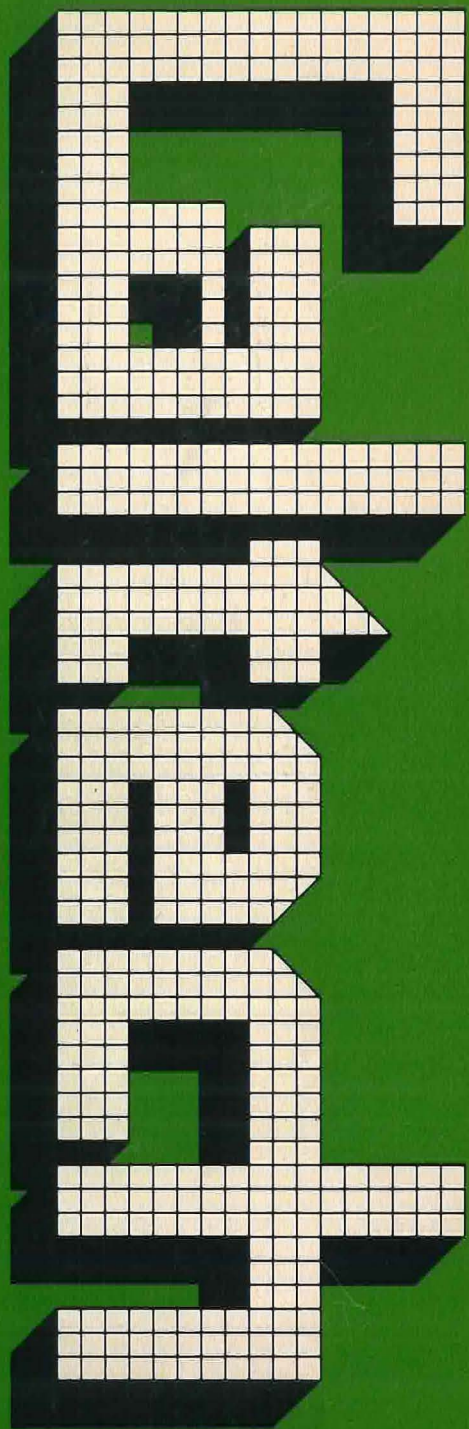


# Information for Students

SEPTEMBER 1979



# INFORMATION FOR STUDENTS 1979-1980

CALIFORNIA INSTITUTE OF TECHNOLOGY  
1201 East California Boulevard  
Pasadena, California 91125  
Telephone: (213) 795-6811

September 1979

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Aeronautics . . . . . Ae	Environmental Engineering
Anthropology . . . . . An	Science . . . . . Env
Applied Mathematics . . . . . AMa	Geology . . . . . Ge
Applied Mechanics . . . . . AM	History . . . . . H
Applied Physics . . . . . APH	Humanities and Social Sciences . . . . . HSS
Art . . . . . Art	Hydraulics . . . . . Hy
Astronomy . . . . . Ay	Independent Studies Program . . . . . ISP
Bioinformation Systems . . . . . BIS	Jet Propulsion . . . . . JP
Biology . . . . . Bi	Languages . . . . . L
Business Economics	Linguistics . . . . . Lin
and Management . . . . . BEM	Literature . . . . . Lit
Chemical Engineering . . . . . ChE	Materials Science . . . . . MS
Chemistry . . . . . Ch	Mathematics . . . . . Ma
Civil Engineering . . . . . CE	Mechanical Engineering . . . . . ME
Computer Science . . . . . CS	Music . . . . . Mu
Economics . . . . . Ec	Philosophy . . . . . Pl
Electrical Engineering . . . . . EE	Physical Education . . . . . PE
Engineering . . . . . E	Physics . . . . . Ph
Engineering & Applied Science . . . E & AS	Political Science . . . . . PS
Engineering Graphics . . . . . Gr	Psychology . . . . . Psy
Engineering Science . . . . . ES	Social Science . . . . . SS

## ACADEMIC CALENDAR 1979-80

### 1979

	<b>First Term</b>
September 19	Registration of entering freshmen — 1:00 p.m.-4:30 p.m.
September 20-22	New Student Orientation
September 24	General Registration — 8:30 a.m.-4:30 p.m.
September 24	Undergraduate Academic Standards and Honors Committee — 9:00 a.m.
September 25	Beginning of instruction — 8:00 a.m.
October 12	Last day for adding courses and for removing conditions and incompletes
October 29- November 2	Mid-Term week
November 2	Last day for admission to candidacy for Master's and Engineer's degrees
November 5	Mid-Term deficiency notices due — 9:00 a.m.
November 12-16	Pre-registration for second term, 1979-80
November 22-25	Thanksgiving recess
November 22-23	Thanksgiving holidays
November 30	Last day for dropping courses, changing sections, and track changes
December 8-14	Final examinations, first term, 1979-80
December 15	End of first term, 1979-80
December 16- January 6	Christmas recess
December 17	Instructors' final grade reports due — 9:00 a.m.
December 21-25	Christmas holidays
December 31	New Year's Day holiday

### 1980

### Second Term

January 1	New Year's Day holiday
January 7	General Registration — 8:30 a.m.-4:30 p.m.
January 7	Undergraduate Academic Standards and Honors Committee — 9:00 a.m.
January 8	Beginning of instruction — 8:00 a.m.
January 25	Last day for adding courses and for removing conditions and incompletes
February 11-15	Mid-Term week
February 18	Mid-Term deficiency notices due — 9:00 a.m.
February 25-29	Pre-registration for third term, 1979-80
March 7	Last day for dropping courses, changing sections, and track changes
March 15-21	Final examination, second term, 1979-80
March 21	Last day for obtaining admission to candidacy for the degree of Doctor of Philosophy
March 22	End of second term, 1979-80
March 23-30	Spring recess
March 24	Instructors' final grade reports due — 9:00 a.m.

**1980****Third Term**

March 31	General Registration — 8:30 a.m.-4:30 p.m.
March 31	Undergraduate Academic Standards and Honors Committee — 9:00 a.m.
April 1	Beginning of instruction — 8:00 a.m.
April 18	Last day for adding courses and for removing conditions and incompletes
April 28-May 2	Mid-Term week
May 5	Mid-Term deficiency notices due — 9:00 a.m.
May 9-10	Examinations for admission to upper classes, September 1980
May 19-23	Pre-registration for first term, 1980-81, and registration for summer research (graduate and undergraduate)
May 23	Last day for dropping courses, changing sections, and track changes
May 26	Memorial Day holiday
May 30	Last day for presenting theses for the degrees of Doctor of Philosophy and of Engineer
May 31- June 6	Final examinations for senior and graduate students, third term, 1979-80
June 7-13	Final examinations for undergraduate students, third term, 1979-80
June 9	Instructors' final grade reports due for senior and graduate students — 9:00 a.m.
June 11	Undergraduate Academic Standards and Honors Committee — 9:00 a.m.
June 11	Curriculum Committee meeting — 10:00 a.m.
June 11	Faculty meeting — 2:00 p.m.
June 13	Commencement
June 14	End of third term, 1979-80
June 16	Instructors' final grade reports due for undergraduate students — 9:00 a.m.
June 25	Undergraduate Academic Standards and Honors Committee — 9:00 a.m.
July 3-4	Independence Day holiday
September 1	Labor Day holiday

**First Term 1980-81**

September 24	Registration of entering freshmen, 1:00 p.m.-4:30 p.m.
September 25-27	New Student Orientation
September 29	General Registration — 8:30 a.m.-4:30 p.m.
September 30	Beginning of instruction — 8:00 a.m.

## OFF-CAMPUS UNIT LOCATIONS

- Azusa Hydraulics Laboratory  
Azusa
  
- Big Bear Solar Observatory  
Fawnskin
  
- Jet Propulsion Laboratory  
4800 Oak Grove Drive, Pasadena
  
- Kerckhoff Marine Laboratory  
Corona del Mar
  
- Owens Valley Radio Observatory  
Big Pine
  
- Palomar Observatory  
Palomar Mountain
- San Diego County

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# CAMPUS DIRECTORY

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- 28. Alles Laboratory (Molecular Biology)
- 3. Alumni Swimming Pool
- 25. Arms Laboratory (Geological and Planetary Sciences)
- 77. Art Gallery
- 61. Athenaeum (Faculty Club)
- 77. Baxter Lecture Hall
- 77. Baxter, Donald E., M.D., Ha.. (Humanities and Social Sciences)
- 91. Beckman Auditorium
- 76. Beckman Laboratories (Behavioral Biology)
- 60. Blacker House (Undergraduate Residence)
- 51. Bookstore (Student Center)
- 79. Booth Computing Center
- 88. Braun House (Graduate Residence)
- 75. Braun Laboratories (Cell Biology and Chemistry) (Site of)
- 34. Bridge Annex
- 33. Bridge Laboratory (Physics)
  - 1. Brown Gymnasium
- 74. Campbell Laboratory (Plant Research)
- 85. Central Engineering Services
  - 5. Central Plant
- 52. Chandler Dining Hall
- 43. Chemical Engineering Laboratory
- 73. Chemistry Laboratory, Undergraduate
- 29. Church Laboratory (Chemical Biology)
- 93. Coffeehouse, Student
  - 4. Cooling Tower Buildings
- 34. Cosmic Ray Laboratory
- 30. Crellin Laboratory (Chemistry)
- 40. Dabney Hall (Administration, EQL, and Humanities)
- 58. Dabney House (Undergraduate Residence)
- 36. Development Offices
- 47. Downs Laboratory (Physics)
- 96. Environmental Quality Laboratory
- 50. Firestone Laboratory (Flight Sciences and Applied Mathematics)
- 57. Fleming House (Undergraduate Residence)
- 31. Gates Building
- 31A. Gates Annex (Chemistry)
- 82. Grounds Operations Office
- 45. Guggenheim Laboratory (Aeronautics and Applied Physics)
- 56. Housing Office
- 90. Industrial Relations Center
- 35. Isotope Handling Laboratory
- 80. Jorgensen Laboratory (Computer Science and Bioinformation Systems)
- 46. Karman Laboratory (Fluid Mechanics and Jet Propulsion)
- 86. Keck House (Graduate Residence)
- 78. Keck Laboratories (Environmental Engineering and Materials Science)
- 38. Kellogg Radiation Laboratory
- 27. Kerckhoff Laboratory (Biological Sciences)
- 48. Lauritsen Laboratory (High Energy Physics)
- 54. Lloyd House (Undergraduate Residence)
- 89. Marks House (Graduate Residence)
- 32. Millikan (Library and Administration)
- 87. Mosher-Jorgensen House (Graduate Residence)
- 23. Mudd, North (Geology and Geochemistry)
- 21. Mudd, South (Geophysics and Planetary Sciences)
- 72. Noyes Laboratory (Chemical Physics)
- 53. Page House (Undergraduate Residence)
- 4, 5, 82, 83, 84. Physical Plant
- 92. Public Events Office
- 71. Public Relations and Publications
- 77. Ramo Auditorium
- 59. Ricketts House (Undergraduate Residence)
- 24. Robinson Laboratory (Astrophysics)
- 55. Ruddock House (Undergraduate Residence)
- 37. Sloan Laboratory (Mathematics and Physics)
  - 6. Spalding Building (Business Services)
- 41. Spalding Laboratory (Chemical Engineering)
- 94. Steele House (Residence, Master of Student Houses)
- 81. Steele Laboratory (Applied Physics and Electrical Engineering)
- 44. Thomas Laboratory (Civil and Mechanical Engineering)
- 92. Ticket Office
- 82. Transportation and Grounds Operations
- 95. Watson Laboratories of Applied Physics (Site of)
- 51. Winnett Student Center
- 51. Caltech Y
- 8. Young Health Center





## Section I

# CALIFORNIA INSTITUTE OF TECHNOLOGY

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<i>Master of Student Houses</i> .....	James W. Mayer

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- INSTITUTE ADMINISTRATIVE COUNCIL — *M. L. Goldberger, Chairman*; R. F. Christy, D. Goodstein, R. W. Gould, H. B. Gray, N. H. Horowitz, W. B. Kamb, H. C. Martel, D. W. Morrisroe, B. C. Murray, R. G. Noll, R. D. Owen, C. J. Pings, M. Schmidt, R. E. Vogt.
- INSURANCE AND ANNUITIES—*L. Davis Jr., Chairman*; J. P. Click, F. H. Felberg, J. Goodstein, D. M. Grether, D. W. Morrisroe, W. P. Strong, W. Whaling.
- RADIATION SAFETY—*T. A. Tombrello, Jr., Chairman*; F. H. Boehm, D. S. Burnett, E. B. Emery, G. P. Garmire, P. Lowy, J. J. Morgan, S. O. Samson, W. F. Wegst, Jr.
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- SHOP FACILITIES — *T. Vreeland, Jr., Chairman*; J. F. Bonner, N. W. Keidel, J. E. Mercereau, D. W. Morrisroe, S. O. Samson, E. E. Sechler, J. A. Westphal.
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- SPONSORED STUDENT RESEARCH—*D. S. Wood, Chairman*; D. E. Hudson, R. W. Oliver, W. Whaling.

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1979-1980

### OFFICERS

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*Vice Chairman:* E. J. List

*Secretary:* D. C. Elliot

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*Term expires*

*June 30, 1980*

T. M. Apostol

C. A. Barnes

P. B. Dervan

R. E. Dickerson

D. J. Kevles

H. W. Liepmann

*Term expires*

*June 30, 1981*

M. Gell-Mann

W. A. Goddard III

G. W. Housner

G. A. Lorden

J-P. Revel

W. Whaling

*Term expires*

*June 30, 1982*

C. R. Allen

P. E. Dimotakis

S. Epstein

J. K. Knowles

T. C. McGill

R. F. Scott

STEERING COMMITTEE — *D. L. Goodstein*, C. A. Barnes, R. F. Christy, R. E. Dickerson, D. C. Elliot, J. K. Knowles, E. J. List, G. A. Lorden

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*Term expires June 30, 1980*

C. R. Allen

F. C. Anson

N. R. Corngold

*Term expires June 30, 1981*

D. S. Cohen

J. J. Morgan

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<sup>1</sup>Option Representative

<sup>2</sup>Pre-Medical Adviser

<sup>3</sup>Joint appointment with Carnegie Institution of Washington

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A. James Hudspeth, M.D., Ph.D. <sup>1</sup>	<i>Biology</i>
Henry A. Lester, Ph.D.	<i>Biology</i>
John D. Pettigrew, M.D.	<i>Biology</i>
James H. Strauss, Ph.D.	<i>Biology</i>
David C. Van Essen, Ph.D.	<i>Biology</i>

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Nancy S. Petersen, Ph.D.	<i>Biology</i>
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<sup>1</sup>Pre-Medical Adviser<sup>2</sup>In residence 1978-79<sup>3</sup>Undergraduate Student Adviser

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Ahmed H. Zewail, Ph.D. ....	Chemical Physics

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**Associate**

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Robert R. Gagné, Ph.D. ....	<i>Chemistry</i>
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**Noyes Research Instructor**

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Ranier Dyllick-Brenzinger, Dr.nat. sc.	Anne C. Moore, Ph.D.
Steven E. Ealick, Ph.D.	James I. Mullins, Ph.D.
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 John Samuel Batchelder  
 William Matthew Bowser

Stuart Thomas Hopkins  
 Kevin Eugene Jones

#### *Chemical Engineering*

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 Alan Brad Anton  
 Samir Ilyas Barudi  
 Mark Elliott Bassett  
 Barry Jerome Bentley  
 Clarke Berdan II  
 Russell Leslie Bone  
 Willie Ann Brown  
 Douglas Glenn Carson  
 Paul Chun-Ho Chan  
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 Douglas Snyder Clark  
 James Gleason Crump  
 Brian Henry Davison  
 Michael Thomas Duncan  
 Paul Nathan Dunlap  
 Kenneth Eagle  
 Howard Edwin Evans  
 Silvia Fernandez  
 Kurt Dale Fickie  
 Lynn Forester  
 Gerald Gendall Fuller  
 Anthony Sigmund Geller  
 Cigdem Gurer  
 Daniel Dale Hanle  
 Philip Alan Hookham  
 Stephen Ju-ming Hsia  
 Dale Edward Ibbotson  
 Nicholas Alexandrou Kaffes  
 William Samson Kalema  
 Rohit Khanna  
 John Edwin Killough

