GRADUATE STUDY IN PHYSICS AND ASTRONOMY

The University of Iowa

Graduate Study in Physics and Astronomy

Professor Dwight Nicholson
Chair of Department

Van Allen Hall from the southwest

Faculty and Research Staff

Professor Christoph Goertz

CARLSON, Richard R., Ph.D., Chicago, 1951.
Professor. Experimental low-energy nuclear physics.

CARPENTER, Raymon T., Ph.D., Northwestern, 1962.
Professor. Experimental plasma physics.

D'ANGELO, Nicola, Ph.D., Rome, 1953.
Professor. Experimental plasma physics, experimental space physics.

ENEMARK, Donald D., Ph.D., Iowa, 1970.
Adjunct Associate Professor. Electronics.

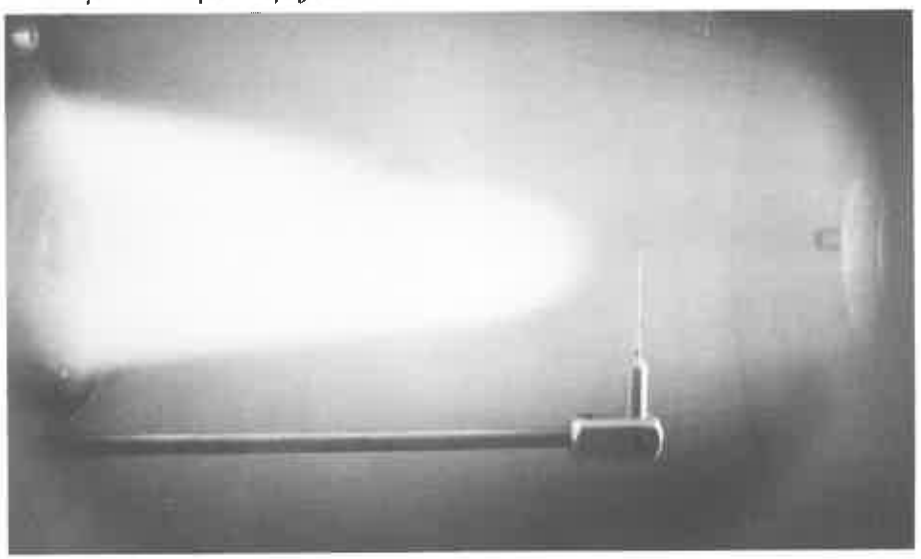
FIX, John D., Ph.D., Indiana, 1969.
Professor. Astrophysics.

FRANK, Louis A., Ph.D., Iowa, 1964.
Professor. Experimental space physics.

GOERTZ, Christoph K., Ph.D., Rhodes, 1972.
Professor. Theoretical space physics.

GOREE, John A., Ph.D., Princeton, 1985.
Assistant Professor. Experimental plasma physics.

Neutral atoms glow after being struck by electrons in an experimental plasma physics device



GURNETT, Donald A., Ph.D., Iowa, 1965.
Professor. Experimental space physics.

KLEIBER, Paul D., Ph.D., Colorado, 1981.
Assistant Professor. Atomic, molecular, and laser physics.

KLINK, William H., Ph.D., Johns Hopkins, 1964.
Professor. Elementary particle physics, mathematical physics.

KNORR, Georg E., Ph.D., Munich, 1963.
Professor. Theoretical plasma physics.

LASTER, Howard J., Ph.D., Cornell, 1957.
Professor. Cosmic ray astrophysics, international energy policy.

LONNGREN, Karl E., Ph.D., Wisconsin, 1964.
Professor (also Electrical and Computer Engineering). Experimental plasma physics.

McCLIMENT, Edward R., Ph.D., Illinois, 1962.
Professor. Elementary particle physics.

MERLINO, Robert L., Ph.D., Maryland, 1980.
Associate Professor. Experimental plasma physics.

MUTEL, Robert L., Ph.D., Colorado, 1975.
Professor. Radio astronomy.

NEFF, John S., Ph.D., Wisconsin, 1961.
Professor. Observational optical astronomy.

NELSON, Edward B., Ph.D., Columbia, 1949.
Professor Emeritus.

NEWSOM, Charles R., Ph.D., Texas, 1980.
Assistant Professor. Experimental intermediate-energy nuclear physics.

NICHOLSON, Dwight R., Ph.D., California, Berkeley, 1975.
Professor and Chair. Theoretical plasma physics.

NORBECK, Edwin, Ph.D., Chicago, 1956.
Professor. Experimental nuclear physics.
PAYNE, Gerald L., Ph.D., California, San Diego, 1967.
Professor. Theoretical nuclear physics, theoretical plasma physics.
POLYZOU, Wayne N., Ph.D., Maryland, 1979.
Associate Professor. Theoretical nuclear physics.
SAVAGE, William R., Ph.D., Iowa State, 1956.
Professor. Acoustics and experimental solid-state physics.
SCHWEITZER, John W., Ph.D., Cincinnati, 1966.
Professor. Theoretical solid-state physics.
SHAWHAN, Stanley D., Ph.D., Iowa, 1966.
Professor. Observational radio astronomy, experimental space physics.
SPANGLER, Steven R., Ph.D., Iowa, 1975.
Associate Professor. Astrophysics, extragalactic radio astronomy.
STWALLEY, William C., Ph.D., Harvard, 1969.
Professor (also Chemistry). Quantum optics, low-temperature physics, atomic and molecular physics, laser physics.
VAN ALLEN, James A., Ph.D., Iowa, 1939.
Professor Emeritus. Experimental space physics, astrophysics.

Research Scientists

Kent L. Ackerson, Ph.D., Iowa, 1972.
Space plasma physics.
Roger R. Anderson, Ph.D., Iowa, 1976.
Interplanetary and magnetospheric plasma waves.
Wynne Calvert, Ph.D., Colorado, 1962.
Space plasma waves.
John D. Craven, Ph.D., Iowa, 1969.
Auroral and magnetospheric physics.
Timothy E. Eastman, Ph.D., Alaska, 1979.
Space plasma physics.
William S. Kurth, Ph.D., Iowa, 1979.
Interplanetary and magnetospheric plasma waves.
Robert R. Shaw, Ph.D., Iowa, 1975.
Space physics.

Associate Research Scientists

Crockett L. Grabbe, Ph.D., California Institute of Technology, 1977.
Theoretical plasma physics.
Mary M. Mellott (Hoppe), Ph.D., Washington (St. Louis), 1975.
Space plasma physics.
Bruce A. Randall, Ph.D., Iowa, 1972.
Magnetospheric physics.
James P. Sheerin, Ph.D., Michigan, 1980.
Theoretical plasma physics.

Assistant Research Scientists

Cheryl Y. Huang, Ph.D., Iowa, 1981.
Space physics.
Marjatta Lyyra, Ph.D., Stockholm, Sweden, 1979.
Laser spectroscopy.
Shinobu Machida, Ph.D., Tokyo, Japan, 1983.
Theoretical space plasma physics.
Ken-Ichi Nishikawa, Ph.D., Nagoya, Japan, 1981.
Theoretical space plasma physics.

Research Investigators

Iver Cairns, Ph.D., Sydney, Australia, 1986.
Theoretical astrophysics.
Steven L. Cartier, Ph.D., Iowa, 1986.
Experimental plasma physics.
Richard Rairden, Ph.D., Iowa, 1985.
Space plasma physics.

Professor Gerald Payne and a graduate student

Advanced Degrees

Inside the six-million-volt Van de Graaff accelerator

Two advanced degrees are offered in physics: the Master of Science, with thesis or with critical essay; and the Doctor of Philosophy with a research dissertation. One advanced degree is offered in astronomy: the Master of Science with thesis or with critical essay. A student who wishes to pursue a program in astronomy beyond the M.S. level may qualify for a Doctor of Philosophy degree in physics with specialization and a dissertation in astronomy or astrophysics. An interdepartmental (Ph.D.) program is available in applied mathematical science.

Each graduate student has an individual faculty adviser who oversees the student's academic work and thesis or dissertation research. A typical Ph.D. program requires five years of graduate work.

North Liberty Radio Observatory

Facilities

Facilities for graduate study in physics and astronomy are located in the 195,000-square-foot Van Allen Hall. This completely air-conditioned building houses an excellent open-stack library, machine shops, laboratories, offices, storerooms, auditoria, darkrooms, classrooms, lecture halls, and seminar rooms. A desk and private study area are provided for each graduate student.

