1974.

Susumu Toda *(Aeronautical Engineer)* B.E., Waseda University 1964; M.E., 1966.

Charl Christo Veldman *(Mechanical Engineer)* B.Sc., University of Pretoria 1972; M.S., California Institute of Technology 1974.

DOCTOR OF PHILOSOPHY

DIVISION OF BIOLOGY

Gerald Joseph Audesirk *(Neurophysiology)* B.A., Rutgers University 1970.
Thesis: I. Studies on the Organization of the Eye of *Aplysia californica.* II. Studies on the Interrelationship between Two Neuronal Circadian Oscillators in *Aplysia californica.*

Paul Arlyn Barstad *(Biochemistry and Chemistry)* B.S., Western Washington State College 1970.
Thesis: A Current Look at the Biological Basis of Antibody Diversity and Specificity.

John Lee Compton *(Biophysics and Chemistry)* A.B., Yale College 1969; M.S., California Institute of Technology 1971.
Thesis: Specific DNA Restriction Fragments as Internal Markers in the Electron Microscope: Superimposing the ϕX174 Genetic Map on ϕX174/S13 DNA Heteroduplexes.

Ellen Jeanne Elliott *(Biochemistry and Neurophysiology)* B.A., Centre College of Kentucky 1969.
Thesis: Chemical Properties and Physiological Activity of a Neuroactive Component from the Venom of *Conus californicus.*

P. John Flory, Jr. *(Biology and Chemistry)* A.B., Harvard College 1967.
Thesis: Studies of the Replicative Intermediates and of the Structure of Animal Cell Mitochondrial DNA.

Yuh Nung Jan *(Biophysics and Physics)* B.S., National Taiwan University 1967; M.S., California Institute of Technology 1970.
Thesis: I. Chitin Synthetase and Sensory Transduction in *Phycomyces.* II. The Avoidance Response, the House Growth Response and the Rheotropic Response of *Phycomyces.*

Amy So-Ming Shiu Lee *(Biophysics)* B.A., University of California, Berkeley 1970; M.S., California Institute of Technology 1972.
Thesis: The Cleavage of ϕX174 DNA with Restriction Endonucleases.

Robert George Rohwer *(Biophysics and Chemistry)* B.S., University of Wisconsin 1967.
Thesis: The Maturation of Bacteriophage ϕX174—The Isolation and Characterization of Subviral Particles.

Suzanne Thelma Ostrand Rosenberg *(Immunology)* A.B., Barnard College 1970.
Thesis: Studies of Bovine Blood Cell Surfaces.

Lloyd Herbert Smith *(Biophysics)* B.S., University of California, Davis 1969.
Thesis: The Selective Transcription of ϕX174 Replicative Form DNA *in vitro.*

DIVISION OF CHEMISTRY AND CHEMICAL ENGINEERING

Kiran Ravindra Bakshi *(Chemical Engineering and Environmental Engineering Science)* B.Tech., Indian Institute of Technology 1970; M.S., California Institute of Technology 1972.
Thesis: Characterization of Acid-Base Catalysts and Its Application to Catalyst Poisoning.

Joel Mark Bowman *(Chemistry)* A.B., University of California, Berkeley 1969.
Thesis: Theoretical Studies of Electronically Adiabatic and Non-Adiabatic Chemical Reaction Dynamics.

Ronald Jerome Brown *(Chemical Engineering)* B.A., Stanford University 1969.
Thesis: I. Quasi-Elastic Light Scattering from Liquids and Liquid Mixtures: A Study of Mass and Thermal Diffusivities. II. Observation of Translational and Intramolecular Diffusion of Circular Duplex DNA by Quasi-Elastic Light Scattering.

Roger L. Clough *(Chemistry)* B.A., University of Utah 1971.
Thesis: Preparation and Properties of Molecules Having High Steric Crowding. 1,8-Diphenylnaphthalenes.

Michael John Coggiola *(Chemistry)* B.S., University of California, Berkeley 1969.
Thesis: Experimental Investigations of Molecule-Molecule and Electron-Molecule Scattering.