James Gregory Kralik  
 Constantine Kravaris  
 Ronald Robert Lagnado  
 Seong Hee Lee  
 Joseph Anthony Leone  
 Oded Levy  
 Edward Douglas Lynch  
 William Kevin Moonan  
 William Lee Olbricht  
 Byron Lance O'Steen  
 Nutan Kumari Pande  
 Andrew John Pesthy  
 Charunya Phichitkul  
 Puvin Pichaichanarong  
 Danny David Reible  
 Donald F. Rogers  
 Gregory Ryskin  
 Kai-Yiu San  
 John Robert Schlup  
 Karl Allen Seibert  
 Mark Alan Siddoway  
 Aguilas Carlos Sobrero  
 Arthur Wesley Stelson  
 David Michael Strand  
 David Walter Suobank  
 Michael Karpovich Templeton  
 Grant Fred Tiefenbruck  
 Nick Vasilakos  
 Jimmy K. Y. Wang  
 Dale S. Warren  
 Albert Theodore Watson  
 Gary Eugene Whatley  
 Thomas Stephen Wittrig



*Chemistry*

George Adler  
 David Andrew Agard  
 Janet Noel Allison  
 William George Antypas, Jr.  
 Peter Bruce Armentrout  
 Pamela Rae Auburn  
 Jay Douglas Audett  
 Roger Bennett Baar  
 Raymond Alan Bair  
 Utpal Banerjee  
 Paul Theron Barger  
 Javier Francisco Bartroli  
 Michael McClellan Becker  
 Nancy Newton Becker  
 Tadhg Pulcarius Begley  
 D. Wayne Berman  
 Donald Harry Berry  
 Scott Adams Biller  
 Steven Gerard Blanchard  
 John James Boland  
 David Scott Bomse  
 Mark John Bowick  
 Robert Clark Bowman, Jr.  
 David Edward Brinza  
 William Joseph Brittain  
 Duncan William Brown  
 Frank Ripley Brown, Jr.  
 Katherine Ann Brown-Wensley  
 Gary Wayne Brudvig  
 Daniel Alan Buttry  
 Gary Wayne Campbell  
 Michael Paul Casassa  
 Carla Jutta Casewit  
 Robert John Cave  
 Francis Gabriel Celii  
 Richard Eugene Cherpeck  
 Jocelyn Terese Chupka  
 Steven Alan Cohen  
 Benjamin Norman Conner  
 William Robert Croasmun  
 John Powell Daub  
 Robert Anthony dePaola  
 John Austin Dodge  
 Nancy Marie Doherty  
 William Clinton Dow  
 Kenneth Martin Doxsee  
 Horace Rainsford Drew III  
 Daniel Charles Duan  
 Richard Raymond Durand, Jr.  
 Kenneth Eugene Eigenberg  
 Janet Ruth Elliott  
 Michael Dalton Ennis  
 Eric Robert Evitt  
 Joseph John Falke  
 Peter Mark Felker  
 Brian Joseph Fitzsimmons  
 Dorothy Jean Flanagan  
 Jane Elizabeth Frommer  
 James Francis Garvey  
 Jeff Daniel Gelles  
 Patricia Margaret George  
 Gary Eugene Gilmartin  
 James William Gleeson  
 Jorge Soto Gonzalez  
 Marvin Mark Goodgame  
 Paula Jean Grunthaner  
 David Owen Hall  
 Linda Fay Halle  
 Neal Bruce Handy  
 Maureen Alice Hanratty  
 Richard Randolph Hardy  
 Lawrence Michael Henling  
 Brian Garnet Herndier  
 Mark William Hersey  
 Robert Philip Hertzberg  
 Albert John Highe  
 William Dinan Hinsberg  
 Ellen Yuan-Chu Ho  
 Diane Marie Hood  
 Thomas Robert Howard  
 John Mitchell Huggins  
 Richard Alan Ikeda  
 Carl R. Illig  
 David Michael Ingle  
 Melvin Owen Jones  
 Robert James Kaiser, Jr.  
 Santosh Pandurang Kamath  
 Keiko Kanamori  
 Robert McNamara Kanne  
 Jack Alan Kaye  
 Peter Martin Koelsch  
 Charles Frederick Koerting  
 Eric Martin Krauss  
 Robert Paul Kreh  
 Chia-Lam Kuo  
 Paul Martin Lahti  
 William Roger Lambert  
 JohnBosco Chi-Bun Lee  
 George Clark Lisensky  
 Thomas P. Lockhart  
 John James Low  
 Robert Ross Lucchese  
 David Neil Marks  
 William Alan Marritt  
 Craig Timothy Martin  
 David John Mathre  
 Andrew William Maverick  
 James Moers Mayer

Mark H. McAdon  
 Lisa Ann McElwee  
 Dennis Emmett McGee  
 Lawrence R. McGee  
 Daniel Keith McIntyre  
 David Philip Millar  
 James Arthur Miller  
 Charles H. Mitch  
 Mark Allen Mitchell  
 David Jerry Moll  
 Eric Jan Moore  
 Hsiao-ping Hsu Moore  
 Randall Heywood Morse  
 David Randall Moser  
 Jan Stanley Najdzionek  
 Michael Wei-Kuo Nee  
 Paul Vincent Neilson  
 James Joseph Neitzel  
 John Victor Nelson  
 Daniel George Nocera  
 Carol Ann Oken  
 Thomas Howard O'Neill  
 Kevin Curtis Ott  
 Mark Thomas Paffett  
 Laurence Timothy Pearson  
 Thomas Gardner Perkins  
 Joseph Walter Perry  
 Anthony Kay Rappe  
 Jeffrey Allan Reimer  
 Ronald Rianda  
 Steven Frederick Rice  
 Randy Richard Robinson  
 Dean Michael Roddick  
 Clifford Eugene Sacks  
 Napapon Sailasuta  
 Irving Daniel Sand  
 Don Sabatino Santilli  
 Richard Henry Scheller

Steven Alan Schichman  
 Peter George Schultz  
 Robert Allen Scott  
 Thomas L. Shih  
 Paul David Siders  
 Penny Slusser  
 Duane Donald Smith  
 Maile Elizabeth Smith  
 Terrance Patrick Smith  
 Clifford Lawrence Spiro  
 Michael Louis Steigerwald  
 Amy Elizabeth Stevens  
 Tom Hall Stevens  
 Catherine Boxley Strader  
 David John Strader  
 Daniel Albert Straus  
 Barry Allen Swartz  
 Alan Paul Sylwester  
 Terry Ray Taber  
 James Michael Takacs  
 Suvit Thaisrivongs  
 Patricia Ann Thiel  
 Richard Scott Threlkel  
 Florence Lucy Trentacosti  
 Thomas Hallworth Upton  
 Michael Wayne Van Dyke  
 Arthur Ford Voter  
 Hsin Wang  
 Mary Ann White  
 Charles Albert Wight  
 Brian Christopher Willett  
 Ellen D. Williams  
 Jay Richmond Winkler  
 Jaroslav Walery Winniczek  
 Peter Thomas Wolczanski  
 Kathryn Mary Yocom  
 Jennifer Joanne Zinck

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Paul C. Jennings, *Executive Officer for Civil Engineering and Applied Mechanics*

Hans W. Liepmann, *Director of the Graduate Aeronautical Laboratories  
 and Executive Officer for Aeronautics*

James J. Morgan, *Executive Officer for Environmental Engineering Science*

Gerald B. Whitham, *Executive Officer for Applied Mathematics*

### Professors Emeriti

Frederick J. Converse, B.S. . . . . . *Soil Mechanics*  
 Pol E. Duwez, D.Sc. . . . . . *Applied Physics and Materials Science*  
 Arthur L. Klein, Ph.D. . . . . . *Aeronautics*

Frederick C. Lindvall, Ph.D., D.Sc., D.Eng.	<i>Engineering</i>
William H. Pickering, Ph.D., D.Sc., D.Eng.	<i>Electrical Engineering</i>
Milton S. Plesset, Ph.D.	<i>Engineering Science</i>
Ernest E. Sechler, Ph.D.	<i>Aeronautics</i>
Vito A. Vanoni, Ph.D.	<i>Hydraulics</i>
J. Harold Wayland, Ph.D., D.Sc.	<i>Engineering Science</i>

**Professors**

Allan J. Acosta, Ph.D.	<i>Mechanical Engineering</i>
Charles D. Babcock, Jr., Ph.D.	<i>Aeronautics</i>
William B. Bridges, Ph.D.	<i>Electrical Engineering and Applied Physics</i>
Norman H. Brooks, Ph.D.	<i>James Irvine Professor of Environmental and Civil Engineering; Director, Environmental Quality Laboratory</i>
Garry L. Brown, D.Phil.	<i>Aeronautics</i>
Thomas K. Caughey, Ph.D.	<i>Applied Mechanics</i>
Francis H. Clauser, Ph.D.	<i>Clark Blanchard Millikan Professor of Engineering</i>
Donald S. Cohen, Ph.D.	<i>Applied Mathematics</i>
Donald E. Coles, Ph.D.	<i>Aeronautics</i>
Noel R. Corngold, Ph.D.	<i>Applied Physics</i>
Fred E. C. Culick, Ph.D.	<i>Applied Physics and Jet Propulsion</i>
Derek H. Fender, Ph.D.	<i>Biology and Applied Science</i>
Joel N. Franklin, Ph.D.	<i>Applied Mathematics</i>
Roy W. Gould, Ph.D.	<i>Applied Physics</i>
George W. Housner, Ph.D. <sup>1</sup>	<i>Carl F Braun Professor of Engineering</i>
Donald E. Hudson, Ph.D.	<i>Mechanical Engineering and Applied Mechanics</i>
Floyd B. Humphrey, Ph.D.	<i>Electrical Engineering and Applied Physics</i>
Wilfred D. Iwan, Ph.D.	<i>Applied Mechanics</i>
Paul C. Jennings, Ph.D.	<i>Civil Engineering and Applied Mechanics</i>
Herbert B. Keller, Ph.D. <sup>2</sup>	<i>Applied Mathematics</i>
Wolfgang G. Knauss, Ph.D.	<i>Aeronautics</i>
James K. Knowles, Ph.D.	<i>Applied Mechanics</i>
Heinz-Otto Kreiss, Dr. Tech.	<i>Applied Mathematics</i>
Toshi Kubota, Ph.D.	<i>Aeronautics</i>
Paco A. Lagerstrom, Ph.D.	<i>Applied Mathematics</i>
Robert V. Langmuir, Ph.D.	<i>Electrical Engineering</i>
Lester Lees, M.S.	<i>Environmental Engineering and Aeronautics</i>
Hans W. Liepmann, Ph.D.	<i>Charles Lee Powell Professor of Fluid Mechanics and Thermodynamics</i>
E. John List, Ph.D.	<i>Environmental Engineering Science</i>
Frank E. Marble, Ph.D.	<i>Jet Propulsion and Mechanical Engineering</i>
James W. Mayer, Ph.D.	<i>Electrical Engineering</i>
James O. McCaldin, Ph.D.	<i>Applied Physics and Electrical Engineering</i>
Gilbert D. McCann, Ph.D.	<i>Applied Science</i>
Thomas C. McGill, Ph.D.	<i>Applied Physics</i>
Jack E. McKee, Sc.D., D.Eng.	<i>Environmental Engineering</i>
Carver A. Mead, Ph.D.	<i>Computer Science and Electrical Engineering</i>
Robert D. Middlebrook, Ph.D.	<i>Electrical Engineering</i>
Julius Miklowitz, Ph.D.	<i>Applied Mechanics</i>
James J. Morgan, Ph.D.	<i>Environmental Engineering Science</i>
Marc-Aurele Nicolet, Ph.D.	<i>Electrical Engineering</i>
Wheeler J. North, Ph.D.	<i>Environmental Science</i>

<sup>1</sup> Half time

<sup>2</sup> On leave of absence

Charles H. Papas, Ph.D.	Electrical Engineering
John R. Pierce, Ph.D., D.Sc., D.Eng., E.D., LL.D. <sup>1</sup>	Engineering
Fredric Raichlen, Sc.D.	Civil Engineering
W. Duncan Rannie, Ph.D.	Robert H. Goddard Professor of Jet Propulsion and Professor of Mechanical Engineering
Anatol Roshko, Ph.D.	Aeronautics
Rolf H. Sabersky, Ph.D.	Mechanical Engineering
Philip G. Saffman, Ph.D.	Applied Mathematics
Ronald F. Scott, Sc.D.	Civil Engineering
Eli Sternberg, Ph.D., D.Sc.	Mechanics
Homer J. Stewart, Ph.D.	Aeronautics
Bradford Sturtevant, Ph.D.	Aeronautics
Ivan E. Sutherland, Ph.D.	Fletcher Jones Professor of Computer Science
Frederick B. Thompson, Ph.D.	Applied Philosophy and Computer Science
Thad Vreeland, Jr., Ph.D.	Materials Science
Gerald B. Whitham, Ph.D.	Applied Mathematics
Charles H. Wilts, Ph.D.	Electrical Engineering and Applied Physics
David S. Wood, Ph.D.	Materials Science
Theodore Y. Wu, Ph.D.	Engineering Science
Amnon Yariv, Ph.D.	Electrical Engineering and Applied Physics
Edward E. Zukoski, Ph.D.	Jet Propulsion and Mechanical Engineering

**Sherman Fairchild Distinguished Scholars**

Julian D. Cole, Ph.D.	Aeronautics and Applied Mathematics
Horst Hoffmann, Habil.	Solid State Physics
Fritz John, Ph.D.	Applied Mathematics
Walter H. Munk, Ph.D.	Geophysics

**Visiting Professors**

Sheldon K. Friedlander, Ph.D. <sup>2</sup>	Chemical Engineering and Environmental Engineering
Edward C. Posner, Ph.D.	Electrical Engineering
Lawrence L. Rauch, Ph.D.	Electrical Engineering
Russell A. Westmann, Ph.D.	Aeronautics

**Associate Professors**

Christopher Brennen, Ph.D.	Mechanical Engineering
Francis S. Buffington, Sc.D.	Materials Science
Thomas J. R. Hughes, Ph.D.	Structural Mechanics
Hardy C. Martel, Ph.D.	Electrical Engineering
David F. Welch, I.D.	Engineering Design

**Visiting Associate Professors**

Martin Rem, Ph.D.	Computer Science
Lincoln J. Wood, Ph.D.	Systems Engineering

**Research Associates**

James E. Broadwell, Ph.D.	Aeronautics
John P. Gray, Ph.D.	Computer Science

<sup>1</sup> Half time

<sup>2</sup> In residence 1978-79

Robert C. Y. Koh, Ph.D. ....	<i>Environmental Engineering Science</i>
Charles L. Seitz, Ph.D. ....	<i>Computer Science</i>