The laboratories are well equipped and the central machine shop is staffed with skilled instrument makers and machinists. There are several electronics and machine shops for the use of advanced students and the research staff.

An IBM 4381 computer, five Prime 9955 processors, and the associated facilities of the Weeg Computing Center are available for research use by students and staff. The department itself has two DEC Vax 11/780 computers and numerous microcomputers dedicated to specific research programs. Many time-sharing terminals and extensive auxiliary apparatus are provided for student use.

Supercomputers are accessed by telephone at the National Magnetic Fusion Energy Computing Center in Livermore, California; the National Center for Atmospheric Research in Boulder, Colorado; the National Center for Supercomputing Applications in Champaign, Illinois; and the Los Alamos National Laboratory in Los Alamos, New Mexico.

Major research facilities in physics and astronomy are

(a) A comprehensive array of low-energy particle accelerators, electronic test equipment, and environmental test chambers and clean rooms, and an optics laboratory for the development, calibration, and proof testing of instruments for space flight.

(b) A computer-assisted design (CAD) facility.

(c) A 6-MV Van de Graaff accelerator in a nuclear physics laboratory adjoining Van Allen Hall.

(d) A fully equipped high-energy physics laboratory used for design, construction, and testing of detectors to be used in experiments at Fermilab and other large facilities around the world.

(e) Twenty-four-inch and 12-inch Cassegrain telescopes at the Riverside Astronomical Observatory 10 miles south of Iowa City.

(f) Sixty-foot and 28-foot radio telescopes located at the North Liberty Radio Observatory 12 miles north of Iowa City (part of the national Very Long Baseline Interferometry network). This facility will soon become the site of one element in the new Very Long Baseline Array (VLBA) network.

(g) A solid-state laboratory with facilities for magnetic susceptibility, resistivity, Hall effect, and specific heat measurements at low temperatures and facilities for the preparation of experimental materials.

(h) Several plasma physics laboratories including a 6-kG Q-machine facility and a variety of multidipole plasma devices and associated computer-based diagnostic equipment used for basic plasma physics research, laboratory simulation of space plasma physics phenomena, and applications to plasma processing of materials.

(i) An acoustics laboratory for study of the physics of musical instruments.

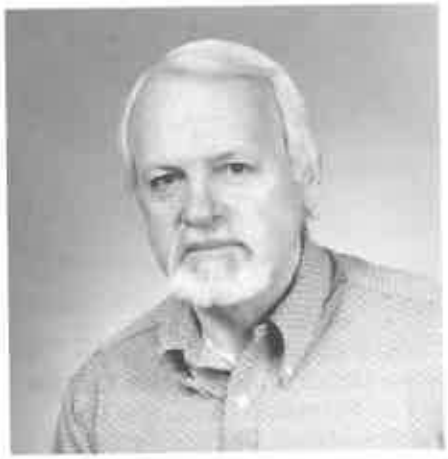
(j) The Iowa Laser Facility (physically located in the Chemistry-Botany Building) which contains a wide variety of modern laser instrumentation. Several monochromators (with lengths to 3.4 meters), high-vacuum molecular beam systems, and low-temperature equipment (including a 110-kG superconducting magnet and a helium dilution refrigerator capable of 0.012 K) are also located in the laboratory.

Advanced astronomy students also conduct research at the National Astronomy and Ionosphere Center at Arecibo, Puerto Rico; the Very Large Array radio telescope near Socorro, New Mexico; the Very Long Baseline Interferometry Network; Haystack Observatory at Westford, Massachusetts; Kitt Peak National Observatory, near Tucson, Arizona; the Infrared Telescope Facility, Mauna Kea, Hawaii; and the International Ultraviolet Explorer, Goddard Space Flight Center, Greenbelt, Maryland.

Arrangements are available for student research in nuclear physics at the Argonne National Laboratory in Argonne, Illinois; in elementary particle physics at the Fermi National Accelerator Laboratory in Batavia, Illinois, the Los Alamos Meson Physics Facility in Los Alamos, New Mexico, and several other accelerators around the world; in space plasma physics at the Los Alamos National Laboratory in Los Alamos, New Mexico; and in ionospheric plasma physics at the National Astronomy and Ionosphere Center near Arecibo, Puerto Rico.

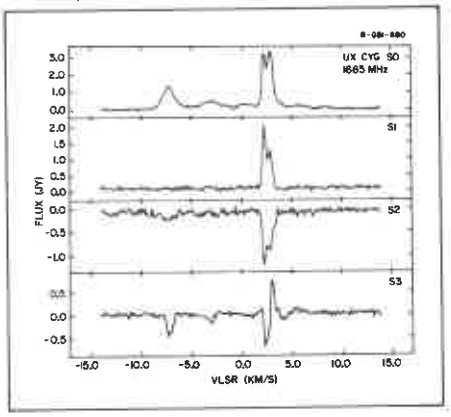
Research

Professor Jack Fix



Professor Thomas Carpenter

Radio spectra of the star UX Cygni



Currently active areas of research include the following:

Experimental:
- Acoustics of Musical Instruments
- Astronomy (Optical and Radio)
- Atomic, Molecular, and Laser Physics
- Auroral Physics
- Cosmic Rays
- Elementary Particle Physics
- Nuclear Physics
- Low-Temperature Physics
- Magnetospheric Physics
- Planetary Physics
- Plasma Physics
- Solid-State Physics
- Space Plasma Physics

Theoretical:
- Astrophysics
- Atomic, Molecular, and Laser Physics
- Elementary Particle Physics
- Nuclear Physics
- Plasma Physics
- Solid-State Physics
- Space Plasma Physics

Research in physics and astronomy is supported by state funds and by the Air Force Office of Scientific Research, the Department of Energy, the National Aeronautics and Space Administration, the National Science Foundation, the Office of Naval Research, and the Petroleum Research Fund. Separately budgeted research expenditures were over $5 million during 1986.

Acoustics

The acoustics facility includes a reverberant recording room, tape recorders, and a real-time spectrum analyzer for the study of musical sounds. The emphasis is on the physics of plucked string instruments. The equipment has uses in other applications for interdisciplinary studies. The research in musical acoustics is a joint undertaking with the School of Music.

Astronomy and Astrophysics

Research programs in optical and infrared astronomy are carried out at The University of Iowa Observatory near Riverside and at several national observatories. The observatory is equipped for both photometric and spectrophotometric observations. Current research programs include spectrophotometry of comets, novae, binary stars, and stars with unusual energy distributions. Work on surface photometry of comets and emission nebulae is also in progress. Work carried out at national facilities includes photometry, spatial interferometry, and spectroscopy of stellar masers.

Radio astronomy observations are carried out at the North Liberty Radio Observatory (NLRO) near Iowa City as well as at several national observatories. The principal research instrument at the North Liberty Radio Observatory is a 60-foot telescope used for both continuum and spectral line observations at centimetric wavelengths. Current research programs at the North Liberty Radio Observatory include synoptic studies of 18-cm OH emission from stellar masers, searches for new OH sources, and very long baseline interferometric observations of both OH stellar masers and extragalactic continuum sources. NLRO is one of the observatories in the national Very Long Baseline Interferometry (VLBI) network, and it has been chosen to be one of the sites for the new VLBA. Work at national observatories includes spatial mapping of extragalactic, stellar, and solar system objects; observations of molecular clouds; and a variety of VLBI investigations.

Theoretical astrophysics study is concentrated on the gas and dust in the circumstellar envelopes of evolved stars. Topics of current interest include computer simula-

tions of the hydrodynamics and radiative transfer in circumstellar mass flows, the scattering properties of circumstellar dust shells, models of OH masers near the cool stars, and scattering properties of the interstellar medium. Other theoretical work involves study of plasma physics topics of astrophysical importance, particularly the characteristics of nonlinear plasma waves, including shocks and solitons, and their interaction with charged particles. The goal of this research is to better understand physical processes in radio sources and the interstellar medium.

Atomic, Molecular, and Laser Physics

High-vacuum atomic and molecular beam systems are used for the study of collision dynamics in simple molecular systems. Conventional and laser high-resolution spectroscopic studies complementary to these collision dynamics studies are being carried out simultaneously. In several instances, these molecular systems include either actual or potential laser transitions of considerable promise.