Donald Edward Cormack *(Chemical Engineering)* B.A.Sc., University of Toronto 1970; M.A.Sc. 1972.
Thesis: Topics in Geophysical Fluid Dynamics: I. Natural Convection in Shallow Cavities. II. Studies of a Phenomenological Turbulence Model.

Peter John Drivas *(Chemical Engineering)* S.B., Massachusetts Institute of Technology 1969; S.M. 1970.
Thesis: Investigation of Atmospheric Dispersion Problems by Means of a Tracer Technique.

Robert Wallace Fillers *(Chemical Engineering)* B.S., California State Polytechnic College 1968; M.S., California Institute of Technology 1969.
Thesis: The Effect of Temperature and Pressure on the Linear Viscoelastic Response of Elastomers.

Michael Stewart Foster *(Chemistry)* B.S., University of Wisconsin 1969.
Thesis: Properties and Reactions of Some Inorganic and Organometallic Compounds in the Gas Phase.

Franklin Robert Fronczek *(Chemistry)* B.S., Louisiana State University 1970.
Thesis: Structural Studies of Binuclear Cobalt (III) Cyano Complexes.

Bosco Po-wai Ho *(Chemical Engineering)* B.Ch.E., University of Minnesota 1970.
Thesis: Suspension Mechanics: I. Inertial and Non-Newtonian Migration of Neutrally Buoyant Rigid Spheres in Two-Dimensional Unidirectional Flows. II. The Effect of Viscoelasticity on the Creeping Motion of a Train of Neutrally Buoyant Newtonian Drops through a Circular Tube.

Robert Andrew Keppel *(Chemistry)* B.S., University of Wisconsin 1970.
Thesis: Organic Reactions in the Gas Phase.

Paulus A. Kroon *(Chemistry)* B.Sc., Auckland University 1967; M.S., 1968; M.S., California Institute of Technology 1971.
Thesis: I. The Use of Deuterated Phospholipids to Elucidate Lipid-Lipid Interactions in Bilayer Vesicles. II. The Effect of Chain Length on the Secondary Structure of Oligoadenylates.

Richard Bruce Moon *(Chemistry)* B.S., California Institute of Technology 1971.
Thesis: Nuclear Magnetic Resonance Studies of Hemoglobin and Red Blood Cell Function.

Oren Allen Mosher *(Chemistry)* B.S., University of California, Berkeley 1968.
Thesis: Electronic Spectroscopy by the Electron Impact Method.

Saon Patumtevapibal *(Chemistry)* B.S., University of California, Berkeley 1970.
Thesis: I. The Construction of a Mode-Locked Nd^{3+}: Glass Laser and Non-Linear Optical Techniques. II. Applications of Picosecond Laser Pulses in Chemistry, Vibrational Relaxation Times in Liquid Alkanes and Alkenes.

Dale R. Powers *(Chemistry and Chemical Engineering)* B.S., Iowa State University 1970.
Thesis: I. The Pyrolysis of N-Butane, 1-Butene, and *Cis*-2-Butene. II. The Reaction of Ethylene Oxide with N-Acetylmethionine and the Effects of Ethylene Oxide on Bacillus *sphericus* Spores.

Dana Auburn Powers *(Chemistry, Chemical Engineering, and Economics)* B.S., California Institute of Technology 1970.
Thesis: Magnetic Behavior of Basic Iron (III) Compounds. I. Magnetic Behavior of the Basic Iron Sulfates and Basic Iron Chromates. II. Magnetic Behavior of Delta Ferric Oxide Hydroxide.

Jill Rawlings *(Chemistry)* B.A., Northwestern University 1969.
Thesis: Spectral and Kinetic Studies of Iron-Sulfur Proteins.

Grant Earl Robertson *(Chemical Engineering)* B.A.Sc., University of Toronto 1969; M.A.Sc. 1970.
Thesis: Combined Forced and Free Convection in Stratified and Unstratified Flows.

Loren Bennett Schreiber *(Chemical Engineering and Chemistry)* B.S., University of Illinois 1970.
Thesis: A Pulse NMR Trilogy: Anomalies, Anisotropies, and Adsorption.