### Visiting Associates

Jack L. Alford, Ph.D. ....	<i>Civil Engineering</i>
Mircea A. Barglazan, Dipl. <sup>1</sup> ....	<i>Mechanical Engineering</i>
Malcolm I. C. Bloor, Ph.D. <sup>1</sup> ....	<i>Applied Mathematics</i>
Maria I. Bochenek, M.S. <sup>1</sup> ....	<i>Aeronautics</i>
William T. Burke, B.S.E.E. ....	<i>Computer Science</i>
Anthony T. W. Cheung, Ph.D. ....	<i>Engineering Science</i>
Ellen R. Domb, Ph.D. ....	<i>Applied Physics</i>
Sverre T. Eng, Dr. Tech. ....	<i>Electrical Engineering</i>
James M. Galligan, Ph.D. <sup>1</sup> ....	<i>Materials Science</i>
Edward M. Gates, Ph.D. ....	<i>Mechanical Engineering</i>
Avraham Gover, Ph.D. <sup>1</sup> ....	<i>Applied Physics</i>
Estelle Gregory, Ph.D. ....	<i>Biomedical Engineering</i>
Michael S. Longuet-Higgins, Ph.D. ....	<i>Applied Mathematics</i>
Seid Hossein Izadpanah, Ph.D. <sup>1</sup> ....	<i>Applied Physics</i>
Deane B. Jacques, M.D. ....	<i>Biomedical Engineering</i>
Aurora M. Landel, Ph.D. <sup>1</sup> ....	<i>Biomedical Engineering</i>
Shlomo Margalit, D.Sc. <sup>1</sup> ....	<i>Applied Physics</i>
Vasilis Z. Marmarelis, Ph.D. <sup>1</sup> ....	<i>Bioinformation Systems</i>
Samuel A. Marshall, Ph.D. <sup>1</sup> ....	<i>Engineering Science</i>
Akio Masuyama, Dr. Eng. <sup>1</sup> ....	<i>Electrical Engineering</i>
James D. Murray, Ph.D., D.Sc. <sup>1</sup> ....	<i>Applied Mathematics</i>
Frank Obermeier, Ph.D. ....	<i>Applied Mathematics</i>
Thomas E. Ogden, M.D., Ph.D. ....	<i>Biomedical Engineering</i>
Hiroichi Ohira, D.Eng. ....	<i>Aeronautics</i>
Daniel M. Oldenzel, Ph.D. ....	<i>Mechanical Engineering</i>
Gary Parker, Ph.D. <sup>1</sup> ....	<i>Hydraulics</i>
Ruggero L. Pierantoni, Ph.D. ....	<i>Biomedical Engineering</i>
Simon Ramo, Ph.D. ....	<i>Engineering</i>
Subramanian Ranganathan, Ph.D. <sup>1</sup> ....	<i>Applied Physics</i>
Ilan Samid, Ph.D. <sup>1</sup> ....	<i>Applied Physics</i>
C. Hunter Shelden, M.D. ....	<i>Biomedical Engineering</i>
Ryo Suzuki, Ph.D. ....	<i>Applied Physics</i>
Martin F. von Allmen, Ph.D. ....	<i>Applied Physics</i>
Howard Winet, Ph.D. ....	<i>Engineering Science</i>
Dean E. Wooldridge, Ph.D. ....	<i>Engineering</i>
Moshe Yust, M.Sc. ....	<i>Applied Physics</i>

### Assistant Professors

Paul M. Bellan, Ph.D. ....	<i>Applied Physics</i>
Glen R. Cass, Ph.D. ....	<i>Environmental Engineering</i>
Slobodan M. Cuk, Ph.D. ....	<i>Electrical Engineering</i>
Paul E. Dimotakis, Ph.D. ....	<i>Aeronautics and Applied Physics</i>
Richard C. Flagan, Ph.D. ....	<i>Environmental Engineering Science</i>
Bengt Fornberg, Ph.D. ....	<i>Applied Mathematics</i>
William L. Johnson, Ph.D. ....	<i>Materials Science</i>
James T. Kajiya, Ph.D. ....	<i>Computer Science</i>
Charles R. Minter, Ph.D. ....	<i>Computer Science</i>
Darryl L. Smith, Ph.D. ....	<i>Applied Physics</i>

<sup>1</sup>In residence 1978-79

**Senior Research Fellows**

Mool C. Gupta, Ph.D. ....	<i>Aeronautics</i>
Vernal H. Kenner, Ph.D. ....	<i>Aeronautics</i>
Silvanus S. Lau, Ph.D. <sup>1</sup> ....	<i>Applied Physics</i>
George T. Yates, Ph.D. ....	<i>Engineering Science</i>

**Instructors**

James C. Long, Ph.D. ....	<i>Electrical Engineering</i>
Philip M. Neches, M.S. <sup>2</sup> ....	<i>Computer Science</i>

**Lecturers**

Stanley H. Bacon ....	<i>Electrical Engineering</i>
Gerald J. Bierman, Ph.D. ....	<i>Systems Engineering</i>
John Choma, Jr., Ph.D. ....	<i>Electrical Engineering</i>
Richard R. Green, Ph.D. <sup>2</sup> ....	<i>Electrical Engineering</i>
James R. Lesh, Ph.D. <sup>2</sup> ....	<i>Electrical Engineering</i>
Thomas R. McDonough, Ph.D. ....	<i>Engineering</i>
Amr M. Mohsen, Ph.D. ....	<i>Electrical Engineering</i>
Marc H. Raibert, Ph.D. ....	<i>Computer Science</i>
Charles B. Ray, M.S. ....	<i>Computer Science</i>
Marvin K. Simon, Ph.D. ....	<i>Electrical Engineering</i>
David Sonnabend, M.S. ....	<i>Systems Engineering</i>

**Research Fellows**

Michael J. Barcelona, Ph.D. ....	<i>Environmental Engineering Science</i>
Nadav Bar-Chaim, Ph.D. ....	<i>Applied Physics</i>
Robert E. Breidenthal, Jr., Ph.D. ....	<i>Aeronautics</i>
Richard H. Buckholz, Jr., Ph.D. <sup>2</sup> ....	<i>Engineering Science</i>
Pandipati R. K. Chetty, Ph.D. ....	<i>Electrical Engineering</i>
Thomas Erneux, Ph.D. ....	<i>Applied Mathematics</i>
Athanassios S. Fokas, Ph.D. ....	<i>Applied Mathematics</i>
Gregory Gartrell, Jr., Ph.D. <sup>3</sup> ....	<i>Environmental Engineering Science</i>
Valrie Ann Gerard, Ph.D. ....	<i>Environmental Engineering Science</i>
Ilan Golecki, Ph.D. ....	<i>Applied Physics</i>
Lambertus Hesselink, Ph.D. <sup>4</sup> ....	<i>Fluid Mechanics</i>
S. John Hogan, Ph.D. ....	<i>Applied Mathematics</i>
Antoine Kahn, Ph.D. <sup>2</sup> ....	<i>Applied Physics</i>
Kyung-Suk Kim, Ph.D. ....	<i>Aeronautics</i>
John P. Kroeker, Ph.D. ....	<i>Bioinformation Systems</i>
Mark J. Kushner, Ph.D. <sup>3</sup> ....	<i>Applied Physics</i>
David M. Lee, Ph.D. ....	<i>Earthquake Engineering</i>
Stephen H. Lieberman, Ph.D. ....	<i>Environmental Engineering Science</i>
Bruce E. MacNeal, Ph.D. ....	<i>Applied Physics</i>
Martti O. T. Maenpaa, Lic. Tech. ....	<i>Applied Physics</i>
Steven L. Manley, Ph.D. ....	<i>Environmental Engineering Science</i>
Samuel E. Matteson, Ph.D. ....	<i>Applied Physics</i>

<sup>1</sup> Also part-time Lecturer in Materials Science<sup>2</sup> In residence, 1978-79<sup>3</sup> Chaim Weizmann Research Fellow<sup>4</sup> Also part-time Lecturer in Applied Physics

Gabor Mezey, Ph.D. ....	<i>Applied Physics</i>
Tom Smedsaas, Ph.D. ....	<i>Applied Mathematics</i>
Gary Strumolo, Ph.D. <sup>1</sup> .....	<i>Applied Mathematics</i>
Coenraad A. Swarts, Ph.D. <sup>2</sup> .....	<i>Applied Physics</i>
Alan A. Vetter, Ph.D. ....	<i>Applied Physics</i>
Hermann C. von Seefeld, Ph.D. ....	<i>Applied Physics</i>
Per Fredrik Wahlund, D.Phil. ....	<i>Applied Mathematics</i>

<sup>1</sup>In residence 1978-79  
<sup>2</sup>IBM Research Fellow

**Member of the Professional Staff**

William H. Bettes, *Manager GALCIT*

**Graduate Students 1979-80**

*Aeronautics*

Kim Maynard Aaron	Daniel Mark Nosenchuck
Kenneth W. Barker	Tor Endre Ostbo
Thomas Patrick Bauer	Dimitris A. Papantoniou
Luis Paulino Bernal	Judith Elaine Peach
Christopher Jeyaparan Catherasoo	Paul Michael Rapacz
Herzl Chai	Krishnaswamy Ravi Chandar
Samuel Kwang-Yeh Chang	Fredrick Allan Roberts
John Michael Cimbala	Thomas Roesgen
Phuc The Doan	Paul David Ronney
Igor Joze Emri	Olivier Roy
Frank K. Fay	Todd S. Rust
Morteza Gharib	Edward Kenneth Ruth
Ari Glezer	Alejandro Sergio Salamonovitz
Jean-Francois Luc Haas	William Stapf Sargent
James Carl Hermanson	Kevin John Sene
Luc Jozef Heymans	Choon-foo Shih
David Matthew Kuzo	Lorenz Willard Sigurdson
Stelios Kyriakides	David John Steigmann
Kenneth MacDougall Liechti	Ming Han Tang
Wen W. Liu	Vicente Tortoriello
Peter F. Lorber	Bernd Otto Trebitz
Hiroshi Maekawa	Timothy Neal Turner
Patrick Jacques Mattei	Luigi Vigevano
Manoochehr Mohseni-Koochesfahani	Steven Ray Vosen
M. Mullainathan	Chiun Wang
Mark Godfrey Mungal	Joseph Kam-Leung Wat
Michele Nesme	Keith P. Zondervan
Peter John Nicklin	Kevin L. Zondervan
Hideki Nomoto	

*Applied Mathematics*

John Wilson Barker	James Robert Mueller
Evangelos Athanassios Coutsas	Allen C. Robinson
Patrick H. Dunne	Louis Anthony Romero
Jeffrey M. Fier	James Carl Schatzman
Allan Douglas Jepson	Robert Elmer Scheid
William Lawrence Kath	Jeffrey Alan Simmen
Gregory William Medlin	Zareh S. Tatoian

*Applied Mechanics*

Mark Carter Anderson  
 Carl Leei Chen  
 Jeremiah Finbarr Connolly  
 Graham Christopher Fleming  
 Graeme Francis Fowler  
 Basile Jarmak  
 Charles Morton Krousgrill, Jr.  
 Graeme Haynes McVerry

*Applied Physics*

Pierre Asselin  
 Thomas Clyde Banwell  
 Randall Keith Bartman  
 David Verge Baxter  
 Thomas Michael Bemis  
 Martha Ann Berding  
 Henry Abram Blauvelt  
 Michael Anthony Blessinger  
 Elliott Rowe Brown  
 Pei Chuang Chen  
 Wootong Nathan Cheung  
 Arthur Er-terg Chiou  
 Liew-Chuang Chiu  
 Bruce Montgomery Clemens  
 Reuben T. Collins  
 Kenneth Robert Elliott  
 Randall Meindert Feenstra  
 Eric Donald Fredrickson  
 James R. Fruchterman  
 Andrew Keith Gabriel  
 Timothy Joseph Gallagher  
 Patrick William Goalwin  
 Glenn Joel Greene  
 Mark Allen Hedemann  
 Anne Marie Hofmeister  
 Ralph Boyd James  
 Prakash Kasiraj  
 David Clark Keezer  
 Isabella Brygida Kierkowska  
 Thomas Lawson Koch  
 Evelyn Ann Kramer

*Civil Engineering*

Jean-Pierre Bardet  
 Jean-Luc Bilhou-Nabera  
 Dirceu Luiz Rodrigues Botelho  
 Alexander N. Brooks  
 William Robert Brownlie  
 Jing-Chang Chen  
 Glen John Cherepon  
 John Eric Christenson  
 Martin Francis Cohen  
 Bernard Andre Jean-Marie Cuny  
 Lee Don Dobbs  
 Reda Abdu el-Hay Mohamed Ali El-Damak

Timothy Christopher O'Sullivan  
 Thomas James Pence  
 Gustaf Per Reinhall  
 Nicolas Alexis Roy  
 Rodney Allen Stephenson  
 James Michael Winget  
 Paul Jerome Yoder  
 Layne Zee

David Alan Krider  
 Thomas Francis Kuech  
 Daniel Bernard Lang  
 Martin D. Lerner  
 Christian Mailhiot  
 Gordon Stuart Mitchard  
 Douglas Marion Moody, Jr.  
 Richard Harrison Moyer  
 Michael Steven Muha  
 Dean Paul Neikirk  
 David Mort Pepper  
 Dale Austen Prouty  
 Mark Alan Richards  
 Kenneth V. Rousseau  
 Robert Schulz  
 David Martin Scott  
 Joseph Emmett Shepherd  
 Chun-Ching Shih  
 Virgil Simon Speriosu  
 Lawrence Henry Sverdrup, Jr.  
 Michael Alan Tenhower  
 John R. Torczynski  
 Jeffrey Eugene Ungar  
 Israel Ury  
 Jeffrey Owen White  
 Arthur Ray Williams  
 Daniel Paul Wilt  
 Paul Kit-Lai Yu  
 Jan Jacek Zebrowski  
 Amikam Zur

Marius Gerber  
 Medhat Ahmed El-Sayed Haroun  
 Randall Lee Harrill  
 Mohammed Fawzy Helwa  
 Moh-jian Huang  
 Behnam Hushmand  
 Dominic John Izzo  
 Sudhir Kumar Jain  
 Garrett Duane Jeong  
 Thierry Lepelletier  
 Albert Niu Lin  
 Anne Lin



Wing Kam Liu  
 Jaime Jose Olaechea  
 Louis Alexander Ortiz  
 Ronald Yu Sang Pak  
 Panayiotis Nikolas Papanicolaou  
 Ioannis John Psycharis

*Computer Science*

Anthony Francis Barton  
 Eric Edward Barton  
 Sally Anne Browning  
 Christopher Ralph Carroll  
 Marina Chien-Mei Chen  
 Young-Il Choo  
 Erik Penn DeBenedictis  
 Stefan Gabriel Demetrescu  
 Gregory H. Efland  
 Moshe Gray  
 Gideon Hess  
 Sai Yuen Billy Ho  
 Tai-Ping Ho  
 David Lawrence Johannsen  
 Charles Richard Lang, Jr.  
 Herman Sui Ning Li

*Electrical Engineering*

Mustafa Abushagur Gyth Abushagur  
 Abdul-Rehman Abdul-Mohsen Al-Bassam  
 Denis William Aull  
 Nancy Walden Barcus  
 Meir Bartur  
 Farhad Barzegar  
 Robert Jacques Bensoussan  
 Bruno Bernard Berlizot  
 Philippe Rene Bertrand  
 Alex M. Bolea  
 Richard Carl Bozzuto, Jr.  
 Arthur Raymond Brown  
 Giles Chaumeny  
 Bo Hyung Cho  
 Joseph James Connery, Jr.  
 Henry Marie Defalque  
 Alain Delsupexhe  
 Mark Barry Dolson  
 Steven Glen Eaton  
 James Richard Ellison  
 Nader Engheta  
 Robert Warren Erickson, Jr.  
 Sai-Wai Fu  
 Celestino John Gaeta  
 Dhrumil Jayantilal Gandhi  
 Douglas Gene Hager  
 Christopher Harder  
 Jerry Michael Harris  
 Kuo Ting Ho

Ahmed Atef Rashed  
 Michael Vincent Russo  
 John George Sherstobitoff  
 James Eric Skjelbreia  
 Costas Emmanuel Synolakis  
 Catharine L. van Ingen

Pey-yun Li  
 Bartholomew N. Locanthi III  
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 Philip Malcolm Neches  
 Alexandros Christos Papachristidis  
 James Allely Rowson  
 Richard Lawrence Segal  
 Larry Dean Seiler  
 Gary Mario Tarolli  
 Alastair James Thompson  
 Stephen Mathias Trimberger  
 Michael Karl Ullner  
 Lawrence Allan White  
 Telle Elizabeth Whitney  
 Kwang-I Yu