Theoretical work in atomic and molecular physics is concerned primarily with determination of atomic and molecular interactions, especially potential energy curves of diatomic molecules. Also of interest are radiative transition probabilities and lifetimes, elastic and inelastic scattering cross sections, corrections to the Born-Oppenheimer separation of electronic and nuclear motion, and the dependence of atomic cluster properties on atomic size.

Lasers are used to probe atomic and molecular processes through high-resolution spectroscopy and various laser pump-probe techniques. Primary emphasis is on the study of excited-state collision dynamics; in many cases these excited-state interactions are important for the development of new laser sources. Similar laser pump-probe techniques are being applied to the study of the kinetics and dynamics of cluster or particulate nucleation and condensation.

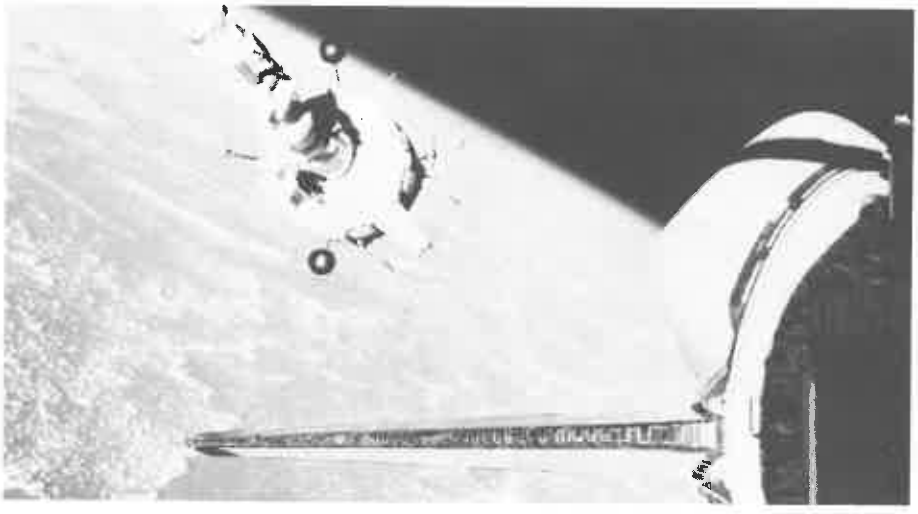
Intense laser fields can appreciably modify the dynamics of atomic and molecular interactions. Detailed studies of nonlinear phenomena in this important strong radiation field-atom coupling limit are also currently under way.

Elementary Particle Physics

Research in high- and medium-energy experimental particle physics is currently being carried out at Fermilab and Los Alamos. Present activities at Fermilab involve high-precision measurements of polarization phenomena in the production and decay of hyperons. This research is being done in collaboration with an international team of investigators from Brazil, China, Fermilab, Iowa, Mexico, and the Soviet Union. A well-equipped high-energy physics laboratory is maintained at Iowa to develop apparatus for these experiments. This lab is now the scene of an

Professor Louis Frank

The Plasma Diagnostics Package during a space shuttle flight



Professor Edwin Norbeck

intense effort to adapt state-of-the-art silicon strip particle detectors to the hyperon facility at Fermilab.

The Los Alamos effort involves neutrino charge current and oscillation experiments and high-precision polarized neutron experiments. To be used in this effort, a new high-intensity proton source and a large, new experimental hall have been approved and are under construction at Los Alamos.

Theoretical research in elementary particle physics deals with scattering matrix theories of multiparticle reactions, applications of group theory to particle physics, the representation theory of groups (in collaboration with members of the mathematics department), and aspects of completely integrable and nearly completely integrable Hamiltonian systems.

Nuclear Physics

A versatile 6-MV Van de Graaff accelerator is used to study nuclear reactions induced by all stable isotopes of hydrogen, helium, lithium, and beryllium. A unique design allows energies up to 14 MeV for triply charged ions. Special emphasis is given to the study of lithium-ion reactions where three or more particles are produced. An additional program of the laboratory uses the ion beams for measuring the chemical and physical structure of semiconductor materials. The laboratory also conducts nuclear experiments using higher-energy beams at national accelerator facilities.

Theoretical research in nuclear and intermediate energy physics is directed at understanding the interactions between the elementary constituents of the nucleus. Areas of current research include relativistic quark models of the nucleus, few-nucleon models of the nucleus, lepton-nuclear interactions, and symmetry properties of scattering amplitudes. This research requires both analytical and numerical calculations. The numerical work is done either on the departmental Vax or the CRAY-XMP at Lawrence Livermore National Laboratory. We are engaged in research collaborations with scientists at both Argonne National Laboratory and Los Alamos National Laboratory.

Plasma Physics

Research in plasma physics includes the study of basic plasma properties and the applications of basic plasma phenomena to thermonuclear fusion plasmas, space plasmas, astrophysical plasmas, and plasmas for microfabrication processing.

One emphasis is on experiments designed to simulate, in the laboratory, various plasma processes occurring in the ionosphere; this work is being funded by the Office of Naval Research. Some topics under investigation are electrostatic ion cyclotron waves and their relation to ion beam and conic formation in the auroral zone, double layers, and ionospheric instabilities. Several plasma devices are available for these studies including a

Professor Nicola D'Angelo uses a computer to analyze experimental plasma physics data

Q-machine, a coaxial double plasma device, and several multidipole plasma devices. In addition, devices are available for studying plasma phenomena associated with the properties of cusp confinement. Experimental study of the properties of solitons is funded through the National Science Foundation. Experimental research on high-power radio waves in ionospheric plasma is performed at the National Astronomy and Ionosphere Center near Arecibo, Puerto Rico.

Another experimental emphasis is in the applied area of plasma processing. Plasma etching and sputtering for microcircuit fabrication are under investigation. Experiments are conducted with radio frequency discharges in a computer-automated laboratory. Tunable dye lasers are employed for laser-induced fluorescence diagnostics of plasmas.

Theoretical plasma physics uses a combination of analytic and numerical techniques. Two kinds of numerical techniques are used: the nonlinear partial differential fluid equations, which describe a plasma, are integrated numerically; and Newton's laws of motion together with Maxwell's equations are solved for systems of 1,000 to 1,000,000 particles. The work concentrates on the study of equilibrium, stability, solitons, nonlinear waves, and turbulence in laboratory plasmas, fusion plasmas, ionospheric plasmas, magnetospheric plasmas, space plasmas, and astrophysical plasmas. The numerical work is performed on the campus computers as well as via telephone on supercomputers in California, Colorado, Illinois, and New Mexico.

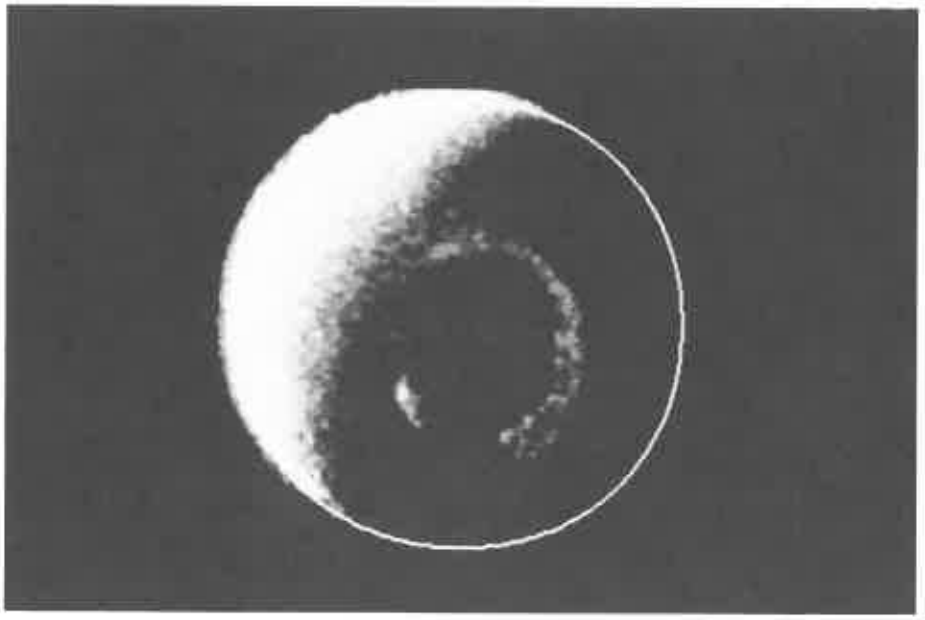
Solid-State Physics

Experiments on fundamental thermal, electrical, and magnetic properties of materials are included in the experimental solid-state program. Currently studies are focused on the samarium monochalcogenide and pnictide compounds and their mutual solid solutions in an investigation of intermediate valence phenomena in rare-earth systems and on electrically conducting glasses and chemically deposited thin films of semiconductors. Experimental work is also concerned with spin-polarized atoms.