Jeffrey B. Smith *(Chemistry)* A.B., Harvard College 1969.
Thesis: Kinetic Theory of Normal Quantum Fluids.

Russell Timkovich *(Chemistry)* B.S., Michigan State University 1970.
Thesis: The Structure Determination of *M. denitrificans* Cytochrome c_{550}.

Julius Uradnisheck III *(Chemical Engineering)* B.S., Drexel University 1971.
Thesis: Rates and Mechanisms of Chemical Reactions During Flow of Secondary Sewage Effluent Through Porous Beds.

Willard Rogers Wadt *(Chemistry)* B.A., Williams College 1970.
Thesis: I. The Electronic Structure of Criegee Intermediate. II. The Electronic Structure of Pyrazine. III. Approximate Integral Methods and Correlated Wavefunctions.

Danny Lee Yeager *(Chemistry)* B.S., B.A., University of Iowa 1968.
Thesis: Applications of the Equations of Motion Method.

Erdinc Zana *(Chemical Engineering)* B.S., University of Tulsa 1970; M.S., California Institute of Technology 1972.
Thesis: Bubble Motion and Mass Transfer in Viscoelastic Liquids.

DIVISION OF ENGINEERING AND APPLIED SCIENCE

Jerome Martin Auerbach *(Mechanical Engineering)* Sc.B., Brown University 1967; M.S., California Institute of Technology 1968.
Thesis: Experimental Studies of the Noise Produced in a Supersonic Nozzle by Upstream Acoustic and Thermal Disturbances.

John Beauchamp Berrill *(Civil Engineering)* B.E., University of Canterbury 1963: M.S., University of Colorado 1971.
Thesis: A Study of High-Frequency Strong Ground Motion from the San Fernando Earthquake.

Thomas Carl Brown, Jr. *(Engineering Science and Mathematics)* B.S., University of North Carolina 1966; M.S., 1968.
Thesis: A Structured Design Method for Specialized Proof Procedures.

Johnnie B. Cannon *(Mechanical Engineering)* B.S., Tuskegee Institute 1970; M.S., California Institute of Technology 1972.
Thesis: Convective Flows under Conditions Applicable to Fires in High Rise Buildings.

Liang-Chou Chang *(Aeronautics)* B.A., National Taiwan University 1965; B.S., Michigan State University 1968; M.S., 1969.
Thesis: Theoretical Investigations of Turbulent Boundary Layer over a Wavy Surface.

Wilkie Yung-Kee Chen *(Applied Physics and Engineering Science)* B.Sc., National Taiwan University 1968; M.S., California Institute of Technology 1971.
Thesis: Properties of Superconducting Cu-Rich Composites Containing V_3Si or V_3Ga.

Yoshiaki Daimon-Hagihara *(Electrical Engineering and Physics)* B.S., California Institute of Technology 1971; M.S., 1972.
Thesis: Charge Transfer in Charge Coupled Devices.

Stephen K. Decker *(Applied Physics)* B.S., Auburn University 1969; M.S., California Institute of Technology 1971.
Thesis: Investigations of Noise and of Quantum Interference in Proximity Effect Bridges.

Gary Alan Evans *(Electrical Engineering and Physics)* B.S.E.E., University of Washington 1970; M.S., California Institute of Technology 1971.
Thesis: Electromagnetic Theory of Distributed Feedback Lasers in Periodic Dielectric Waveguides.

Joseph Shao-Ying Feng *(Electrical Engineering)* B.S., California Institute of Technology 1969; M.S., Northwestern University 1970; M.S., California Institute of Technology 1971.
Thesis: I. Stopping Cross Section Additivity for 0-2 MeV^4 He Ions in Solids. II. Magnetite Thin Films: Fabrication and Electrical Properties.

Richard I. Gomberg *(Engineering Science)* B.S., University of Puerto Rico 1967; M.S., California Institute of Technology 1970.
Thesis: Test Particle Motion in a Lorentz Gas.

Henri Michel Horgen *(Applied Physics)* Ing., Mining School of Paris 1968; M.S., California Institute of Technology 1969.
Thesis: Analysis of Object-Image Relationships in Electron Microscopy by Computer Image Processing Techniques.