Kwok Kee Ho  
 Kuan-Hsiung Hsieh  
 Shi-Ping Hsu  
 Joseph Katz  
 Michael Joseph Kavaya  
 Conor Francis Kehoe  
 David Louis Keller  
 Vijaya Narayan Korwar  
 Albert Yau Yee Lam  
 Billy Ying Bui Lau  
 Kam-Yin Lau  
 Bosco Hok-Chung Leung  
 Bruce Stephen Levine  
 Shawn Michael Logan  
 Paul Henry Milenkovic  
 Patrick Bartholomew Moran  
 Phyllis Roberta Nelson  
 Khai D. T. Ngo  
 Elliot Martin Pines  
 William Michael Polivka  
 Arati Prabhakar  
 Keith Gerard Regan  
 Loman Rensink  
 Wayne Harvey Richardson  
 William Allen Salter  
 Martine Marie Francoise Savalle  
 Pierre Schnoeller  
 Edgard Roger Schweig  
 Linda Ann Seltzer

Ralph Eric Strong  
 John Edward Tanner  
 Allen Eric Tracht  
 Bor-Yeu Tsaur  
 Paul William Tuinega

*Engineering Science*

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 Michael Jiu-Wei Chen  
 Jean-Luc Cornet  
 Peter Kent Edberg  
 K. Jeffrey Eriksen  
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 Nam Quan Huyn  
 Michael Yih-Hwa Jin

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Lisa Anderson  
 Martha Harriet Conklin  
 Deanna Sherry Dean  
 Jesus Moria De La Garza Rodriguez  
 Bruce Charles Faust  
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 Harry Andrew Gray  
 James Evan Houseworth  
 James Robert Hunt  
 Steven Wayne Johnston  
 Tony Siu Pong Kong  
 James Shigeru Kuwabara  
 Howard Michael Liljestrand  
 Gregory John McRae

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Paul Baxter Harwood

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 MD Khairul Alam  
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 Katherine Hamilton Barhydt  
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 David Miner Braisted  
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 Dimitri S. Chamieh  
 Albert Lee Charles  
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 Burnett Deloney Gunter  
 Shawn Anthony Hall  
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 Belgacem Jery  
 Ann Renee Karagozian  
 Joseph Katz  
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 Francois Le Clerc de Bussy  
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 Edmond Yatman Lo  
 Eric Francois Matthys  
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Olin Perry Norton  
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 Julio A. Rodriguez Polanco  
 Armistead Goode Russell  
 Makoto Satoh

Paul M. Schermerhorn  
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 Duane Andre Smith  
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 Malladi Venkata Subbaiah  
 Dean Dalton Taylor  
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 Kamal Youcef Toumi  
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**Research Fellows**

Mark Allen, Ph.D. ....	<i>Planetary Science</i>
Michel Cara, Ph.D. ....	<i>Geophysics</i>
Shuji Deguchi, Ph.D. ....	<i>Planetary Science</i>
Joel E. Everson, Ph.D. ....	<i>Geochemistry</i>
Kazuya Fujita, Ph.D. ....	<i>Geophysics</i>
Marian J. Furst, Ph.D. ....	<i>Geochemistry</i>
Stephen H. Hartzell, Ph.D. ....	<i>Geophysics</i>
Tai-Lin Hong, Ph.D. ....	<i>Geophysics</i>
Thomas Kaiser, Ph.D. ....	<i>Geochemistry</i>
Louise Levien, Ph.D. ....	<i>Geology</i>
Barry R. Lienert, Ph.D. ....	<i>Geophysics</i>
Kon-Kee Liu, Ph.D. ....	<i>Geochemistry</i>
George Mellman, Ph.D. ....	<i>Geophysics</i>
Franz R. Niederer, Ph.D. ....	<i>Geochemistry</i>
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Malcolm R. Somerville, Ph.D. ....	<i>Geophysics</i>
Ute R. Vetter, Ph.D. ....	<i>Geophysics</i>
Ian S. Williams, Ph.D. ....	<i>Geology</i>

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Arthur A. Chodos, M.S., *Senior Research Spectroscopist*  
 Glenn L. Berge, Ph.D., *Senior Scientist*

**Graduate Students, 1979-80***Applied Physics*

Mark Bruce Boslough

Gregory Allen Lyzenga

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Timothy Miller Benjamin

John Hume Jones

Robert Everett Criss

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*Planetary Science*

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William T. Jones, Ph.D. <sup>2</sup> .....	<i>Philosophy</i>
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George P. Mayhew, Ph.D. <sup>1</sup> .....	<i>English</i>
Richard D. McKelvey, Ph.D. ....	<i>Political Science</i>
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Robert W. Oliver, Ph.D. ....	<i>Economics</i>
Rodman W. Paul, Ph.D. ....	<i>Edward S. Harkness Professor of History</i>
Charles R. Plott, Ph.D. ....	<i>Economics</i>
James P. Quirk, Ph.D. <sup>1</sup> .....	<i>Economics</i>
Robert A. Rosenstone, Ph.D. ....	<i>History</i>
Thayer Scudder, Ph.D. ....	<i>Anthropology</i>
Eleanor M. Searle, Ph.D. ....	<i>History</i>
Frederick B. Thompson, Ph.D. ....	<i>Applied Philosophy and Computer Science</i>

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G. S. Maddala, Ph.D. ....	<i>Economics</i>

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Steven A. Lippman, Ph.D. ....	<i>Business Economics</i>
Alan Schwartz, LL.B. ....	<i>Law and Social Science</i>

**Associate Professors**

Louis Breger, Ph.D. ....	<i>Psychology</i>
Heinz E. Ellersieck, Ph.D. ....	<i>History</i>
Stuart A. Ende, Ph.D. ....	<i>English</i>
Jenijoy La Belle, Ph.D. ....	<i>English</i>
David R. Smith, Ph.D. ....	<i>English</i>
Louis L. Wilde, Ph.D. ....	<i>Economics</i>

**Visiting Associate Professor**

James S. Jordan, Jr., Ph.D. ....	<i>Economics</i>
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**Research Associates**

R. Talbot Page, Ph.D. ....	<i>Economics</i>
Bozena Henisz-Dostert Thompson, Ph.D. ....	<i>Linguistics</i>

<sup>1</sup>Leave of absence

<sup>2</sup>Part time

### Visiting Associates

Edward J. Green, Ph.D.	<i>Economics</i>
Nancy Hayles, Ph.D.	<i>English</i>
Hans-Jörn Kruse, Dr. rer. pol.	<i>Economics</i>
Edward W. Packel, Ph.D.	<i>Political Science</i>

### Assistant Professors

Kim Border, Ph.D.	<i>Economics</i>
Bruce E. Cain, Ph.D.	<i>Political Science</i>
Robert Forsythe, Ph.D.	<i>Economics</i>
David W. Galenson, Ph.D. <sup>1</sup>	<i>Social Science and History</i>
D. Roderick Kiewiet, Ph.D.	<i>Political Science</i>
Forrest D. Nelson, Ph.D.	<i>Economics</i>
George W. Pigman III, Ph.D.	<i>English</i>
Jennifer F. Reinganum, Ph.D.	<i>Economics</i>
Randolph N. Splitter, Ph.D.	<i>English</i>

### Visiting Assistant Professor

David DeLeon, Ph.D.	<i>History</i>
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### Mellon Postdoctoral Instructors

Gordon Appleby, Ph.D.	<i>Anthropology</i>
Terrence J. McDonald, Ph.D.	<i>History</i>

### Instructors

David W. Burchmore, Ph.D.	<i>English</i>
Nicholas B. Dirks, Ph.D.	<i>History</i>

### Lecturers

Andreas Aebi, Ph.D.	<i>German</i>
Irving S. Bengelsdorf, Ph.D. <sup>1</sup>	<i>Science Communication</i>
David J. Britton, D.M.A.	<i>Music</i>
Lee F. Browne, M.S. <sup>1</sup>	<i>Education</i>
Klara Carmely, Ph.D.	<i>German</i>
Clayton Eshleman, M.A.T.	<i>Dreyfuss Poet in Residence and Lecturer in Creative Writing</i>
Barbara Fass, Ph.D. <sup>1</sup>	<i>Psychology</i>
Brady Lee Garrison, M.A.	<i>Debate</i>
Sonia Ghattas, Ph.D.	<i>French</i>
Stirling L. Huntley, Ph.D.	<i>Drama</i>
Edward Hutchings, Jr., B.A.	<i>Journalism</i>
Sigrid R. McPherson, Ph.D. <sup>1</sup>	<i>Psychology</i>
David W. Morrisroe, M.B.A. <sup>1</sup>	<i>Business Economics</i>
Jon R. Pariser, M.A.	<i>Russian</i>
Aimée Brown Price, Ph.D.	<i>Art History</i>
Harihar Rao	<i>Music</i>
Anne C. Rose, M.A.	<i>History</i>
Elma Schonbach, B.M.	<i>Music</i>
Annette J. Smith, Ph.D.	<i>French</i>
Victor V. Veysey, M.B.A. <sup>1</sup>	<i>Business Economics and Industrial Relations</i>
Robert R. Wark, Ph.D. <sup>1</sup>	<i>Art</i>
Valentina Zaydman, M.A.	<i>Russian</i>

<sup>1</sup>Part-time



**Research Fellow**

George Fox, Ph.D. . . . . *Economics*

**Graduate Students 1979-80**

*Social Science*

Joel Abe Balbien  
 Michael Stanley Becker  
 Donna Hope Berry  
 Isabelle Roux-Buisson  
 Randall Lee Calvert  
 Cynthia Rae Carlson  
 Gary Walter Cox  
 James Michael Gerard  
 Robert William Hahn  
 Steven Wayne Hashimoto  
 James Takfay Hong  
 Robert Mark Isaac  
 Jeffrey Bowman Johnson  
 Julie Marie Laherty  
 Carl J. Lydick

Mathew Daniel McCubbins  
 Kenneth Frank McCue  
 Thomas Rossman Palfrey III  
 Asha Bhalachandra Paranjape  
 William Paul Rogerson  
 Venkatraman Sadanand  
 John Patrick Schmitz  
 Stephen Richard Selinger  
 Charles Seymour Slater  
 Lee Ira Sparling  
 Shin-Ichi Takekuma  
 Howard Alan Tarre  
 Paul Arthur Thomas  
 John Marshall Williamson

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 Eugene W. Cowan, Ph.D.<sup>1</sup> . . . . . *Physics*  
 Leverett Davis, Jr., Ph.D. . . . . *Physics*  
 Richard A. Dean, Ph.D. . . . . *Mathematics*

<sup>1</sup>Leave of absence, first term, 1979-80

Charles R. De Prima, Ph.D.	Mathematics
Robert P. Dilworth, Ph.D.	Mathematics
Ronald W. P. Drever, Ph.D.	Physics
Richard P. Feynman, Ph.D., Nobel Laureate	Richard Chace Tolman Professor of Theoretical Physics
William A. Fowler, Ph.D., D.Sc.	Institute Professor of Physics
Steven C. Frautschi, Ph.D.	Theoretical Physics
F. Brock Fuller, Ph.D.	Mathematics
Gordon P. Garmire, Ph.D.	Physics
Murray Gell-Mann, Ph.D., Sc.D., Nobel Laureate <sup>1</sup>	Robert Andrews Millikan Professor of Theoretical Physics
Marvin L. Goldberger, Ph.D.	Theoretical Physics
Peter Goldreich, Ph.D.	Planetary Science and Astronomy
Ricardo Gomez, Ph.D.	Physics
David L. Goodstein, Ph.D.	Physics and Applied Physics
Jesse L. Greenstein, Ph.D.	Lee A. DuBridges Professor of Astrophysics
James E. Gunn, Ph.D.	Astronomy
Marshall Hall, Jr., Ph.D.	IBM Professor of Mathematics
Ralph W. Kavanagh, Ph.D.	Physics
Herbert B. Keller, Ph.D. <sup>1</sup>	Applied Mathematics
Heinz-Otto Kreiss, Docent	Applied Mathematics
Robert B. Leighton, Ph.D.	Physics
Gary Lorden, Ph.D.	Mathematics
W. A. J. Luxemburg, Ph.D.	Mathematics
Jon Mathews, Ph.D. <sup>1</sup>	Theoretical Physics
James E. Mercereau, Ph.D., D.Sc.	Physics and Applied Physics
Alan T. Moffet, Ph.D.	Radio Astronomy
Gerry Neugebauer, Ph.D.	Physics
J. Beverley Oke, Ph.D.	Astronomy
Charles W. Peck, Ph.D.	Physics
Jerome Pine, Ph.D.	Physics
H. David Politzer, Ph.D.	Theoretical Physics
Herbert J. Ryser, Ph.D.	Mathematics
Wallace L. W. Sargent, Ph.D.	Astronomy
Maarten Schmidt, Ph.D., Sc.D.	Astronomy
Frank J. Sciulli, Ph.D.	Physics
Edward C. Stone, Jr., Ph.D.	Physics
Kip S. Thorne, Ph.D.	Theoretical Physics
John Todd, B.Sc.	Mathematics
Thomas A. Tombrello, Jr., Ph.D.	Physics
Rochus E. Vogt, Ph.D.	Physics
David B. Wales, Ph.D.	Mathematics
Robert L. Walker, Ph.D.	Physics
Alan Weinstein, Ph.D.	Mathematics
Ward Whaling, Ph.D.	Physics
Gerald B. Whitham, Ph.D.	Applied Mathematics
Fredrik Zachariasen, Ph.D.	Theoretical Physics
Harold Zirin, Ph.D.	Astrophysics
George Zweig, Ph.D.	Theoretical Physics

**Sherman Fairchild Distinguished Scholars**

Alexandra Bellow, Ph.D.	Mathematics
Irving Kaplansky, Ph.D.	Mathematics

<sup>1</sup>Leave of absence, 1979-80

Lyman Spitzer, Ph.D. ....	<i>Astronomy</i>
Valentine Telegdi, Ph.D. ....	<i>Physics</i>
John Thompson, Ph.D. ....	<i>Mathematics</i>

**Visiting Distinguished Scholar**

Bruno Zumino, Ph.D. ....	<i>Theoretical Physics</i>
--------------------------	----------------------------

**Visiting Professors**

Benno Fuchssteiner, Ph.D. ....	<i>Mathematics</i>
N. G. de Bruijn, Ph.D. ....	<i>Mathematics</i>
James G. Wendel, Ph.D. ....	<i>Mathematics</i>

**Associate Professors**

Judith G. Cohen, Ph.D. ....	<i>Astronomy</i>
Geoffrey Fox, Ph.D. ....	<i>Theoretical Physics</i>
David Hitlin, Ph.D. ....	<i>Physics</i>
Alexander S. Kechris, Ph.D. ....	<i>Mathematics</i>
Steven E. Koonin, Ph.D. ....	<i>Physics</i>
Peter G. Wannier, Ph.D. ....	<i>Radio Astronomy</i>

**Visiting Associate Professor**

Michael J. Collins, Ph.D. ....	<i>Mathematics</i>
--------------------------------	--------------------

**Research Associates**

Richard D. Field, Ph.D. <sup>1</sup> ....	<i>Theoretical Physics</i>
Richard J. Powers, Ph.D. ....	<i>Physics</i>
Pierre Ramond, Ph.D. ....	<i>Physics</i>
Anthony C. S. Readhead, Ph.D. ....	<i>Radio Astronomy</i>
John H. Schwarz, Ph.D. ....	<i>Theoretical Physics</i>
George A. Seielstad, Ph.D. ....	<i>Radio Astronomy</i>
Petr Vogel, Ph.D. ....	<i>Physics</i>