Theoretical work in solid-state physics is concerned with the application of various many-body approaches to the theory of the electronic and magnetic properties of condensed matter. Areas of special current interest include valence instabilities in rare-earth compounds and related narrow-band phenomena and nonlinear effects in quasi-one-dimensional models of condensed matter.

Professor William Savage

The northern lights as seen in ultraviolet light from the Dynamics Explorer spacecraft



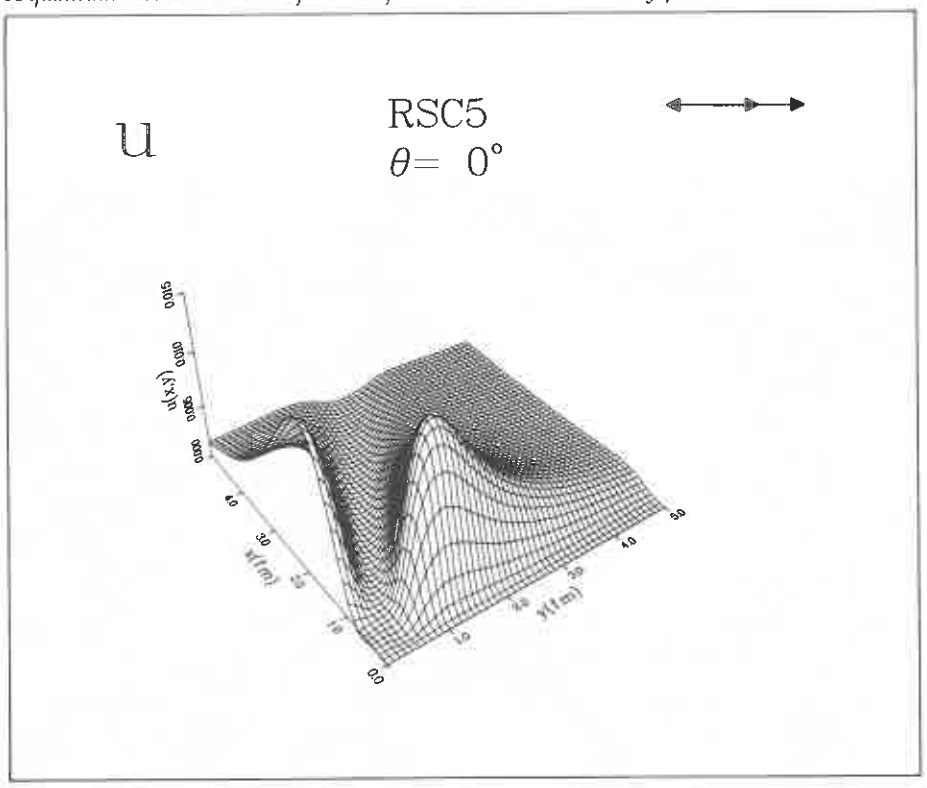
Professor Steven Spangler

Space Physics

A major program of experimental and theoretical space physics is conducted as a regular part of the graduate work of the department. Extensive facilities and an engineering and technical staff are available for the design, construction, and testing of equipment for flight in rockets, space craft, and the space shuttle; the reception of satellite telemetry; and the computerized decoding and analysis of data. Emphasis is on comprehensive observational and theoretical study of (*a*) the magnetospheres of Earth, Jupiter, Saturn, and Uranus, (*b*) the interplanetary medium, including the propagation of energetic particles therein, and (*c*) the galactic cosmic radiation. The space physics group has currently active instruments on IMP-8; Pioneers 10 and 11 now at over 38 AU and 20 AU, respectively, from the sun; International Sun-Earth Explorers 1, 2, and 3; Dynamics Explorer 1; and Voyagers 1 and 2. The Plasma Diagnostics Package (PDP), a comprehensive set of plasma-wave and particle detectors, has flown twice on the space shuttle. Two major instruments have been completed for the Galileo (Jupiter Orbiter) mission (1987 or 1988 launch). Four instruments are being defined for the International Solar Terrestrial Physics mission. Surveys of the energetic charged particle, plasma, and plasma-wave environment of Saturn were made by Pioneer 11 in September 1979, Voyager 1 in November 1980, and Voyager 2 in August 1981. Voyager 2 encountered Uranus in 1986 and will encounter Neptune in 1989. The Recoverable Plasma Diagnostics Package (RPDP) is currently being constructed for flight on the space shuttle in the early 1990s.

Space plasma physics deals mainly with the magnetohydrodynamics, wave-particle interactions, transport, and acceleration of charged particles in planetary magnetospheres. In situ measurements by the various instruments described above enable the research teams to utilize the planetary magnetospheres as natural laboratories for plasma physics. These laboratories provide some unique conditions that are either difficult or impossible to simulate in a man-made laboratory. Due to the complex conditions present in the magnetospheres, this field is still very much in a mode of discovery. As a leading institution in this field, we participate in this sense of discovery in both our observational and theoretical work.

A quantum mechanical wave function from the nuclear three-body problem



Recent Recipients of the Ph.D. Degree

(Name, Current Employment, Thesis Title)

1981

Joseph E. Borovsky, Los Alamos National Laboratory, Los Alamos, New Mexico
"The Simulation of Plasma Double Layer Structures in Two Dimensions"

Mark J. Claussen, University of Massachusetts, Amherst, Massachusetts
"Polarization Properties of Main-Line OH Maser Emission from Circumstellar Shells of Late-Type Variable Stars"

Cheryl Yu-Yin Huang, The University of Iowa, Iowa City, Iowa
"A Theoretical Study of Plasmaspheric Hiss"

Ping-Tien Wu, Institute of Nuclear Energy Research, Lung-Tan, Taiwan, Republic of China
"Lithium-Lithium Elastic Scattering from 2.0 to 5.5 MeV"

1982

Dennis L. Gallagher, University of Alabama, Huntsville, Alabama
"Short Wavelength Electrostatic Waves in the Earth's Magnetosheath"

Lee A. Reinleitner, Marshall Space Flight Center, Huntsville, Alabama
"Whistler Mode Chorus Generation of Beam Driven Electrostatic Bursts"

1983

Paul J. Hansen, Lockheed Missiles and Space Company, Palo Alto, California
"Studies in Weak Turbulence"

Robert L. Tokar, Los Alamos National Laboratory, Los Alamos, New Mexico
"Whistler Mode Turbulence at Earth's Bow Shock: Generation via Electron Beams and Ray Path Integrated Amplification"

1984

David J. Doiron, Clemson University, Clemson, South Carolina
"Radio Emission in RS CVn Binary Stars"

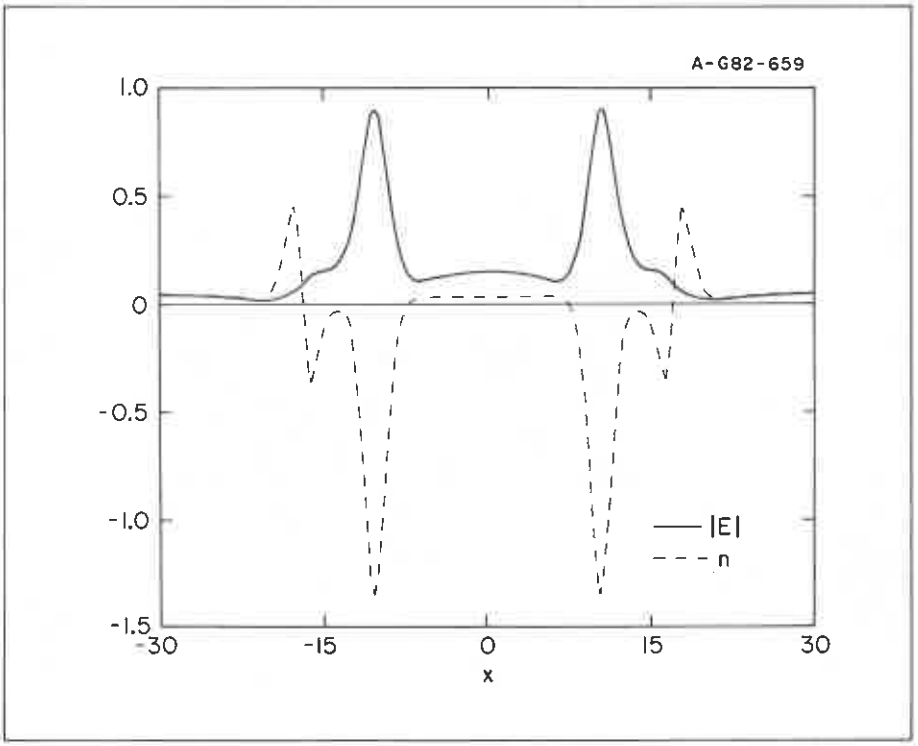
Stephen A. Fuselier, Los Alamos National Laboratory, Los Alamos, New Mexico
"The Downshift of Electron Plasma Oscillations in the Electron Foreshock Region"