William Lewis Johnson *(Applied Physics)* A.B., Hamilton College 1970.
Thesis: Superconductivity in Metal-Semiconductor Eutectic Alloys.

Stuart Ronald Keller *(Engineering Science)* B.S., Purdue University 1971; M.S., California Institute of Technology 1972.
Thesis: Fluid Mechanical Investigations of Ciliary Propulsion.

Nikolaos Evangelos Kotsovinos *(Civil Engineering)* Civ. Eng. Diploma, Aristotelion University of Thessaloniki 1967; M.S., California Institute of Technology 1972.
Thesis: A Study of the Entrainment and Turbulence in a Plane Buoyant Jet.

Vijay Anand Kulkarny *(Aeronautics)* B.Tech., Indian Institute of Technology 1969; M.S., California Institute of Technology 1970.
Thesis: An Experimental Investigation on Focussing of Weak Shock Waves in Air.

Glenn Alan Laguna *(Applied Physics)* B.S., State University of New York, Stony Brook 1971; M.S., California Institute of Technology 1972.
Thesis: Second Sound Attenuation in a Liquid Helium Counterflow Jet.

Tsu-wei Frank Lee *(Electrical Engineering and Applied Mathematics)* B.S., National Taiwan University 1967; M.S., Washington University 1970.
Thesis: Deep Levels and High Concentrations of Impurities in Silicon.

Alexander Constantine R. Livanos *(Engineering Science and Physics)* B.S., California Institute of Technology 1970; M.S., 1973.
Thesis: I. Edge Diffraction of a Convergent Wave. II. Diffraction of Laguerre Gaussian Beams by a Circular Aperture.

David Rodgers MacQuigg *(Applied Physics)* B.S., California Institute of Technology 1969; M.S., 1970.
Thesis: The Modulated Grating Hologram.

Vincent Marrello *(Electrical Engineering)* B.A.Sc., University of Toronto 1970; M.S., California Institute of Technology 1971.
Thesis: I. Solid-Phase Growth of Ge Structures. II. Condensation of Injected Electrons and Holes in Ge.

Richard Devern Samuels Melville, Jr. *(Electrical Engineering)* B.S., University of Southern California 1960; M.S., United States Naval Post Graduate School 1967.
Thesis: Spatial and Spectral Behavior of Speckle in an Imaging System.

March J. Moronval *(Aeronautics and Applied Mathewatics)* Diplôme d'Ingénieur, École Nationale Supérieure des Arts et Métiers 1971; Maîtrise de Mécanique, Faculté des Sciences 1971; M.S., California Institute of Technology 1972.
Thesis: Optimization of Arch and Shell Structures.

Pericles Leonidas Nicolaides *(Engineering Science, Mathematics, and German Literature)* B.S., California Institute of Technology 1969; M.S., 1971.
Thesis: RELSIM: An On-Line Simulation Language for the Social Sciences.

Paul Thomas Roberts *(Environmental Engineering Science)* B.A., Rice University 1969; M.Ch.E., 1970.
Thesis: Gas-to-Particle Conversion: Sulphur Dioxide in a Photochemically Reactive System.

Haluk Sankur *(Electrical Engineering)* B.S., Robert College 1970; M.S., California Institute of Technology 1971.
Thesis: I. Diffusion of Si in Al and Solid Phase Growth of Epitaxial Si Structures in Al. II. Investigations on the Si-Au Interface Effects and on the Phase Diagrams of Si-Au-Cu.

Virendra Sarohia *(Aeronautics)* B.Sc., Punjab Engineering College, Chandigarh 1970; M.S., California Institute of Technology 1971.
Thesis: Experimental and Analytical Investigation of Oscillations in Flows over Cavities.

Edgar Harry Satorius *(Electrical Engineering)* B.S., University of California, Los Angeles 1970; M.S., California Institute of Technology 1971.
Thesis: Electromagnetic Pulses at the Boundary of a Nonlinear Plasma.

Dhiraj Kumar Sharma *(Electrical Engineering and Engineering Science)* B.Tech., Indian Institute of Technology, Kanpur 1971; M.S., California Institute of Technology 1972.
Thesis: Predictive Encoding of Digitized TV Pictures.