**Visiting Associates**

Daniel Birx, Ph.D. ....	<i>Physics</i>
Ronald J. Crowley, Ph.D. ....	<i>Physics</i>
Ebbel de Jonge, Ph.D. ....	<i>Mathematics</i>
David Garelick, Ph.D. ....	<i>Physics</i>
Sylvester J. Gates, Ph.D. ....	<i>Theoretical Physics</i>
Leonid P. Grishchuk, Ph.D. ....	<i>Physics</i>
Albert J. Howard, Ph.D. ....	<i>Physics</i>
Sir Fred Hoyle, D.Sc. ....	<i>Physics</i>
Ardon Hyland, Ph.D. ....	<i>Physics</i>
Denis Johnson, Ph.D. ....	<i>Mathematics</i>
Joseph B. Krieger, Ph.D. ....	<i>Physics</i>
Paul S. Lee, Ph.D. ....	<i>Physics</i>
Thomas G. Phillips, Ph.D. ....	<i>Radio Astronomy</i>
Charles Rockland, Ph.D. ....	<i>Mathematics</i>

<sup>1</sup>Richard Chace Tolman Research Associate

P. G. Rooney, Ph.D.	<i>Mathematics</i>
Mark H. Shapiro, Ph.D.	<i>Physics</i>
Armando Silva Moreira, Ph.D.	<i>Physics</i>
James H. Trainor, Ph.D.	<i>Physics</i>

#### Assistant Professors

Jack F. Conn, Ph.D.	<i>Mathematics</i>
Eric J. Siskind, Ph.D.	<i>Physics</i>
Peter Young, Ph.D.	<i>Astronomy</i>

#### Senior Research Fellows

G. John Dick, Ph.D.	<i>Applied Physics</i>
Alan M. Dressler, Ph.D.	<i>Astronomy</i>
Richard Ellis, Ph.D.	<i>Theoretical Physics</i>
Thomas R. Geballe, Ph.D.	<i>Astronomy</i>
Terrance J. Goldman, Ph.D.	<i>Theoretical Physics</i>
Gillian Knapp, Ph.D.	<i>Radio Astronomy</i>
Kwok-Yung Lo, Ph.D.	<i>Radio Astronomy</i>
Kenneth Marsh, Ph.D.	<i>Astrophysics</i>
Richard A. Mewaldt, Ph.D.	<i>Physics</i>
Ronald L. Moore, Ph.D.	<i>Astrophysics</i>
Douglas Ross, Ph.D.	<i>Theoretical Physics</i>
I-Juliana Sackmann, Ph.D.	<i>Physics</i>
Michael Shaevitz, Ph.D.	<i>Physics</i>
B. Thomas Soifer, Ph.D.	<i>Physics</i>

#### Instructors

Michael J. Hoffman, Ph.D. <sup>1</sup>	<i>Mathematics</i>
A. J. Janssen, Ph.D. <sup>1</sup>	<i>Mathematics</i>
Richard P. Morton, Ph.D. <sup>1</sup>	<i>Mathematics</i>
Robert Roth, Ph.D. <sup>1</sup>	<i>Mathematics</i>
Anton R. Schep, Ph.D.	<i>Mathematics</i>
William A. Squires, Ph.D. <sup>1</sup>	<i>Mathematics</i>
Neculai S. Teleman, Ph.D.	<i>Mathematics</i>

#### Research Fellows

Thomas B. Ake III, Ph.D.	<i>Astronomy</i>
Yoram Alhassid, Ph.D. <sup>2</sup>	<i>Physics</i>
Charles Beichman, Ph.D.	<i>Physics</i>
William Bieber, Ph.D.	<i>Physics</i>
Eric Bovet, Ph.D.	<i>Physics</i>
Carlton M. Caves, Ph.D.	<i>Physics</i>
Brian L. Combridge, Ph.D.	<i>Physics</i>
France A. Cordova, Ph.D.	<i>Physics</i>
Peter Cottrell, Ph.D.	<i>Astronomy</i>
Joseph Cugnon, Ph.D.	<i>Physics</i>
William M. DeCampli, Ph.D. <sup>2</sup>	<i>Astrophysics</i>
K. R. Sandhya Devi, Ph.D.	<i>Physics</i>

<sup>1</sup> Harry Bateman Research Instructor

<sup>2</sup> Chaim Weizmann Research Fellow

Jean O. Dickey, Ph.D.	Physics
Joseph E. Griffith, Ph.D.	Physics
Frank P. Israel, Ph.D.	Radio Astronomy
Rosemary G. Kennett, Ph.D.	Physics
Edward W. Kolb, Ph.D.	Physics
Bahram Mashhoon, Ph.D.	Physics
Colin R. Masson, Ph.D.	Radio Astronomy
David L. Meier, Ph.D.	Physics
Robert L. Messner, Ph.D.	Physics
Stefan Mochnecki, Ph.D.	Astronomy
John A. Nousek, Ph.D.	Physics
Bruce M. Paine, Ph.D.	Physics
David G. Payne, Ph.D.	Theoretical Astrophysics
Timothy J. Pearson, Ph.D.	Radio Astronomy
Frank C. Porter, Ph.D. <sup>1</sup>	Physics
Thomas A. Prince, Ph.D.	Physics
David G. Sandler, Ph.D.	Physics
Anneila Sargent, Ph.D.	Astronomy
Jean Thierry-Mieg, Ph.D.	Theoretical Physics
David L. Tubbs, Ph.D.	Physics
Stephen Unwin, Ph.D.	Radio Astronomy
R. Craig Walker, Ph.D.	Radio Astronomy
Keh-Chung Wang, Ph.D.	Physics
Stephen V. Weber, Ph.D. <sup>1</sup>	Astrophysics
Alwyn Wooten, Ph.D.	Radio Astronomy
Alice Wu, Ph.D.	Physics
Cosmas Zachos, Ph.D.	Theoretical Physics
John L. Zyskind, Ph.D.	Physics

**Members of the Professional Staff**

- Martin S. Ewing, *Senior Research Engineer*
- Herbert E. Henrikson, *Senior Design Engineer*
- Keith Matthews, *Scientist*
- Richard B. Read, *Senior Engineer*
- Donald Skelton, *Engineer*
- Barbara A. Zimmerman, *Computing Analyst*

**Graduate Students 1979-80**

*Applied Mathematics*

- David Leslie Brown
- Elizabeth Ann Crooks
- Bernard Joseph Deppmeier
- John Alan Fawcett
- Thomas M. Hagstrom
- Uli Manfred Huener
- Fai Ma
- George Joseph Majda
- John Weidman McLean

- David Joseph Perozzi
- Michael D. Prendergast
- Douglas Alan Reinelt
- Luis Guillermo Maria Reyna
- Leonid Rudin
- Saleh Ahmed Tanveer
- Daniel Herbert Turnbull
- Daniel Ian Zwilling

<sup>1</sup>Chaim Weizmann Research Fellow

*Astronomy*

Graham Berriman  
 John Anthony Biretta  
 Kirk Daniel Borne  
 Alexei Vladimir Filippenko  
 Boris Gokhman  
 John Greg Hoessel  
 Keith Douglas Horne  
 Stephen Matthew Kent  
 Stephen Morris Lichten  
 Roger Paul Linfield  
 Thomas Glenn Lockhart

*Mathematics*

Richard Paul Anstee  
 Gary Ray Becker  
 Stuart Lynch Blackburn  
 Arthur Robert Calderbank  
 Leslie Joseph Deusch  
 Jeffrey Lee Fordon  
 Philip James Hanlon  
 Dean Robert Hart  
 Ralph Elwood Howard  
 Michael David Huffman

*Physics*

Timothy James Alleman  
 Hideaki Aoyama  
 Gregory John Ball  
 Alan Voltz Barnes  
 Howard Louis Berg  
 Robert Eugene Blair  
 Anthony Michael Bloch  
 Norman Bobroff  
 Hugh Herbert Breneman  
 Richard Laurence Brenner  
 Eugene David Brooks III  
 Kay Wyatt Brown  
 Nestor Felipe Caticha-Alfonso  
 Ariel Caticha  
 Yia-chung Chang  
 Yam Ki Chu  
 Joseph Stevens Clapp  
 Christopher Alan Cole  
 Walter Richardson Cook  
 Barbara Hope Cooper  
 Brian Ronald Davis  
 Murray Scott Daw  
 Eva Maria Dohrn  
 Mark F. Dumke  
 Charles David Edwards, Jr.  
 David James Ennis  
 Mark Harold Finger  
 Richard Alan Flammang  
 Bradley Arnold Flanders

Matthew Arnold Malkan  
 Jeffrey Ross Pier  
 Douglas Mark Rabin  
 Russell Ormond Redman  
 Abhijit Saha  
 Donald Patrick Schneider  
 William Lawrence Sebok  
 Richard Stanley Simon  
 Richard Alan Wade  
 Howard Kwong Chew Yee

Reiner Josef Kallenborn  
 Ilias George Kastanas  
 Hong-Chuan Lin  
 Bruce Michael Ian Rands  
 Geoffrey Raymond Robinson  
 Subhash Sharma  
 Gregory Paul Tollisen  
 Igor Mikolic-Torreira  
 Frans Gerhardus Johannes Wiid  
 John Charles Wolfskill

Michael David Foote  
 Patrick Michael Frantz  
 George Michael Fuller  
 Cornelius Adolf Gehrels  
 James Lawrence Gimlett  
 Mark Golomb  
 Jeffrey Mark Greif  
 Rajan Gupta  
 Yekta Gursel  
 Craig Warren Gustafson  
 Jeffrey John Hamilton  
 Michael David Hamrick  
 Jeffrey Alan Harvey  
 Robert Lee Hatch  
 Jay Hauser  
 Lowell Eugene Hazelton  
 William Donald Hazelton  
 Mark Hereld  
 Andrew Thompson Hunter  
 Kenneth Alan Jensen  
 Sarbmeet Singh Kanwal  
 Rosemary Gillian Kennett  
 Jaisam Kim  
 Jeffrey George Koller  
 ArieH Konigl  
 Dale Edward Koop  
 Keith E. Krombel  
 Heemin Kwon  
 Nai-Hang Kwong

Warren Yiu-cho Lai  
Koon Hang Lau  
James Roy Lee  
Pui-Tang Leung  
Mark Allen Ludwig  
Douglas Alan MacDonald  
David Brian MacFarlane  
Narayan Krishna Mahale  
Neil Marcus  
John Keven Markey  
Max Marshall  
Olivier Christian Martin  
Michael Charles McNab  
Charles Kenneth Meins, Jr.  
Marcus Holden Mendenhall  
Geoffrey Blount Mills  
Richard Gerard Milner  
Donald Paul Mitchell  
John Anthony Murphy  
Daniel Nadeau  
Frank Joseph Nagy  
Joseph Michael Nilsen  
John Joseph Nugent  
Peter Oliver Orland  
John Lawrence Osborne  
Steve William Otto  
Richard Allan Partridge  
Robert Charles Pike  
Milind Vasant Purohit  
Ian H. Redmount  
David Benjamin Reiss  
Jeffrey David Richman  
Leonid Zinovy Rivkin  
James William Rohlf

Larry James Romans  
Ann Judith Rosenthal  
Augusto Sagnotti  
Raghendra Sahai  
Balachandran Sathiapalan  
Bonny Laura Schumaker  
Lucy Elizabeth Seiberling  
Kristen Sellgren  
Michael P. Shatz  
Byron Bong Siu  
Robert Thomas Skelton  
John David Spalding  
Srinivas Sridhar  
Stuart Reh Stampke  
Gayle Arden Sugiyama  
Eugene Szedenits, Jr.  
Peter Taborek  
Anthony Emerson Terrano  
Stephen Trentalange  
Tsun-yan Tse  
Michael Patrick Tuite  
John Reinhold Valainis  
Mark Alan Voelker  
Michael Ben Weimer  
Roy David Williams  
Brian David Wilson  
Harold Stevenson Wilson  
Jack Leach Wisdom  
Stephen Wolfram  
Hitoshi Yamamoto  
Kar Woo Yung  
Mark Edward Zimmermann  
James Frederick Zumberg

**Owens Valley Radio Observatory  
Staff Members**

Alan T. Moffet, *Director*

Glenn L. Berge, Ph.D.  
Marshall H. Cohen, Ph.D.  
Martin S. Ewing, Ph.D.  
Gillian R. Knapp, Ph.D.  
Robert B. Leighton, Ph.D.  
Alan T. Moffet, Ph.D.

Duane O. Muhleman, Ph.D.  
Thomas G. Phillips, Ph.D.  
Richard B. Read, Ph.D.  
Wallace L. W. Sargent, Ph.D.  
George A. Seielstad, Ph.D.  
Peter Wannier, Ph.D.

## Sherman Fairchild Distinguished Scholars

### 1978-79

Seymour Jonathan Singer, Ph.D.

*Professor of Biology, University of California, San Diego*

### 1979-80

Theodore W. Anderson, Ph.D.

*Professor of Statistics and Economics, Stanford University*

Alexandra Bellow, Ph.D.

*Professor of Mathematics, Northwestern University*

Julian D. Cole, Ph.D.

*Professor of Engineering and Mathematics, School of Engineering and Applied Science, University of California, Los Angeles*

William Hayes, Sc.D.

*Professor of Genetics, The Australian National University*

Horst Hoffmann, Habil.

*Head of the Physics Department, University of Regensburg*

Fritz John, Ph.D.

*Professor, Courant Institute of Mathematical Sciences, New York University*

Irving Kaplansky, Ph.D.

*George Herbert Mead Distinguished Service Professor, Department of Mathematics, The University of Chicago*

Robert P. Kraft, Ph.D.

*Professor and Astronomer, Lick Observatory, University of California, Santa Cruz; Chairman, Board of Studies in Astronomy and Astrophysics*

William R. Levick, M.Sc.

*Professorial Fellow in Physiology, The John Curtin School of Medical Research, the Australian National University*

G. S. Maddala, Ph.D.

*Graduate Research Professor of Economics, University of Florida*

Peter A. G. Scheuer, Ph.D.

*Assistant Director of Research in Physics, Cavendish Laboratory, University of Cambridge*

Lyman Spitzer, Ph.D., D.Sc., LL.D.

*Professor of Astronomy, Princeton University*

Valentine L. Telegdi, Ph.D.

*Professor of Physics, The University of Chicago*

John G. Thompson, Ph.D.

*Rouse Ball Professor of Mathematics, University of Cambridge*

F. Xavier Wilhelm, Ph.D.

*Head of Research, National Center for Scientific Research, Institute of Molecular and Cellular Biology (Strasbourg)*



## **Athletics and Physical Education**

Warren G. Emery, M.S., *Director of Athletics and Physical Education*

### *Full-Time Staff*

Bob Davies, M.S.  
E. Leroy Neal, M.A.

Edward T. Preisler, B.A.  
Edwin Spencer, B.S.

### *Part-Time Staff*

David E. Beck, B.A.  
Dean G. Bond, B.A.  
Donald R. Cameron, B.Sc.  
Harold G. Cassriel, B.S.  
George Clovis

John L. Lamb  
Elizabeth Oberstein, M.A.  
Tsutomu Ohshima, B.A.  
Hudson L. Scott, M.S.

### **Athletic Council**

The intercollegiate athletic program is under the supervision of the Athletic Council, which consists of representatives of the faculty, the Associated Students of the California Institute of Technology (ASCIT), and the alumni of the Institute.