Mark W. Hodges, Owens Valley Radio Observatory, Big Pine, California
"VLBI Observations of Compact Double Radio Sources"

Nojan Omidi, University of Maryland, College Park, Maryland
"Generation of Auroral Kilometric and Z-Mode Radiation by the Cyclotron Maser Instability"

Professor William Klink

Numerical solution for the electric field and the density in two plasma solitons which have just collided



Professor Donald Gurnett

Guo-Zheng Sun, Laboratory for Plasma and Fusion Energy Studies, University of Maryland, College Park, Maryland
"Statistical Theory of Cubic Langmuir Turbulence"

Daniel R. Weimer, Regis College Research Center, Weston, Massachusetts
"Auroral Zone Electric Fields from DE-1 and -2 at Magnetic Conjunctions"

1985

Chia-Rong Chen, University of Rochester, Rochester, New York
"Effects of the Three-Nucleon Forces on the Trinucleon System"

Michael L. Cobb, Steward Observatory, University of Arizona, Tucson, Arizona
"Infrared Photometry and High-Resolution Imaging of OH/IR Stars"

Ralph A. Gaume, University of Michigan, Ann Arbor, Michigan
"A Study of the Ground State Hydroxyl Maser Emissions Associated with Eleven Regions of Star Formation"

Richard L. Rairden, The University of Iowa, Iowa City, Iowa
"Geocoronal Imaging with Dynamics Explorer"

1986 (Partial)

Mark M. Baumback, The University of Iowa, Iowa City, Iowa
"Properties of Auroral Kilometric Radiation from an Interferometer Analysis of the ISEE-1 and -2 Plasma Wave Data"

Robert A. Bosch, University of Michigan, Ann Arbor, Michigan
"Plasma Confinement in a Spindle Cusp Magnetic Field"

Steven L. Cartier, The University of Iowa, Iowa City, Iowa
"Properties of Electrostatic Ion-Cyclotron Waves in a Non-uniform Magnetic Field and Their Association with Strong, Magnetized Double Layers"

Professor William Stwalley studies laser-induced plasmas and metal vapors with a microprocessor-controlled Nd:YAG/Dye laser

Recent Publications

1. U.S. INAN, M. PON, P. M. BANKS, P. R. WILLIAMSON, W. J. RAITT, and S. D. SHAWHAN. Modulated Beam Injection from the Space Shuttle during Magnetic Conjunctions of STS-3 with the DE-1 Satellite. *Radio Sci.* 19 (1984): 487-95.

2. CROCKETT L. GRABBE and TIMOTHY E. EASTMAN. Generation of Broadband Electrostatic Noise by Ion Beam Instabilities in the Magnetotail. *J. Geophys. Res.* 89 (1984): 3865-72.

3. D. J. WILLIAMS and L. A. FRANK. Intense Low-Energy Ion Populations at Low Equatorial Altitudes. *J. Geophys. Res.* 89 (1984): 3903-11.

4. D. R. NICHOLSON, G. L. PAYNE, R. M. DOWNIE, and J. P. SHEERIN. Solitons versus Parametric Instabilities during Ionospheric Heating. *Phys. Rev. Lett.* 52 (1984): 2152-55.

5. STEVEN L. CARTIER and ROBERT L. MERLINO. Comments on the "New Method to Measure Plasma Potential with Emissive Probes." *Rev. Sci. Instrum.* 55 (1984): 1002-3.

6. Y. T. CHIU, R. R. ANDERSON, J. FENNELL, L. FRANK, R. HOFFMAN, M. HUDSON, L. LYONS, P. PALMADESSO, E. UNGSTRUP, R. VONDRAK, D. WILLIAMS, and R. WOLF. Connection between the Magnetosphere and Ionosphere. Chapter 7 of *Solar Terrestrial Physics: Present and Future*, ed. D. M. Butler and K. Papadopoulos, pp. 7-1—7-48. NASA Reference Publication 1120, 1984.

7. C. F. KENNEL, F. L. SCARF, F. V. CORONITI, C. T. RUSSELL, K.-P. WENZEL, T. R. SANDERSON, P. VAN NES, W. C. FELDMAN, G. K. PARKS, E. J. SMITH, B. T. TSURUTANI, F. S. MOZER, M. TEMERIN, R. R. ANDERSON, J. D. SCUDDER, and M. SCHOLER. Plasma and Energetic Particle Structure Upstream of a Quasi-Parallel Interplanetary Shock. *J. Geophys. Res.* 89 (1984): 5419-35.

8. C. F. KENNEL, J. P. EDMISTON, F. L. SCARF, F. V. CORONITI, C. T. RUSSELL, E. J. SMITH, B. T. TSURUTANI, J. D. SCUDDER, W. C. FELDMAN, R. R. ANDERSON, F. S. MOZER, and M. TEMERIN. Structure of the November 12, 1978, Quasi-Parallel Interplanetary Shock. *J. Geophys. Res.* 89 (1984): 5436-52.

9. P. B. HAYS, T. L. KILLEEN, N. W. SPENCER, L. E. WHARTON, R. G. ROBLE, B. A. EMERY, T. J. FULLER-ROWELL, D. REES, L. A. FRANK, and J. D. CRAVEN. Observations of the Dynamics of the Polar Thermosphere. *J. Geophys. Res.* 89 (1984): 5597-5612.

10. E. F. GABL and K. E. LONNGREN. On Grid Launched Linear and Nonlinear Ion-Acoustic Waves—II. *Plasma Phys. Control. Fusion* 26 (1984): 799-811.

11. JEAN-FRANCOIS LESTRADE, ROBERT L. MUTEL, ROBERT B. PHILLIPS, JOHN C. WEBBER, ARTHUR E. NIELL, and ROBERT A. PRESTON. Detection of a Submilliarcsecond Radio Component in the RS CVn System HR 1099. *Astrophys. J. Lett.* 282 (1984): L23-L26.

12. J. D. CRAVEN, Y. KAMIDE, L. A. FRANK, S.-I. AKASOFU, and M. SUGIURA. Distribution of Aurora and Ionosopheric Currents Observed Simultaneously on a Global Scale. In *Magnetospheric Currents*, ed. Thomas A. Potemra, pp. 137-46. Geophysical Monograph 28. Washington, D.C.: AGU, 1984.

13. L. A. FRANK, C. Y. HUANG, and T. E. EASTMAN. Currents in the Earth's Magnetotail. In *Magnetospheric Currents*, ed. Thomas A. Potemra, pp. 147-57. Geophysical Monograph 28. Washington, D.C.: AGU, 1984.

14. T. E. EASTMAN and L. A. FRANK. Boundary Layers of the Earth's Outer Magnetosphere. In *Magnetic Reconnection in Space and Laboratory Plasmas*, pp. 249-62. Geophysical Monograph 30. Washington, D.C.: AGU, 1984.

15. F. V. CORONITI, F. L. SCARF, C. F. KENNEL, and D. A. GURNETT. Continuum Radiation and Electron Plasma Oscillations in the Distant Geomagnetic Tail. *Geophys. Res. Lett.* 11 (1984): 661-64.

Professor John Schweitzer

Riverside Astronomical Observatory

Professor Howard Laster

16. G. KNORR. Hysteresis Phenomena in Plasmas and Catastrophe Theory. *Plasma Phys. Control. Fusion* 26 (1984): 949-53.

17. J. L. FRIAR, B. F. GIBSON, and G. L. PAYNE. Deuteron Forward Photodisintegration. *Phys. Rev. C.* 30 (1984): 441-55.

18. J. A. VAN ALLEN. Energetic Particles in the Inner Magnetosphere of Saturn. In *Saturn*, ed. Tom Gehrels and Mildred Shapley Matthews, pp. 281-317. Tucson, Arizona: University of Arizona Press, 1984.