Donald Alan Simons *(Applied Mechanics)* B.M.E., M.Sc., Ohio State University 1968.
Thesis: Scattering of a Rayleigh Wave by the Edge of a Thin Surface Layer.

Gordon Carl Smith *(Aeronautics and Economics)* B.S., United States Air Force Academy 1964; M.S., Stanford University 1968.
Thesis: An Experimental Investigation of the Dynamic Fracture of a Brittle Material.

Yen-Sheng Edmund Sun *(Applied Physics, Electrical Engineering, and Business Economics)* B.S., National Chiao Tung University 1969; M.S., California Institute of Technology 1971.
Thesis: Proximity Effect in Ag-Pb Alloys.

Peter Szolovits *(Engineering Science)* B.S., California Institute of Technology 1970.
Thesis: The REL Language Writer's Language: A Metalanguage for the Implementation of Specialized Application Languages.

Gordon P. Treweek *(Environmental Engineering Science)* B.S., United States Military Academy 1964; M.S., California Institute of Technology 1971.
Thesis: The Flocculation of *E. coli* with Polyethyleneimine.

Alan August Vetter *(Mechanical Engineering)* B.E., State University of New York, Stony Brook 1968; M.S., California Institute of Technology 1969.
Thesis: Kinetics and Structure of the CS_2/O_2 Flame Laser.

DOCTOR OF PHILOSOPHY—*Continued*

John Bernard Wilgen *(Electrical Engineering)* B.A., University of Minnesota 1968; M.S., California Institute of Technology 1969.
Thesis: Cyclotron Harmonic Emission in a Penning Discharge.

Hung Leung Wong *(Applied Mechanics)* B.S., University of Utah 1972; M.S., California Institute of Technology 1973.
Thesis: Dynamic Soil-Structure Interaction.

DIVISION OF GEOLOGICAL AND PLANETARY SCIENCES

Richard W. Forester *(Geochemistry)* B.Sc., McGill University 1965; M.Sc., 1967; M.S., California Institute of Technology 1971.
Thesis: $^{18}O/^{16}O$ and D/H Studies on the Interactions between Heated Meteoric Groundwaters and Igneous Intrusions: Western San Juan Mountains, Colorado, and the Isle of Skye, Scotland.

Todd King Hinkley *(Geology)* A.B., Occidental College 1964; M.S., California Institute of Technology 1970.
Thesis: Weathering Mechanisms and Mass Balance in a High Sierra Nevada Watershed—Distribution of Alkali and Alkaline Earth Metals in Components of Rock and Soil, Snow, Soil Moisture and Stream Outflow.

Glenn Scott Orton *(Planetary Science)* Sc.B., Brown University 1970.
Thesis: I. Spatially Resolved Absolute Spectral Reflectivity of Jupiter: 3390-8400 A. II. The Jovian Thermal Structure from Pioneer 10 Infrared Radiometer Data. III. Observations and Analysis of 8-14 Micron Thermal Emission of Jupiter: A Model of Thermal Structure and Cloud Properties.

Spencer Hoffman Wood *(Geology)* B.S., Colorado School of Mines 1964; M.S., California Institute of Technology 1970.
Thesis: Holocene Stratigraphy and Chronology of Mountain Meadows, Sierra Nevada, California.

DIVISION OF PHYSICS, MATHEMATICS AND ASTRONOMY

Peter Andrew Batay-Csorba *(Physics)* S.B., Massachusetts Institute of Technology 1968.
Thesis: A Study of the $T(d,\gamma)^5He$ Reaction.

Kwong Wah Chu *(Astronomy)* S.B., Massachusetts Institute of Technology 1967; M.S., California Institute of Technology 1970.
Thesis: HI Observations of Dust Clouds.

William Kenneth Delaney *(Mathematics)* B.S., California Institute of Technology 1971.
Thesis: A Counterexample in the Theory of Fourier Transforms in the Complex Domain.

Warren E. Ferguson, Jr. *(Applied Mathematics)* B.S., Clarkson College of Technology 1971.
Thesis: A Singularly Perturbed Two-Point Boundary-Value Problem.