## **Willis H. Booth Computing Center**

Charles B. Ray, *Director*

Kiku Matsumoto, *Deputy Director*

### **Staff Members**

James V. Bys  
Albert Fuwu Chang  
Lucie E. Cofield  
Joseph H. Dailey  
James P. Elliott  
Edith P. Huang  
Michael D. Lackman

Robert S. Logan  
Dallas W. Oller, Jr.  
William C. Peterson  
Donald D. Rintala  
Hector R. Valdez  
Kimo Yap  
Dimitrios Zorbas

## **Environmental Quality Laboratory**

Norman H. Brooks, *Director*

### **Staff Council**

Norman H. Brooks, *Chairman*  
Glen R. Cass<sup>1</sup>  
John Ferejohn<sup>1</sup>  
Richard C. Flagan  
Leroy E. Hood  
Robert C. Y. Koh  
Lester Lees<sup>1</sup>  
E. John List<sup>1</sup>

James J. Morgan  
Roger G. Noll  
R. Talbot Page  
Charles R. Plott  
James P. Quirk<sup>2</sup>  
John H. Seinfeld<sup>1</sup>  
Frederick H. Shair  
Leon T. Silver

<sup>1</sup>Executive Committee

<sup>2</sup>On leave 1979-80

### Research Staff

Norman H. Brooks, Director; James Irvine Professor of Environmental and Civil Engineering  
 Glen R. Cass, Assistant Professor of Environmental Engineering  
 John Ferejohn, Professor of Political Science  
 Richard C. Flagan, Assistant Professor of Environmental Engineering Science  
 Robert E. Forsythe, Assistant Professor of Economics  
 George Fox, Research Fellow in Economics  
 Morton S. Isaacson, Research Engineer  
 Robert C. Y. Koh, Research Associate in Environmental Engineering Science  
 Lester Lees, Professor of Environmental Engineering Science and Aeronautics  
 E. John List, Professor of Environmental Engineering Science  
 Gregory J. McRae, Senior Research Engineer  
 James J. Morgan, Professor and Executive Officer of Environmental Engineering Science  
 Roger G. Noll, Professor of Economics; Chairman, Division of the Humanities and Social Sciences  
 R. Talbot Page, Research Associate in Economics  
 James P. Quirk, Professor of Economics  
 Christian Seigneur, Research Fellow in Chemical Engineering  
 John H. Seinfeld, Professor and Executive Officer of Chemical Engineering  
 Frederick H. Shair, Professor of Chemical Engineering  
 Brent D. Taylor, Senior Research Engineer, Member of the Professional Staff  
 James W. Tilden, Senior Research Engineer  
 Wade Wells, Hydrologist (on assignment to EQL by U.S. Forest Service)  
 Louis L. Wilde, Assistant Professor of Economics

### Consultant

James E. Krier, Professor of Law, Stanford University

### Graduate Students 1978-79

William Brownlie ( <i>Engineering</i> )	Gregory McRae ( <i>Engineering</i> )
Robert Hahn ( <i>Social Science</i> )	Thomas Palfrey ( <i>Social Science</i> )
Steven Hashimoto ( <i>Social Science</i> )	Charles Slater ( <i>Social Science</i> )
Mark Isaac ( <i>Social Science</i> )	

### Hale Observatories

*Operated jointly by the California Institute of Technology  
 and the Carnegie Institution of Washington*

Maarten Schmidt, *Director*

### Observatory Committee

Halton C. Arp	Wallace L. W. Sargent
Gerry Neugebauer	Maarten Schmidt, <i>Chairman</i>
S. Eric Persson	James A. Westphal
Allan R. Sandage	

### Staff Members

Halton C. Arp, Ph.D.	Judith G. Cohen, Ph.D.
Horace W. Babcock, Ph.D., Sc.D.	Jesse L. Greenstein, Ph.D.

James E. Gunn, Ph.D.	Wallace L. W. Sargent, Ph.D.
Robert F. Howard, Ph.D.	Maarten Schmidt, Ph.D., Sc.D.
Jerome Kristian, Ph.D.	Leonard Searle, Ph.D.
Robert B. Leighton, Ph.D.	Stephen A. Sheckman, Ph.D.
Gerry Neugebauer, Ph.D.	Arthur H. Vaughan, Ph.D.
J. Beverley Oke, Ph.D.	James A. Westphal, B.S.
S. Eric Persson, Ph.D.	Peter J. Young, Ph.D.
George W. Preston, Ph.D.	Harold Zirin, Ph.D.
Allan R. Sandage, Ph.D., Sc.D., D.Sc., LL.D.	

**Staff Associates**

Robert J. Brucato, Ph.D.	B. Thomas Soifer, Ph.D.
Charles T. Kowal, B.S.	John T. Trauger, Ph.D.
Jean J. Lorre, M.S.	Michael W. Werner, Ph.D.
Keith W. Matthews, M.S.	

**Senior Research Fellows**

Alan M. Dressler, Ph.D.	Ronald Moore, Ph.D.
Thomas R. Geballe, Ph.D.	Robert J. Zinn, Ph.D.

**Research Fellows**

Thomas B. Ake III, Ph.D.	Barry J. LaBonte, Ph.D.
Peter L. Cottrell, Ph.D.	Stefan Mochnacki, Ph.D.
Gary S. Da Costa, Ph.D.	Jeremy R. Mould, Ph.D.
Debra M. Elmegreen, Ph.D.	Anneila I. Sargent, Ph.D.
Howard B. French, Ph.D.	Horace A. Smith, Ph.D.
Robert C. Kennicutt, Jr., Ph.D.	

**Health Center**

Gregory Ketabgian, M.D.	<i>Director of Health Services</i>
Marlene Coleman, M.D.	<i>Attending Physician</i>
Barbara Fass, Ph.D.	<i>Institute Psychologist</i>
Judson James, M.D.	<i>Attending Physician</i>
Warren Jones, M.D.	<i>Consulting Psychiatrist</i>
Jack Lindheimer, M.D.	<i>Consulting Psychiatrist</i>
Haig Manjikian, M.D.	<i>Attending Physician</i>
Sigrid R. McPherson, Ph.D.	<i>Senior Institute Psychologist</i>
Robert Drezner, Ph.D.	<i>Institute Psychologist</i>

**Industrial Relations Center**

Victor V. Veysy, M.B.A., *Director, Industrial Relations Center;*  
*Lecturer in Business Economics and Industrial Relations*

## Jet Propulsion Laboratory

*Administered by Caltech for the National Aeronautics and Space Administration*

Bruce C. Murray, *Director*  
 C. H. Terhune, Jr., *Deputy Director*

### Advisory Council

- |  |   |
|--|---|
| Dr. Philip H. Abelson<br>Editor, <i>Science</i>  | Dr. James J. Morgan<br>Professor of Environmental Engineering<br>Science and Executive Officer,<br>Environmental Engineering Science; Chairman<br>of the Faculty, Caltech |
| Dr. Arden Albee<br>Professor of Geology, Caltech;<br>Chief Scientist, JPL  | Dr. Roger Noll<br>Professor of Economics and Chairman of<br>the Division of the Humanities and Social<br>Sciences, Caltech  |
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| Mr. Walter Burke<br>Caltech Trustee, and President of<br>Sherman Fairchild Foundation, Inc.  | Dr. Allen Peterson<br>Professor of Electrical Engineering and<br>Co-Director, Stanford Center for Radar<br>Astronomy, Stanford University                                 |
| Dr. Lee A. DuBridg<br>President Emeritus, Caltech, and<br>Life Trustee of Caltech  | Dr. John R. Pierce<br>Professor of Engineering, Caltech   |
| Dr. Eugene G. Fubini<br>E. G. Fubini Consultants, Ltd.   | Mr. Stanley R. Rawn, Jr.<br>Caltech Trustee, and President of<br>Marline Resources Company, Inc.  |
| Mr. John Gardner<br>Chairman, President's Commission on<br>White House Fellowships, and<br>Founding Chairman, Common Cause                 | Dr. Eberhardt Reichtin<br>President, Aerospace Corporation  |
| Hon. Shirley Hufstedler<br>Caltech Trustee, and Circuit Judge,<br>U.S. Court of Appeals  | Mrs. Mary L. Scranton<br>Caltech Trustee  |
| Dr. Barclay Kamb<br>Professor of Geology and Geo-<br>physics; Chairman of the Division of<br>Geological and Planetary Sciences,<br>Caltech | Dr. John M. Teem ( <i>Council Chairman</i> )<br>President, Association of Universities<br>for Research in Astronomy, Inc.   |

#### *Ex Officio:*

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Vice President and Provost, Caltech

- Mr. David Morrisroe  
Vice President for Business and Finance  
and Treasurer, Caltech

#### *Past Members:*

- Mr. Benjamin Biaggini  
Dr. Harry Gray  
Mr. Robert Gilmore  
Dr. Ray Owen

- Dr. Simon Ramo  
Dr. Robert Sharp  
Dr. Robert W. Vaughan<sup>1</sup>  
Dr. Rochus Vogt

<sup>1</sup>Deceased

### Institute Libraries

Johanna E. Tallman, *Director*

- Janet Casebier, Humanities and Documents Librarian
- Roderick J. Casper, Public Services Librarian, MPS
- Judith R. Goodstein, Institute Archivist, MPS
- Helen Lyons, Engineering Librarian
- Donald McNamee, Catalog Librarian
- Edward R. Moser, Serials Librarian
- Dana L. Roth, Sciences Librarian, MPS

### Representatives for the Departmental Libraries

- Clarence R. Allen, Ph.D.
- Tom M. Apostol, Ph.D.
- John F. Benton, Ph.D.
- Felix H. Boehm, Ph.D.
- Charles J. Brokaw, Ph.D.
- Norman H. Brooks, Ph.D.
- Francis S. Buffington, Ph.D.
- Marshall Cohen, Ph.D.
- Donald E. Coles, Ph.D.

- George R. Gavalas, Ph.D.
- Paco A. Lagerstrom, Ph.D.
- Gilbert D. McCann, Ph.D.
- Charles H. Papas, Ph.D.
- Rolf H. Sabersky, Ph.D.
- Walter A. Schroeder, Ph.D.
- Leonard Searle, Ph.D.
- Victor V. Veysey, M.B.A.

### Musical Activities

- Olaf Frodsham ..... *Director of Choral Music*
- Monica Roegler ..... *Assistant Director of Choral Music*
- William Bing ..... *Jazz Band Director*
- Kim Kowalke ..... *Symphony Orchestra Director*
- James Rötter ..... *Wind Ensemble Director*
- James Boyk ..... *Interpretive Music Class*



## OFFICERS AND FACULTY

- Marvin Leonard Goldberger, Ph.D., *President; Professor of Physics*  
B.S., Carnegie Institute of Technology, 1943; Ph.D., The University of Chicago, 1948. California Institute, 1978-.
- Allan James Acosta, Ph.D., *Professor of Mechanical Engineering*  
B.S., California Institute, 1945; M.S., 1949; Ph.D., 1952. Assistant Professor, 1954-58; Associate Professor, 1958-66; Professor, 1966-.
- Andreas Aebi, Ph.D., *Lecturer in German*  
M.A., University of Southern California, 1970; Ph.D., 1974. Lecturer in French. California Institute, 1978; Lecturer in German, 1978-.
- William Scott Agnew, Ph.D., *Research Fellow in Chemistry*  
A.B., University of California (Los Angeles), 1968; Ph.D., 1976. California Institute, 1976-.
- Thomas J. Ahrens, Ph.D., *Professor of Geophysics*  
B.S., Massachusetts Institute of Technology, 1957; M.S., California Institute, 1958; Ph.D., Rensselaer Polytechnic Institute, 1962. Associate Professor, California Institute, 1967-76; Professor, 1976-.
- Thomas Bellis Ake III, Ph.D., *Research Fellow in Astronomy*  
B.S., Case Western Reserve University, 1971; M.S., 1974; Ph.D., 1977. California Institute, 1978-.
- Arden Leroy Albee, Ph.D., *Professor of Geology; Chief Scientist, Jet Propulsion Laboratory*  
A.B., Harvard College, 1950; A.M., Harvard University, 1951; Ph.D., 1957. Visiting Assistant Professor, California Institute, 1959-60; Associate Professor, 1960-66; Professor, 1966-; Academic Officer, Geological and Planetary Sciences, 1971-79; Chief Scientist, 1979-.
- Igor Tigranovich Alexanian, Cand. Sci., *Visiting Associate in Electrical Engineering*  
Bacc., Moscow State University, 1958; Cand. Sci., 1964. Head, Laboratory of Physical Problems in Microelectronic Reliability, Institute of Electronic Technology (Moscow), 1974-. California Institute, 1979.
- Yoram Alhassid, Ph.D., *Weizmann Research Fellow in Physics*  
B.Sc., The Hebrew University, 1974; Ph.D., 1978. California Institute, 1979-80.
- Clarence Roderic Allen, Ph.D., *Professor of Geology and Geophysics*  
B.A., Reed College, 1949; M.S., California Institute, 1951; Ph.D., 1954. Assistant Professor, 1955-59; Associate Professor, 1959-64; Professor, 1964-. Interim Director of Seismological Laboratory, 1965-67; Acting Chairman, Division of Geology, 1967-68.
- Mark Andrew Allen, Ph.D., *Research Fellow in Planetary Science*  
B.A., Columbia University, 1971; Ph.D., California Institute, 1976. Research Fellow, 1978-79.
- John Morgan Allman, Ph.D., *Associate Professor of Biology*  
B.A., University of Virginia, 1965; A.M., The University of Chicago, 1968; Ph.D., 1971. Assistant Professor, California Institute, 1974-77; Associate Professor, 1977-.
- George Amthauer, Dr.rer.nat., *Visiting Associate in Mineralogy*  
Dipl., University of Bonn, 1970; Dr.rer.nat., University of Saarbrücken, 1974. Research Associate University of Marburg, 1974-. California Institute, 1978-79.
- Carl David Anderson, Ph.D., Sc.D., LL.D., Nobel Laureate, *Board of Trustees Professor of Physics, Emeritus*  
B.S., California Institute, 1927; Ph.D., 1930. Research Fellow, 1930-33; Assistant Professor, 1933-37; Associate Professor, 1937-39; Professor, 1939-76; Chairman, Division of Physics, Mathematics and Astronomy, 1962-70; Board of Trustees Professor Emeritus, 1976-.
- David Maurice Anderson, Ph.D., *Research Fellow in Biology*  
B.A., California State University (Fresno), 1970; M.A., 1972; Ph.D., Purdue University, 1977. California Institute, 1977-.
- Don Lynn Anderson, Ph.D., *Professor of Geophysics; Director, Seismological Laboratory*  
B.S., Rensselaer Polytechnic Institute, 1955; M.S., California Institute, 1958; Ph.D., 1962. Research Fellow, 1962-63; Assistant Professor, 1963-64; Associate Professor, 1964-68; Professor, 1968-; Director, 1967-.

- Robert Charles Anderson, Ph.D., *Research Fellow in Chemistry*  
B.Sc., University of Waterloo, 1974; Ph.D., 1978. California Institute, 1978-79.
- Theodore W. Anderson, Ph.D., *Sherman Fairchild Distinguished Scholar*  
B.S., Northwestern University, 1939; M.A., Princeton University, 1942; Ph.D., 1945. Professor, Stanford University, 1967-. California Institute, 1979-80.
- Fred Colvig Anson, Ph.D., *Professor of Chemistry*  
B.S., California Institute, 1954; Ph.D., Harvard University, 1957. Instructor, California Institute, 1957-58; Assistant Professor, 1958-62; Associate Professor, 1962-68; Professor, 1968-; Executive Officer for Chemistry, 1973-77.
- Tom M. Apostol, Ph.D., *Professor of Mathematics*  
B.S., University of Washington, 1944; M.S., 1946; Ph.D., University of California, 1948. Assistant Professor, California Institute, 1950-56; Associate Professor, 1956-62; Professor, 1962-.
- Gordon Appleby, Ph.D., *Mellon Postdoctoral Instructor in Anthropology*  
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B.A., Immaculate Heart College, 1969; Ph.D., University of California (Los Angeles), 1977. California Institute, 1977-.
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- Giuseppe Attardi, M.D., *Professor of Biology*  
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- Vasilily I. Avdeev, Cand., *Visiting Associate in Chemical Engineering*  
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B.S., University of Skopje (Yugoslavia), 1965; Ph.D., University of Illinois (Urbana), 1977. California Institute, 1978-79.
- Charles Dwight Babcock, Jr., Ph.D., *Professor of Aeronautics*  
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- Robert Fox Bacher, Ph.D., Sc.D., LL.D., *Professor of Physics, Emeritus*  
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- Stanley H. Bacon, *Lecturer in Electrical Engineering* (PT)  
California Institute, 1977-.
- Raphael Badoud, Ph.D., *Research Fellow in Chemistry*  
Dipl., University of Fribourg, 1973; Ph.D., 1978. California Institute, 1978-79.
- John Dickson Baldeschwieler, Ph.D., *Professor of Chemistry*  
B. ChemE., Cornell University, 1956; Ph.D., University of California, 1959. Professor, California Institute, 1973-; Chairman, Division of Chemistry and Chemical Engineering, 1973-78.