19. F. L. SCARF, L. A. FRANK, D. A. GURNETT, L. J. LANZEROTTI, R. LEPPING, A. LAZARUS, and E. C. SITTLER, JR. Measurements of Plasmas, Plasma Waves, and Suprathermal Charged Particles in Saturn's Inner Magnetosphere. In *Saturn*, ed. Tom Gehrels and Mildred Shapley Matthews, pp. 318-53. Tucson, Arizona: University of Arizona Press, 1984.

20. M. L. KAISER, M. D. DESCH, W. S. KURTH, A. F. GENOVA, B. M. PEDERSEN, and D. R. EVANS. Saturn as a Radio Source. In *Saturn*, ed. Tom Gehrels and Mildred Shapley Matthews, pp. 378-415. Tucson, Arizona: University of Arizona Press, 1984.

21. D. A. MENDIS, J. R. HILL, W.-H. IP, C. K. GOERTZ, and E. GRÜN. Electrodynamic Processes in the Ring System of Saturn. In *Saturn*, ed. Tom Gehrels and Mildred Shapley Matthews, pp. 546-89. Tucson, Arizona: University of Arizona Press, 1984.

Van Allen Hall from the southeast

22. F. M. NEUBAUER, D. A. GURNETT, J. D. SCUDDER, and R. E. HARTLE. Titan's Magnetospheric Interaction. In *Saturn*, ed. Tom Gehrels and Mildred Shapley Matthews, pp. 760-87. Tucson, Arizona: University of Arizona Press, 1984.

23. S. D. SHAWHAN, G. B. MURPHY, and J. S. PICKETT. Plasma Diagnostics Package Initial Assessment of the Shuttle Orbiter Plasma Environment. *J. Spacecr. Rockets* 21 (1984): 387-91.

24. S. D. SHAWHAN, G. B. MURPHY, and D. L. FORTNA. Measurements of Electromagnetic Interference on OV102 Columbia Using the Plasma Diagnostics Package. *J. Spacecr. Rockets* 21 (1984): 392-97.

25. G. B. MURPHY and S. D. SHAWHAN. Radio Frequency Fields Generated by the S-Band Communication Link on OV102. *J. Spacecr. Rockets* 21 (1984): 398-99.

26. BRITTAN KUSTOM, ROBERT L. MERLINO, and NICOLA D'ANGELO. Production of Plasma with Variable, Radial Electric Fields. *Rev. Sci. Instrum.* 55 (1984): 1243-45.

27. JOHN D. FIX and ROBERT L. MUTEL. A Search for $O^{18}H$ Maser Emission from G351.8-0.5. *Astrophys. J.* 283 (1984): 653-54.

28. R. B. WIRINGA, J. L. FRIAR, B. F. GIBSON, G. L. PAYNE, and C.-R. CHEN. Faddeev Monte-Carlo Calculations of Trinucleon Binding Energy with Three-Body Potentials. *Phys. Lett.* 143B (1984): 273-78.

29. C. Y. HUANG, L. A. FRANK, and T. E. EASTMAN. High-Altitude Observations of an Intense Inverted V Event. *J. Geophys. Res.* 89 (1984): 7423-30.

30. J. H. SIMONETTI, J. M. CORDES, and S. R. SPANGLER. Small-Scale Variations in the Galactic Magnetic Field: The Rotation Measure Structure Function and Birefringence in Interstellar Scintillations. *Astrophys. J.* 284 (1984): 126-34.

31. O. HAVNES and C. K. GOERTZ. Magnetospheres of Early-Type Chemically Peculiar Magnetic Stars. *Astron. Astrophys.* 138 (1984): 421-30.

32. M. W. HODGES, R. L. MUTEL, and R. B. PHILLIPS. A VLBI Survey of Peaked Spectrum Radio Sources. *Astron. J.* 89 (1984): 1327-31.

33. J. M. BENSON, R. L. MUTEL, and R. A. GAUME. High-Angular-Resolution Observations of the OH Masers in K51 (Main). *Astron. J.* 89 (1984): 1391-97.

34. J. L. FRIAR, B. F. GIBSON, and G. L. PAYNE. One-Pion-Exchange Potential Deuteron. *Phys. Rev. C* 30 (1984): 1084-86.

35. T. E. EASTMAN. Observations of the Magnetospheric Boundary Layers. In *Proc. Conf. Achievements of the IMS*, June 26-28, 1984, Graz, Austria, ESA SP-217, September 1984, 77-83.

36. R. R. ANDERSON. Plasma Waves at and near the Neutral Point. In *Proc. Conf. Achievements of the IMS*, June 26-28, 1984, Graz, Austria, ESA SP-217, September 1984, 199-204.

37. C. K. GOERTZ and K. BRÜNING. Field-Aligned Currents Observed in the Vicinity of a Moving Arc. In *Proc. Conf. Achievements of the IMS*, June 26-28, 1984, Graz, Austria, ESA SP-217, September 1984, 383-85.

38. R. R. ANDERSON. Advances in Magnetospheric Plasma-Wave Research during the IMS. In *Proc. Conf. Achievements of the IMS*, June 26-28, 1984, Graz, Austria, ESA SP-217, September 1984, 751-60.

39. C. K. GOERTZ. Formation of Saturn's Spokes. *Adv. Space Res.* 4 (1984): 137-41.

40. M. M. MELLOTT. The Physical Mechanisms of Subcritical Collisionless Shock-Wave Formation. *Adv. Space Res.* 4 (1984): 245-53.

41. G. K. PARKS, M. McCARTHY, R. J. FITZENREITER, J. ETCHETO, K. A. ANDERSON, R. R. ANDERSON, T. E. EASTMAN, L. A. FRANK, D. A. GURNETT, C. HUANG, R. P. LIN, A. T. Y. LUI, K. W. OGILVIE, A. PEDERSEN, H. REME, and D. J. WILLIAMS. Particle and Field Characteristics of the High-Latitude Plasma Sheet Boundary Layer. *J. Geophys. Res.* 89 (1984): 8885-8906.

42. D. A. GURNETT, R. L. HUFF, J. D. MENIETTI, J. L. BURCH, J. D. WINNINGHAM, and S. D. SHAWHAN. Correlated Low-Frequency Electric and Magnetic Noise along the Auroral Field Lines. *J. Geophys. Res.* 89 (1984): 8971-85.

43. STEVEN R. SPANGLER, STEVEN T. MYERS, and JEAN J. POGGE. VLA Observations of Radio Galaxies with Extended Lobe Emission: 3C 79 and 3C 430. *Astron. J.* 89 (1984): 1478-86.

44. R. L. MUTEL and R. B. PHILLIPS. Superluminal Motion in BL Lacertae: 10.65 GHz VLBI Observations from 1981.7 to 1982.7. In *VLBI and Compact Radio Sources*, IAU Symposium 110, ed. R. Fanti, K. Kellermann, and G. Setti, pp. 117-18. Dordrecht, Holland: D. Reidel Publishing, 1984.

45. R. L. MUTEL, J.-F. LESTRADE, R. A. PRESTON, A. E. NIELL, R. B. PHILLIPS, and J. WEBBER. VLBI Observations of Stellar Binary Systems. In *VLBI and Compact Radio Sources*, IAU Symposium 110, ed. R. Fanti, K. Kellermann, and G. Setti, pp. 277-79. Dordrecht, Holland: D. Reidel Publishing, 1984.

46. N. D'ANGELO, I. B. IVERSEN, and M. M. MADSEN. Unusual Structures of High-Latitude Stratospheric Electric Fields. *J. Geophys. Res.* 89 (1984): 9659-62. [See correction, *J. Geophys. Res.* 89 (1984): 11,828.]

47. J. L. FRIAR, B. F. GIBSON, G. L. PAYNE, and C.-R. CHEN. Configuration Space Faddeev Continuum Calculations: N-d s-Wave Scattering Lengths with Tensor-Force Interactions. *Phys. Rev. C* 30 (1984): 1121-29.