Gordon James Hurford *(Physics)* B.Sc., McGill University 1963; M.A., University of Toronto 1964.
Thesis: Observations of Hydrogen and Helium Isotopes in Solar Cosmic Rays.

Thomas F. Humphrey *(Physics)* B.S., University of Notre Dame 1966.
Thesis: Zero Degree Hadron Production from an Aluminum Target at 300 GEV.

Robert Paul Kirshner *(Astronomy)* A.B., Harvard College 1970.
Thesis: Spectrophotometry of Supernovae and Their Remnants.

Melvin John Knight II *(Mathematics)* B.A., University of Wyoming 1971.
Thesis: Indices of Principal Orders in Algebraic Number Fields.

Michael A. Kosecoff *(Applied Mathematics)* B.A., University of California, Los Angeles 1970.
Thesis: Some Problems in Nonlinear Elasticity.

Lou-Chuang Lee *(Physics)* B.C., National Taiwan University 1969; M.S., California Institute of Technology 1972.
Thesis: A Theory of Strong and Weak Scintillations with Applications to Astrophysics.

Frederick Michael Mann *(Physics)* B.S., Stanford University 1970.
Thesis: I. Study of Some Beta Decays in the SD Shell. II. Comparison of Experimental Reaction Cross Sections with the Hauser-Feshbach Model.

David William Palmer *(Physics)* B.A., University of Wisconsin 1968.
Thesis: Nonequilibrium Properties of Superconducting-Normal Metal Boundaries.

Paul Schechter *(Physics and Astronomy)* A.B., Cornell University 1968.
Thesis: The Luminosity Function for Galaxies and the Clustering of Galaxies.

Fredrick Hampton Seguin *(Physics and Philosophy)* S.B., Massachusetts Institute of Technology 1969.
Thesis: The Structure and Stability of Relativistic, Differentially Rotating Stars.

Elias Sai Wan Shiu *(Mathematics and Engineering Science)* B.S., M.Sc., University of Manitoba 1971.
Thesis: Numerical Ranges of Powers of Operators.

Thomas Stevens *(Applied Mathematics)* B.Sc., University of British Columbia 1970.
Thesis: Numerical Methods for Ill-Posed, Linear Problems.

Solomon Benjamin Vidor *(Physics)* B.S., Rensselaer Polytechnic Institute 1969.
Thesis: Observations of Nitrogen and Oxygen Isotopes in the Low Energy Cosmic Rays.

Run-Han Wang *(Physics)* B.S., University of California, Los Angeles 1967; M.S., California Institute of Technology 1971.
Thesis: I. Equilibrium and Nonequilibrium Superconducting Quantum Interference Phenomena. II. Applications of Superconducting Quantum Magnetometer.

Prizes and Awards

GEORGE W. GREEN MEMORIAL AWARD

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

Robert Edward Walkup

Joseph Gerard Polchinski

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.*

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.

Ole Lloyd Anderson

José Ignacio Cabezon

David James Edward Callaway

Brian Keith Jenkins

Ruth Ann Mullen

Christopher B. Russell

Subhash Sharma

DAVID JOSEPH MACPHERSON PRIZE IN ENGINEERING

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

Stephen Richard Colley

DONALD S. CLARK 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.

Richard Karl Feldman, sophomore

Richard Scott Larson, junior

HAREN LEE FISHER MEMORIAL AWARD IN JUNIOR PHYSICS

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

Thomas Michael Himel

SIGMA XI AWARD

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

Wilson Ho

THE MORGAN WARD AWARD

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

Albert Lewis Wells, Jr., freshman

MARY A. EARLE McKINNEY PRIZE IN ENGLISH

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

James Michael Wilson

James Takfay Hong

JACK E. FROEHLICH MEMORIAL AWARD

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

Laurence Gregory Yaffe

ERIC TEMPLE BELL UNDERGRADUATE MATHEMATICS RESEARCH PRIZE

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

James Bergheim Shearer, junior

Eric Devon Williams, senior

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

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

Designee: *Timothy Eric Erickson*