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- Nadav Bar-Chaim, Ph.D., *Research Fellow in Applied Physics*  
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- Mircea A. Barglazan, Dipl., *Visiting Associate in Mechanical Engineering*  
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- Barry Clark Barish, Ph.D., *Professor of Physics*  
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- Charles Andrew Barnes, Ph.D., *Professor of Physics*  
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- Richard H. Becker, Ph.D., *Senior Research Fellow in Geochemistry*  
B.S., Brooklyn College, 1965; Ph.D., The University of Chicago, 1971. California Institute, 1978-
- Charles Beichman, Ph.D., *Research Fellow in Physics*  
A.B., Harvard College, 1973; M.S., University of Hawaii, 1975; Ph.D., 1979. California Institute, 1979-80.
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- Paul Murray Bellan, Ph.D., *Assistant Professor of Applied Physics*  
B.Sc., University of Manitoba, 1970; M.A., Princeton University, 1972; Ph.D., 1975. California Institute, 1977-
- Alexandra Bellow, Ph.D., *Sherman Fairchild Distinguished Scholar*  
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B.A., Northwestern University, 1937. Raymond W. and Martha Hilpert Gruner Distinguished Service Professor, The University of Chicago, 1976-. California Institute, 1980.
- Irving S. Bengelsdorf, Ph.D., *Lecturer in Science Communication* (PT)  
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- John Frederick Benton, Ph.D., *Professor of History*  
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Paul Bowerman, A.M., *Professor of Modern Languages, Emeritus*

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Christopher Brennen, Ph.D., *Associate Professor of Mechanical Engineering*

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William B. Bridges, Ph.D., *Professor of Electrical Engineering and Applied Physics; Executive Officer for Electrical Engineering*

B.S., University of California, 1956; M.S., 1957; Ph.D., 1962. Sherman Fairchild Distinguished Scholar, California Institute, 1974-75; Professor, 1977-; Executive Officer for Electrical Engineering, 1978-.

Raymond P. Briggs, Ph.D., *Visiting Associate in Biology*

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B.A., Oakland University (Michigan), 1967; Ph.D., Cornell University, 1973. Chaffey College, 1977-. California Institute, 1978-.

Roy John Britten, Ph.D., *Senior Research Associate in Biology*

B.S., University of Virginia, 1940; Ph.D., Princeton University, 1951. Staff Member, Carnegie Institution, 1951-. Visiting Associate, California Institute, 1971-73; Senior Research Associate, 1973-.

David James Britton, D.M.A., *Lecturer in Music*

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B.M., Oberlin Conservatory of Music, 1963; M.M., Eastman School of Music, 1964; D.M.A., 1973. Assistant Professor of Organ, California State University (Northridge), 1973-. California Institute, 1977-.

James Eugene Broadwell, Ph.D., *Research Associate in Aeronautics*

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Jeremy P. Brockes, Ph.D., *Assistant Professor of Biology*

B.A., University of Cambridge, 1967; Ph.D., Edinburgh University, 1972. California Institute, 1978-.

- Charles Jacob Brokaw, Ph.D., *Professor of Biology; Executive Officer for Biology*  
 B.S., California Institute, 1955; Ph.D., University of Cambridge, 1958. Visiting Assistant Professor, California Institute, 1960; Assistant Professor, 1961-63; Associate Professor, 1963-68; Professor, 1968-; Executive Officer, 1976-.
- Norman Herrick Brooks, Ph.D., *James Irvine Professor of Environmental and Civil Engineering; Director of Environmental Quality Laboratory*  
 A.B., Harvard College, 1949; M.S., Harvard University, 1950; Ph.D., California Institute, 1954. Instructor, 1953-54; Assistant Professor, 1954-58; Associate Professor, 1958-62; Professor of Environmental Science and Civil Engineering, 1962-76; Irvine Professor of Environmental Engineering Science, 1976-77; Irvine Professor of Environmental and Civil Engineering, 1977-; Academic Officer for Environmental Engineering Science, 1972-74; Director, 1974-.
- Garry L. Brown, D.Phil., *Professor of Aeronautics*  
 B.E., University of Adelaide, 1964; D.Phil., University of Oxford, 1967. Research Fellow, California Institute, 1967-69; Senior Research Fellow, 1970; Visiting Associate, 1974; Professor, 1977-.
- Lee F. Browne, M.S., *Lecturer in Education* (PT)  
 B.S., West Virginia State College, 1944; M.S., New York University, 1950. Director of Secondary School Relations, California Institute, 1969-; Lecturer, 1971-.
- Donald Eugene Brownlee II, Ph.D., *Visiting Associate in Geochemistry*  
 B.S., University of California, 1965; Ph.D., University of Washington, 1971. Senior Research Associate, 1974-; California Institute, 1977-.
- Robert Joseph Brucato, Ph.D., *Staff Associate, Hale Observatories*  
 B.S., University of Illinois, 1966; M.S., University of Chicago, 1968; Ph.D., Northwestern University, 1970. Research Fellow, California Institute, 1971-72; Staff Associate, 1972-.
- Richard Hugh Buckholz, Jr., Ph.D., *Research Fellow in Engineering Science*  
 B.S., University of Maryland, 1971; Ph.D., The Johns Hopkins University, 1979; California Institute, 1978-79.
- Francis Stephan Buffington, Sc.D., *Associate Professor of Materials Science; Associate Dean of Graduate Studies*  
 S.B., Massachusetts Institute of Technology, 1938; Sc.D., 1951. Assistant Professor of Mechanical Engineering, California Institute, 1951-56; Associate Professor, 1956-63; Associate Professor of Materials Science, 1963-; Associate Dean of Graduate Studies, 1975-.
- John Douglas Buhr, Ph.D., *Research Fellow in Chemistry*  
 B.S., Bethel College, 1971; Ph.D., Stanford University, 1978. California Institute, 1979-80.
- David W. Burchmore, Ph.D., *Instructor in English*  
 A.B., Princeton University, 1973; M.A., University of Virginia, 1975; Ph.D., 1978. California Institute, 1978-.
- David T. Burhans, Ph.D., *Lecturer in Speech Communication* (PT)  
 B.A., Pepperdine College, 1967; M.A., University of Southern California, 1969; Ph.D., 1973. Instructor, California Institute, 1969-71; Lecturer, 1972-.
- Patricia Virginia Burke, Ph.D., *Visiting Associate in Biology*  
 B.A., Pomona College, 1964; Ph.D., California Institute, 1971. Visiting Associate, 1978.
- William T. Burke, B.S.E.E., *Visiting Associate in Computer Science*  
 B.S.E.E., University of Washington, 1962. Senior Member, IBM Design Automation, 1976-; California Institute, 1979-80.
- Donald Stacy Burnett, Ph.D., *Professor of Nuclear Geochemistry; Academic Officer, Division of Geological and Planetary Sciences*  
 B.S., The University of Chicago, 1959; Ph.D., University of California, 1963. Research Fellow in Physics, California Institute, 1963-65; Assistant Professor of Nuclear Geochemistry, 1965-68; Associate Professor, 1968-75; Professor, 1975-; Academic Officer, 1979-.
- Mark J. Burns, Ph.D., *Research Fellow in Chemistry*  
 B.A., University of California (San Diego), 1974; Ph.D., Harvard University, 1979. California Institute, 1979-80.
- Eugene Thaddeus Butler III, Ph.D., *Research Fellow in Biology*  
 B.S., University of California (Davis), 1973; Ph.D., University of California, 1978. California Institute, 1978-.

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B.A., Bowdoin College, 1970; B.Phil., Oxford University, 1972; Ph.D., Harvard Graduate School of Arts and Sciences, 1976. California Institute, 1976-

**Kathryn Lee Calame, Ph.D., Research Fellow in Biology**

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**Glen R. Cass, Ph.D., Assistant Professor of Environmental Engineering**

B.A., University of Southern California, 1969; M.S., Stanford University, 1970; Ph.D., California Institute, 1977. Senior Research Fellow and Instructor, 1977-79; Assistant Professor, 1979-

**Thomas Kirk Caughey, Ph.D., Professor of Applied Mechanics**

B.Sc., Glasgow University, 1948; M.M.E., Cornell University, 1952; Ph.D., California Institute, 1954. Instructor, 1953-54; Assistant Professor, 1955-58; Associate Professor, 1958-62; Professor, 1962-

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**Enrique Cerdá-Olmedo, Ph.D., Visiting Associate in Biology**

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**Sunney Ignatius Chan, Ph.D., Professor of Chemical Physics and Biophysical Chemistry; Executive Officer for Chemistry**

B.S., University of California, 1957; Ph.D., 1960. Assistant Professor of Chemical Physics, California Institute, 1963-64; Associate Professor, 1964-68; Professor, 1968-76; Professor of Chemical Physics and Biophysical Chemistry, 1976-. Acting Executive Officer, 1977-78; Executive Officer, 1978-

**Bruce W. Chappell, Ph.D., Visiting Professor of Geology**

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**Thomas J. Chester, Ph.D., Research Fellow in Astrophysics**

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**Pandipati Radhakrishnaiah Chetty, Ph.D., Research Fellow in Electrical Engineering**

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B.S., University of Missouri, 1941; S.M., Massachusetts Institute of Technology, 1943; Ph.D., California Institute, 1948. Research Fellow, 1948-50; Assistant Professor, 1950-54; Associate Professor, 1954-61; Professor, 1961-.

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B.S., California Institute, 1972; Ph.D., The University of Wisconsin, 1977. California Institute, 1977-.

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Laurea, University of Rome, 1962; Lib. Doc., 1971. Associate Professor, 1973-. Research Fellow, California Institute, 1970-71; Visiting Associate, 1976; 1977; 1978.

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- Ebbel de Jonge, Ph.D., *Visiting Associate in Mathematics*  
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- Max Delbrück, Ph.D., Sc.D., Nobel Laureate, *Board of Trustees Professor of Biology, Emeritus*  
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 B.Sc., Reading University (England), 1939; M.Sc., 1946; Ph.D., 1956. Senior Research Fellow in Engineering, California Institute, 1961-62; Associate Professor of Biology and Electrical Engineering, 1962-66; Professor of Biology and Applied Science, 1966-.
- John A. Ferejohn, Ph.D., *Professor of Political Science*  
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- Alberto Ferrus, Ph.D., *Research Fellow in Biology*  
 M.S., University of Sevilla, 1972; Ph.D., University of Madrid, 1976. California Institute, 1978-79.
- Richard Phillips Feynman, Ph.D., Nobel Laureate, *Richard Chace Tolman Professor of Theoretical Physics*  
 B.S., Massachusetts Institute of Technology, 1939; Ph.D., Princeton University, 1942. Visiting Professor, California Institute, 1950; Professor, 1950-59; Tolman Professor, 1959-.
- Richard D. Field, Jr., Ph.D., *Richard Chace Tolman Research Associate*  
 B.S., University of California, 1966; Ph.D., 1971. Research Fellow, California Institute, 1973-75; Senior Research Fellow, 1975-78; Research Associate, 1978-79; Tolman Research Associate, 1979-.
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B.S., California Institute, 1949; M.S., Stanford University, 1950; Ph.D., California Institute, 1956. Assistant Professor of Engineering, 1955-58; Associate Professor, 1958-62; Professor of Physics, 1962-74; Professor of Applied Physics, 1974-; Executive Officer for Applied Physics, 1973-79; Chairman, 1979-.

Avraham Gover, Ph.D., *Visiting Associate in Applied Physics*

B.S., Tel Aviv University, 1968; M.S., 1971; Ph.D., California Institute, 1976. Assistant Professor, Tel Aviv University, 1977-. Visiting Associate, California Institute, 1978.

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B.B.A., Emory University, 1966; LL.B., University of Virginia, 1969. Professor of Law, University of Southern California, 1979-. California Institute, 1979-.

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B.S., University of Oklahoma, 1971; M.S., University of Michigan, 1972; Ph.D., 1977. California Institute, 1977-.

Harry Barkus Gray, Ph.D., *William R. Kenan, Jr. Professor and Professor of Chemistry; Chairman of the Division of Chemistry and Chemical Engineering*

B.S., Western Kentucky College, 1957; Ph.D., Northwestern University, 1960. Visiting Professor of Inorganic Chemistry, California Institute, 1965; Professor of Chemistry, 1966-; Kenan Professor, 1976-; Division Chairman, 1978-.

John Peter Gray, Ph.D., *Research Associate in Computer Science*

B.Sc., University of Durham (England), 1964; Ph.D., University of Newcastle, 1967. Visiting Associate, California Institute, 1977-78; Research Associate, 1978-.

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B.S., California Institute, 1964; M.S., 1965; Ph.D., 1969. Manager, Advanced Systems Program, Tracking and Data Acquisition Technology Development Office, Jet Propulsion Laboratory, 1969-. Lecturer, California Institute, 1979.

- Jesse Leonard Greenstein, Ph.D., *Lee A. DuBridge Professor of Astrophysics* (PT)  
A.B., Harvard College, 1929; A.M., Harvard University, 1930; Ph.D., 1937. Associate Professor, California Institute, 1948-49; Professor, 1949-70; Staff Member, Hale Observatories, 1948-; Executive Officer for Astronomy, 1964-72; DuBridge Professor, 1970-.
- Estelle H. Gregory, Ph.D., *Visiting Associate in Biomedical Engineering*  
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- David M. Grether, Ph.D., *Professor of Economics; Executive Officer for Social Sciences*  
B.S., University of California, 1960; Ph.D., Stanford University, 1969. Associate Professor, California Institute, 1970-74; Professor, 1974-; Executive Officer, 1978-.
- Joseph E. Griffith, Ph.D., *Research Fellow in Physics*  
B.A., Rice University, 1973; Ph.D., California Institute, 1979. Research Fellow, 1979-80.
- Jerrold R. Griggs, Ph.D., *Bateman Research Instructor in Mathematics*  
B.A., Pomona College, 1973; Ph.D., Massachusetts Institute of Technology, 1977. California Institute, 1977-.
- Leonid P. Grishchuk, Ph.D., *Visiting Associate in Physics*  
Ph.D., Sternberg Astronomical Institute, 1967. Senior Research Worker, 1973-. California Institute, 1978-79.
- Daniel Grosjean, Ph.D., *Visiting Associate in Chemical Engineering*  
M.A., University of Paris, 1964; Ph.D., 1971. Program Manager, Statewide Air Pollution Research Center, University of California (Riverside), 1978-. Research Fellow in Environmental Science, California Institute, 1973-75; Visiting Associate in Chemical Engineering, 1979-80.
- Timothy L. Grove, Ph.D., *Visiting Assistant Professor of Geology*  
B.A., University of Colorado (Boulder), 1971; A.M., Harvard University, 1975; Ph.D., 1976. Research Associate, State University of New York (Stony Brook), 1976-. California Institute, 1979.
- Robert H. Grubbs, Ph.D., *Professor of Chemistry*  
B.S., University of Florida, 1963; M.S., 1965; Ph.D., Columbia University, 1968. California Institute, 1978-.
- John William Grula, Ph.D., *Research Fellow in Biology*  
B.S., Oklahoma State University, 1973; Ph.D., University of Kansas, 1978. California Institute, 1978-79.
- James Edward Gunn, Ph.D., *Professor of Astronomy*  
B.A., Rice University, 1961; M.S., California Institute, 1965; Ph.D., 1966. Assistant Professor, 1970-72; Professor, 1972-; Staff Member, Hale Observatories, 1972-.
- Mool Chand Gupta, Ph.D., *Senior Research Fellow in Aeronautics*  
B.Sc., Guhurat University, 1966; M.Sc., 1968; Ph.D., Washington State University, 1973. California Institute, 1978-79.
- Jozsef Gyulai, Ph.D., *Visiting Associate in Applied Physics*  
Ph.D., A. Jozsef University (Hungary), 1960. Central Research Institute for Physics (Budapest), 1970-. Research Fellow, California Institute, 1969-70; Visiting Associate, 1974; 1976; 1977; 1979.
- Paul Dieter Habich, Ph.D., *Research Fellow in Chemistry*  
B.S., University of Stuttgart, 1972; M.S., 1975; Ph.D., 1977. California Institute, 1979-80.
- David Milton Hadley, Ph.D., *Visiting Associate in Geophysics*  
B.A., University of California (Riverside), 1971; M.S., 1973; Ph.D., California Institute, 1978. Vice President Sierra Geophysics, 1978-. Research Fellow, California Institute, 1978; Visiting Associate, 1979-80.
- Marshall Hall, Jr., Ph.D., *IBM Professor of Mathematics*  
B.A., Yale University, 1932; Ph.D., 1936. Professor, California Institute, 1959-73; Executive Officer for Mathematics, 1966-69; IBM Professor, 1973-.
- David Hamburg, M.D., *Visiting Associate in Social Sciences*  
A.B., Indiana University, 1944; M.D., 1947. Professor of Psychiatry, Stanford University School of Medicine, 1964-; Chairman, Department of Psychiatry, 1969-; President of the Institute of Medicine of the National Academy of Sciences, 1976-. Sherman Fairchild Distinguished Scholar, California Institute, 1974-75; Visiting Associate, 1975-.