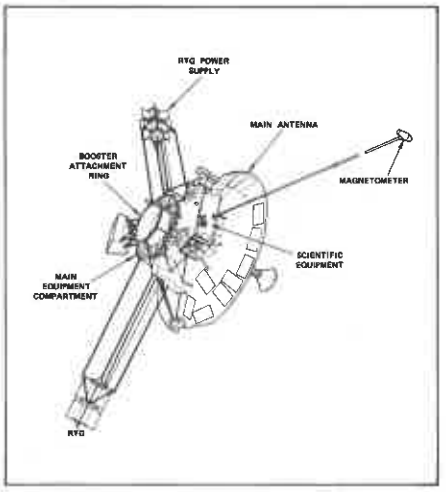
48. G. L. PAYNE, W. H. KLINK, W. N. POLYZOU, J. L. FRIAR, and B. F. GIBSON. Noncompact-Kernel Integral Equation for Three-Body Scattering: nd Quartet Equation and Numerical Results. *Phys. Rev. C* 30 (1984): 1132-39.

49. W. N. POLYZOU, W. H. KLINK, and G. L. PAYNE. Noncompact-Kernel Integral Equation for Three-Body Scattering: Derivation of Boundary Conditions. *Phys. Rev. C* 30 (1984): 1140-45.

50. J. L. FRIAR, B. F. GIBSON, W. H. KLINK, G. L. PAYNE, and W. N. POLYZOU. A New Integral Equation for Three-Body Scattering in Configuration Space. In *Few Body Problems in Physics*, vol. 2—Contributed Papers, ed. B. Zeitnitz, pp. 313-14. Elsevier Science Publishers, B.V., 1984.

Professor Georg Knorr

Simplified drawing of the Pioneer 10/Pioneer 11 spacecraft



Professor Stanley Shawhan

51. J. L. FRIAR, B. F. GIBSON, and G. L. PAYNE. S-Wave Proton-Deuteron Scattering Lengths. In *Few Body Problems in Physics*, vol. 2—Contributed Papers, ed. B. Zeitnitz, pp. 399-400. Elsevier Science Publishers, B.V., 1984.

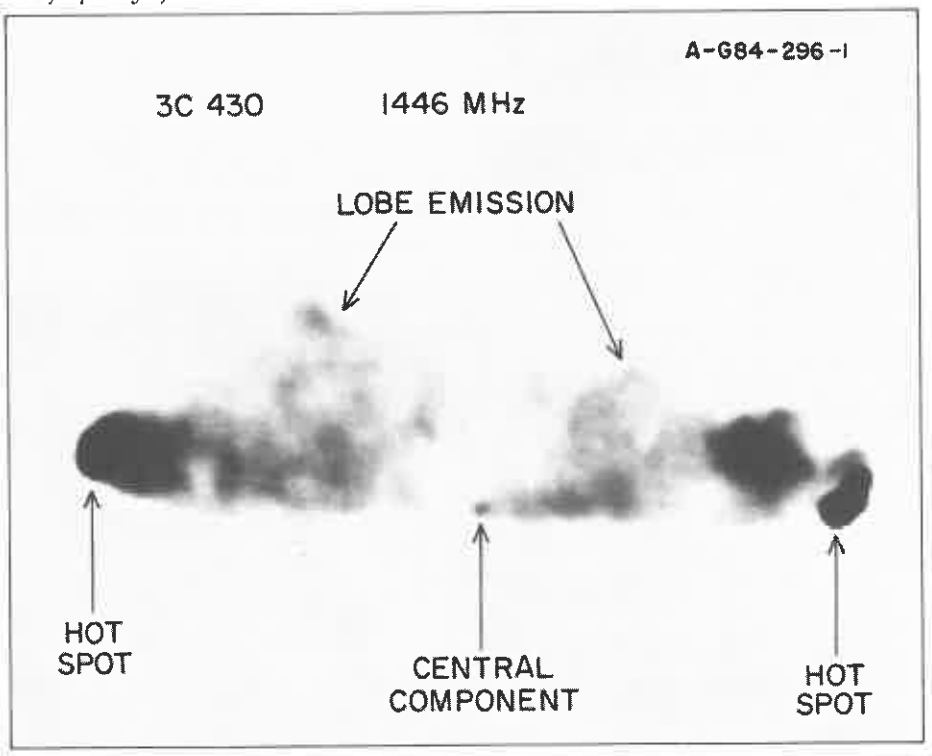
52. N. U. CROOKER, G. L. SISCOE, T. E. EASTMAN, L. A. FRANK, and R. D. ZWICKL. Large-Scale Flow in the Dayside Magnetosheath. *J. Geophys. Res.* 89 (1984): 9711-19.

53. W. S. KURTH, D. A. GURNETT, F. L. SCARF, and R. L. POYNTER. Detection of a Radio Emission at 3 kHz in the Outer Heliosphere. *Nature* 312 (1984): 27-31.

54. CROCKETT L. GRABBE. Resource Letter: PWI-1 Plasma Waves and Instabilities. *Am. J. Phys.* 52 (1984): 970-81.

55. JOHN S. NEFF, DAVID C. HUMM, JAY T. BERGSTRALH, ANITA L. COCHRAN, WILLIAM D. COCHRAN, EDWIN S. BARKER, and ROBERT G. TULL. Absolute Spectrophotometry of Titan, Uranus, and Neptune: 3500 Å-10,500 Å, *Icarus* 60 (1984): 221-35.

Radio image of the radio galaxy 3C 430, made with the Very Large Array at a frequency of 1446 MHz



56. WILLIAM H. KLINK and TUONG TON-THAT. On a Resolution of the Multiplicity Problem for U(n). *Rep. Math. Phys.* 19 (1984): 345-48.

57. C. K. GOERTZ. Kinetic Alfvén Waves on Auroral Field Lines. *Planet. Space Sci.* 32 (1984): 1387-92.

58. S. R. SPANGLER. Nonlinear Evolution of Astrophysical Alfvén Waves. *Proceedings*, Course and Workshop on Plasma Astrophysics, Varenna, Italy, August 28-September 7, 1984, ESA SP-207, November 1984, 197-200.

59. W. S. KURTH, D. A. GURNETT, F. L. SCARF, and R. L. POYNTER. A New Radio Emission at 3 kHz in the Outer Heliosphere. *Proceedings*, Course and Workshop on Plasma Astrophysics, Varenna, Italy, August 28-September 7, 1984, ESA SP-207, November 1984, 285-88.

60. N. OMIDI and D. A. GURNETT. Path-Integrated Growth of Auroral Kilometric Radiation. *J. Geophys. Res.* 89 (1984): 10,801-12.

61. G. L. PAYNE, D. R. NICHOLSON, R. M. DOWNIE, and J. P. SHEERIN. Modulational Instability and Soliton Formation during Ionospheric Heating. *J. Geophys. Res.* 89 (1984): 10, 921-28.

62. O. HAVNES, G. E. MORFILL, and C. K. GOERTZ. Plasma Potential and Grain Charges in a Dust Cloud Embedded in a Plasma. *J. Geophys. Res.* 89 (1984): 10,999-11,003.

63. JOHN D. FIX and MARK J. CLAUSSEN. OH Maser Emission from Warm Variable Stars. *Astrophys. J. Lett.* 287 (1984): L35-L37.

64. M. M. MELLOTT, W. CALVERT, R. L. HUFF, D. A. GURNETT, and S. D. SHAWHAN. DE-1 Observations of Ordinary Mode and Extraordinary Mode Auroral Kilometric Radiation. *Geophys. Res. Lett.* 11 (1984): 1188-91.

65. J. L. FRIAR, B. F. GIBSON, and G. L. PAYNE. Recent Progress in Understanding Trinucleon Properties. *Ann. Rev. Nucl. Part. Sci.* 34 (1984): 403-33.

66. J. M. BULSON, E. F. GABL, and K. E. LONNGREN. Diffraction of Linear and Nonlinear Ion-Acoustic Waves by a Rectangular Aperture. *Electromagnetics* 4 (1984): 55-62.

67. P. R. SUTCLIFFE, D. P. SMITH, A. D. M. WALKER, W. J. HUGHES, and C. K. GOERTZ. Magnetospheric Signatures during the Magnetospheric Substorm of 27 July 1979. *S. Afr. J. Phys.* 7 (1984): 7.

68. D. A. GURNETT and R. R. ANDERSON. Plasma Waves in the Solar Wind: 10 Years of HELIOS Observations. In *10 Years HELIOS*, ed. H. Porsche, pp. 100-105. Oberpfaffenhofen, West Germany: DFVLR, 1984.