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- Michael J. Hoffmann, Ph.D., *Bateman Research Instructor in Mathematics*  
S.B., Massachusetts Institute of Technology, 1970; M.Sc., University of California, 1973; Ph.D., 1979. California Institute, 1979-80.
- Horst Hoffman, Habil., *Sherman Fairchild Distinguished Scholar*  
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- Stephen John Hogan, Ph.D., *Research Fellow in Applied Mathematics*  
B.A., Trinity College, 1976; Ph.D., University of Cambridge, 1979. California Institute, 1979-80.
- Werner Hollander, Ph.D., *Research Fellow in Chemical Engineering*  
Dipl., Technical University of Munich, 1970; Dr.rer.nat., University of Heidelberg, 1977. California Institute, 1979-80.
- Tai-Lin Hong, Ph.D., *Research Fellow in Geophysics*  
B.S., National Tsing-Hua University, 1972; M.S., 1972; Ph.D., California Institute, 1978. Research Fellow, 1978-.
- Leroy E. Hood, M.D., Ph.D., *Ethel Wilson Bowles and Robert Bowles Professor of Biology*  
B.S., California Institute, 1960; M.D., The Johns Hopkins University, 1964; Ph.D., California Institute, 1968. Assistant Professor, 1970-73; Associate Professor, 1973-75; Professor, 1975-77; Bowles Professor, 1977-.
- Norman Harold Horowitz, Ph.D., *Professor of Biology; Chairman of the Division of Biology*  
B.S., University of Pittsburgh, 1936; Ph.D., California Institute, 1939. Research Fellow, 1940-42; Senior Research Fellow, 1946-47; Associate Professor, 1947-53; Professor, 1953-; Executive Officer for Biology, 1971-76; Acting Chairman, Division of Biology, 1973; Chairman, 1977-.
- Yoshiki Hotta, M.D., *Gosney Visiting Associate in Biology*  
M.D., University of Tokyo, 1963. Associate Professor, 1973-. Research Fellow, California Institute, 1968-72; Visiting Associate, 1979-80.
- George William Housner, Ph.D., *Carl F Braun Professor of Engineering* (PT)  
B.S., The University of Michigan, 1933; M.S., California Institute, 1934; Ph.D., 1941. Assistant Professor, 1945-49; Associate Professor, 1949-53; Professor, 1953-74; Braun Professor, 1974-.
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B.S., Yale University, 1958; M.S., 1959; Ph.D., 1963. Professor, Trinity College, 1974-. California Institute, 1979-80.
- Robert Franklin Howard, Ph.D., *Staff Member, Hale Observatories*  
B.A., Ohio Wesleyan University, 1954; Ph.D., Princeton University, 1957. Carnegie Fellow, Hale Observatories, 1957-59; Staff Member, 1961-.
- Sir Fred Hoyle, D.Sc., *Visiting Associate in Physics*  
M.A., University of Cambridge, 1939; D.Sc., University of Norwich, 1967; University of Leeds, 1969. Visiting Professor of Astronomy, California Institute, 1953; 1954; 1956; Addison White Greenway Visiting Professor of Astronomy; Staff Member, Hale Observatories, 1957-62; Visiting Associate, 1963; Sherman Fairchild Distinguished Scholar, 1974-75; Visiting Associate, 1978-79; 1979-80.
- Charles Frank Hoyng, Ph.D., *Research Fellow in Chemistry*  
B.S., Miami University (Ohio), 1972; Ph.D., Massachusetts Institute of Technology, 1976. California Institute, 1976-.
- Henry Vincent Huang, Ph.D., *Research Fellow in Biology*  
A.B., Occidental College, 1972; Ph.D., California Institute, 1977. Research Fellow, 1977-.
- Donald Ellis Hudson, Ph.D., *Professor of Mechanical Engineering and Applied Mechanics*  
B.S., California Institute, 1938; M.S., 1939; Ph.D., 1942. Instructor of Machine Design, 1942-43; Assistant Professor of Mechanical Engineering, 1943-49; Associate Professor, 1949-55; Professor, 1955-63; Professor of Mechanical Engineering and Applied Mechanics, 1963-.
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A.B., Harvard College, 1967; A.M., Harvard University, 1968; M.D., 1973; Ph.D., 1973. Assistant Professor, California Institute, 1975-78; Associate Professor, 1978-.

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Stirling L. Huntley, Ph.D., *Lecturer in Drama; Associate Dean of Graduate Studies; Director of Admissions*

B.A., University of California (Los Angeles), 1945; M.S., 1949; Ph.D., Stanford University, 1956. Associate Dean of Graduate Studies, California Institute, 1971-; Lecturer, 1973-; Director of Admissions and Financial Aid, 1973-76; Director of Admissions, 1976-.

Edward Hutchings, Jr., B.A., *Lecturer in Journalism*

(PT)

B.A., Dartmouth College, 1933. Editor of Engineering and Science Magazine, California Institute, 1948-79; Lecturer, 1952-; Director of Institute Publications, 1964-74.

Ardon Robin Hyland, Ph.D., *Visiting Associate in Physics*

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Michael T. Hyson, Ph.D., *Research Fellow in Biology*

B.S., University of Miami, 1970; M.S., 1973; Ph.D., 1976. California Institute, 1977-.

Andrew Perry Ingersoll, Ph.D., *Professor of Planetary Science*

B.A., Amherst College, 1960; A.M., Harvard University, 1961; Ph.D., 1966. Assistant Professor, California Institute, 1966-71; Associate Professor, 1971-76; Professor, 1976-. Staff Associate, Hale Observatories, 1971-.

Robert Ellsworth Ireland, Ph.D., *Professor of Organic Chemistry*

B.A., Amherst College, 1951; M.S., University of Wisconsin, 1953; Ph.D., 1954. California Institute, 1965-.

Frank Pieter Israel, Ph.D., *Research Fellow in Radio Astronomy*

Ph.D., Leiden State University, 1976. California Institute, 1977-.

Keiichi Itakura, Ph.D., *Visiting Associate in Chemistry*

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B.Sc., Tokyo College of Pharmacy, 1965; M.Sc., 1967; Ph.D., 1970. Associate Research Scientist, City of Hope. California Institute, 1976-.

Wilfred Dean Iwan, Ph.D., *Professor of Applied Mechanics*

B.S., California Institute, 1957; M.S., 1958; Ph.D., 1961. Assistant Professor, 1964-67; Associate Professor, 1967-72; Professor, 1972-.

Seid Hossein Izadpanah, Ph.D., *Visiting Associate in Applied Physics*

B.S., Tehran University, 1964; M.Sc., University College (London), 1966; Ph.D., Sheffield University, 1969. Associate Professor, Pahlavi University, 1969-. California Institute, 1978-79.

Deane Brunton Jacques, M.D., *Visiting Associate in Biomedical Engineering*

B.S., Colorado State University, 1965; M.D., University of Colorado, 1969. Research Fellow in Biology, California Institute, 1975-79; Visiting Associate in Biomedical Engineering, 1979-.

Kenneth C. Janda, Ph.D., *Arthur Amos Noyes Instructor in Chemical Physics*

A.B., Hope College, 1973; A.M., Harvard University, 1975; Ph.D., 1977. California Institute, 1978-.

- Augustus Josephus Elizabeth Maria Janssen, Ph.D., *Bateman Research Instructor in Mathematics*  
M.Sc., University of Technology (Eindhoven), 1976; Ph.D., 1979. California Institute, 1979-80.
- Paul Christian Jennings, Ph.D., *Professor of Civil Engineering and Applied Mechanics; Executive Officer for Civil Engineering and Applied Mechanics*  
B.S., Colorado State University, 1958; M.S., California Institute, 1960; Ph.D., 1963. Research Fellow in Civil Engineering, 1965; Assistant Professor of Applied Mechanics, 1966-68; Associate Professor, 1968-72; Professor, 1972-77; Professor of Civil Engineering and Applied Mechanics, 1977-; Executive Officer, 1975-.
- Fritz John, Ph.D., *Sherman Fairchild Distinguished Scholar*  
Ph.D., Göttingen University, 1933. Professor, Courant Institute of Mathematical Sciences, 1977-; California Institute, 1979-80.
- Denis Johnson, Ph.D., *Visiting Associate in Mathematics* (PT)  
Ph.D., University of California (Los Angeles), 1968. Senior Engineer, Jet Propulsion Laboratory, 1970-; California Institute, 1979-80.
- Tracy Johnson, Ph.D., *Visiting Associate in Geophysics*  
B.A., Dartmouth College, 1968; Ph.D., Columbia University, 1974. Research Associate, 1975-; California Institute, 1979.
- William Lewis Johnson, Ph.D., *Assistant Professor of Materials Science*  
B.A., Hamilton College, 1970; Ph.D., California Institute, 1975. Assistant Professor, 1976-.
- Louis Winchester Jones, A.B., *Dean of Admissions, Emeritus*  
A.B., Princeton University, 1922. Instructor in English, California Institute, 1925-37; Assistant Professor, 1937-43; Registrar, 1942-52; Associate Professor, 1943-68; Dean of Admissions; Director of Undergraduate Scholarships, 1937-68; Dean Emeritus, 1968-.
- William Thomas Jones, Ph.D., *Professor of Philosophy* (PT)  
A.B., Swarthmore College, 1931; B.Litt., Oxford University, 1933; A.M., Princeton University, 1936; Ph.D., 1937. Visiting Professor, California Institute, 1970-72; Andrew W. Mellon Professor, 1972-73; Professor, 1973-.
- James Schuyler Jordan, Jr., Ph.D., *Visiting Associate Professor of Economics*  
B.A., Cornell University, 1970; Ph.D., Northwestern University, 1975. Assistant Professor, University of Minnesota, 1976-; California Institute, 1979-80.
- Richard P. Junghans, Ph.D., *Research Fellow in Chemistry*  
A.B., Harvard College, 1971; Ph.D., University of California, 1975. California Institute, 1976-.
- David B. Kaback, Ph.D., *Research Fellow in Chemistry*  
B.S., State University of New York, 1971; Ph.D., Brandeis University, 1976. California Institute, 1975-.
- Leonard Konrad Kaczmarek, Ph.D., *Spencer Senior Research Fellow in Biology*  
B.Sc., University of London, 1968; M.Sc., D.I.C., 1969; Ph.D., 1971. California Institute, 1976-.
- Thomas Kaiser, Ph.D., *Research Fellow in Geochemistry*  
Ph.D., University of Bern (Switzerland), 1977. California Institute, 1978-79.
- James T. Kajiya, Ph.D., *Assistant Professor of Computer Science*  
Ph.D., The University of Utah, 1978. California Institute, 1978-.
- Walter Barclay Kamb, Ph.D., *Professor of Geology and Geophysics; Chairman of the Division of Geological and Planetary Sciences*  
B.S., California Institute, 1952; Ph.D., 1956. Assistant Professor of Geology, 1956-60; Associate Professor, 1960-62; Professor, 1962-63; Professor of Geology and Geophysics, 1963-; Division Chairman, 1972-.
- Hiroo Kanamori, Ph.D., *Professor of Geophysics*  
B.S., Tokyo University, 1959; M.S., 1961; Ph.D., 1964. Research Fellow, California Institute, 1965-66; Professor, 1972-.
- Irving Kaplansky, Ph.D., *Sherman Fairchild Distinguished Scholar*  
B.A., University of Toronto, 1938; M.A., 1939; Ph.D., Harvard University, 1941. George Herbert Mead Distinguished Service Professor, The University of Chicago, 1968-; California Institute, 1979-80.

- Sergei Fedor Karpenko, Ph.D., *Visiting Associate in Geochemistry*  
B.S., Moscow University, 1963; Ph.D., 1969. Vernadsky Institute of Geochemistry (USSR), 1963-. California Institute, 1979.
- Takuji Kasamatsu, M.D., *Spencer Senior Research Fellow in Biology*  
B.S., Osaka University, 1959; M.D., 1963. California Institute, 1975-.
- Lawrence Michael Kauvar, Ph.D., *Research Fellow in Biology*  
B.A., Harvard University, 1973; Ph.D., Yale University, 1978. California Institute, 1978-.
- Ralph William Kavanagh, Ph.D., *Professor of Physics*  
B.A., Reed College, 1950; M.A., University of Oregon, 1952; Ph.D., California Institute, 1956. Research Fellow, 1956-58; Senior Research Fellow, 1958-60; Assistant Professor, 1960-65; Associate Professor, 1965-70; Professor, 1970-.
- Alexander S. Kechris, Ph.D., *Associate Professor of Mathematics* (LOA)  
M.S., National Technological University (Athens), 1969; Ph.D., University of California (Los Angeles), 1972. Assistant Professor, California Institute, 1974-76; Associate Professor, 1976-.
- Herbert Bishop Keller, Ph.D., *Professor of Applied Mathematics* (LOA)  
B.E.E., Georgia Institute of Technology, 1945; M.A., New York University, 1948; Ph.D., 1954. Visiting Professor of Applied Mathematics, California Institute, 1965-66; Professor, 1967-.
- Vernal Harris Kenner, Ph.D., *Senior Research Fellow in Aeronautics*  
B.S., University of California, 1965; M.S., 1967; Ph.D., 1971. California Institute, 1978-.
- Rosemary G. Kennett, Ph.D., *Research Fellow in Physics*  
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- Gregory Ketabgian, M.D., *Director of Health Services*  
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- Daniel Jerome Kevles, Ph.D., *Professor of History; Executive Officer for the Humanities*  
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- D. Roderick Kiewiet, Ph.D., *Assistant Professor of Political Science*  
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- Karen Linnea Hartsuyker Kindle, Ph.D., *Research Fellow in Chemistry*  
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- Arthur Louis Klein, Ph.D., *Professor of Aeronautics, Emeritus*  
B.S., California Institute, 1921; M.S., 1924; Ph.D., 1925. Research Fellow in Physics and Aeronautics, 1927-29; Assistant Professor of Aeronautics, 1929-34; Associate Professor, 1934-54; Professor, 1954-68; Professor Emeritus, 1968-.
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**Robert Paul Kraft, Ph.D., *Sherman Fairchild Distinguished Scholar***

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**Heinz-Otto Kreiss, Dr.Tech., *Docent, Professor of Applied Mathematics***

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