69. W. C. STWALLEY. A Hybrid Laser-Magnet Trap for Spin-Polarized Atoms. *Prog. Quant. Electr.* 8 (1984): 203-8.

70. G. GUTIÉRREZ, M. de LLANO, and W. C. STWALLEY. Accurate Direct Determination of Effective-Range Expansion Parameters for Several Central Potentials. *Phys. Rev. B* 29 (1984): 5211-12.

71. S. PETER GARY and M. M. MELLOTT. Whistler Damping at Oblique Propagation: Laminar Shock Precursors. *J. Geophys. Res.* 90 (1985): 99-104.

72. ROBERT L. TOKAR and DONALD A. GURNETT. The Propagation and Growth of Whistler Mode Waves Generated by Electron Beams in Earth's Bow Shock. *J. Geophys. Res.* 90 (1985): 105-14.

73. M. F. THOMSEN, J. T. GOSLING, S. J. BAME, and M. M. MELLOTT. Ion and Electron Heating at Collisionless Shocks near the Critical Mach Number. *J. Geophys. Res.* 90 (1985): 137-48.

74. KORNELIA BRÜNING and CHRISTOPH K. GOERTZ. Influence of the Electron Source Distribution on Field-Aligned Currents. *Geophys. Res. Lett.* 12 (1985): 53-56.

75. STEVEN R. SPANGLER, JAMES P. SHEERIN, and GERALD L. PAYNE. A Numerical Study of Nonlinear Alfvén Waves and Solitons. *Phys. Fluids* 28 (1985): 104-9.

76. STEVEN R. SPANGLER and JAMES P. SHEERIN. Nonlinear Effects and the Limitation of Electron Streaming Instabilities in Astrophysics. In *Unstable Current Systems and Plasma Instabilities in Astrophysics*, IAU Symposium 107, ed. Mukul R. Kundu and Gordon D. Holman, pp. 355-59. Dordrecht, Holland: D. Reidel Publishing, 1985.

77. D. F. DuBOIS, HARVEY A. ROSE, and D. R. NICHOLSON. Statistical Theories of Langmuir Turbulence II: Subsonic to Sonic Transition. *Phys. Fluids* 28 (1985): 202-18.

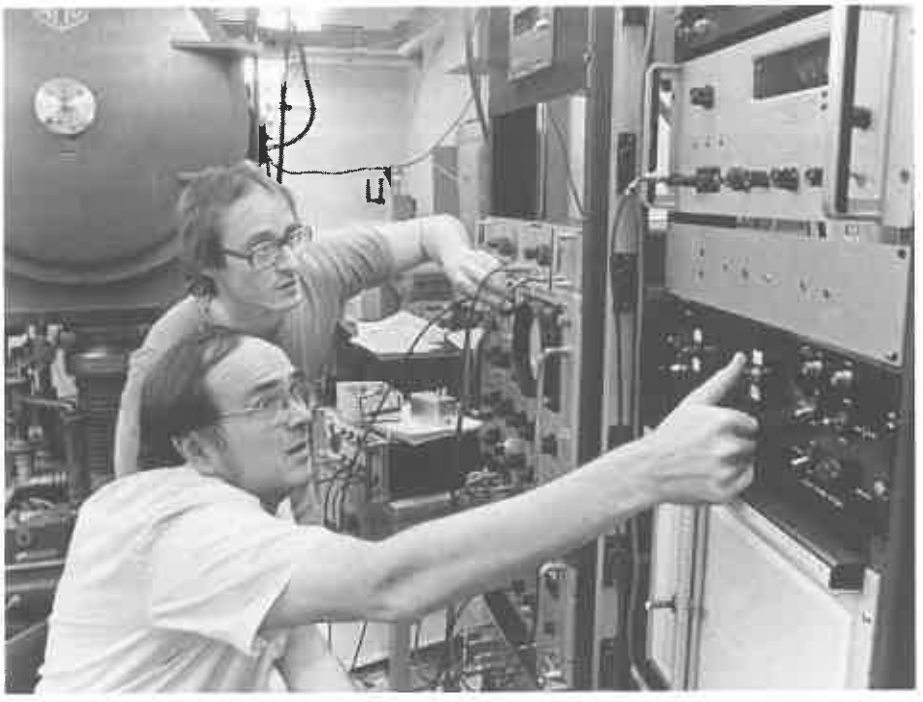
78. STEVEN L. CARTIER, NICOLA D'ANGELO, PETER H. KRUMM, and ROBERT L. MERLINO. Filamental Quenching of the Current-Driven Ion-Cyclotron Instability. *Phys. Fluids* 28 (1985): 432-34.

79. I. B. IVERSEN, M. M. MADSEN, and N. D'ANGELO. Measurements of the Vertical Atmospheric Electric Field and of the Electrical Conductivity with Stratospheric Balloons. *Ann. Geophys.* 3 (1985): 51-56.

80. J. A. VAN ALLEN and B. A. RANDALL. Interplanetary Cosmic Ray Intensity: 1972-1984 and Out to 32 AU. *J. Geophys. Res.* 90 (1985): 1399-1412.

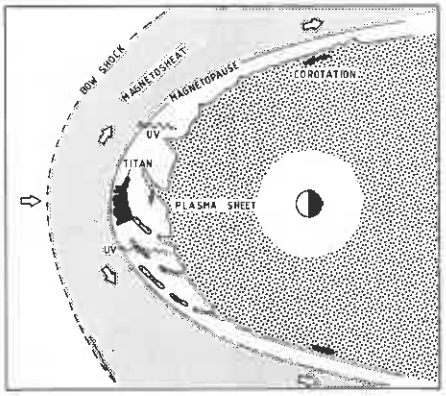
Professor Richard Carlson

Professor Karl Lonngren and a graduate student analyze nonlinear waves in a plasma experiment



Professor Wayne Polyzou

A schematic view of the Saturnian magnetosphere including the plasma sheet whose outer boundary is unstable



81. J. L. BURCH, P. H. REIFF, J. D. MENIETTI, R. A. HEELIS, W. B. HANSON, S. D. SHAWHAN, E. G. SHELLEY, M. SUGIURA, D. R. WEIMER, and J. D. WINNINGHAM. IMF B_y-Dependent Plasma Flow and Birkeland Currents in the Dayside Magnetosphere. 1. Dynamics Explorer Observations. *J. Geophys. Res.* 90 (1985): 1577-93.

82. B. KUSTOM, N. D'ANGELO, and R. L. MERLINO. A Laboratory Investigation of the High-Frequency Farley-Buneman Instability. *J. Geophys. Res.* 90 (1985): 1698-1704.

83. R. L. MUTEL, J.-F. LESTRADE, R. A. PRESTON, and R. B. PHILLIPS. Dual Polarization VLBI Observations of Stellar Binary Systems at 5 GHz. *Astrophys. J.* 289 (1985): 262-68.

84. D. D. BARBOSA, F. V. CORONITI, W. S. KURTH, and F. L. SCARF. Voyager Observations of Lower Hybrid Noise in the Io Plasma Torus and Anomalous Plasma Heating Rates. *Astrophys. J.* 289 (1985): 392-408.

85. EUGENE K. TSIKIS, SANTWANA RAYCHAUDHURI, EDWARD F. GABL, CHRIS GOERTZ, GEORG KNORR, and KARL E. LONNGREN. On the Evolution of an Ion Phase-Space Vortex. *Phys. Scr.* 31 (1985): 159-60.

86. S. TORVÉN, L. LINDBERG, and R. T. CARPENTER. Spontaneous Transfer of Magnetically Stored Energy by Electric Double Layers. *Plasma Phys. Control. Fusion* 27 (1985): 143-58.

87. AKIRA HIROSE and KARL E. LONNGREN. In *Introduction to Wave Phenomena*, p. 355. New York: John Wiley & Sons, 1985.

88. K. BRÜNING and C. K. GOERTZ. Magnetospheric-Ionospheric Coupling Deduced from Measurements above a Discrete Auroral Arc. In *Results of the Arcad 3 Project and of the Recent Programmes in Magnetospheric and Ionospheric Physics*, pp. 145-51. Toulouse 84, France: Cepadues-Editions, 1985.

89. D. VENKATESAN, R. B. DECKER, S. M. KRIMIGIS, and J. A. VAN ALLEN. The Galactic Cosmic Ray Intensity Minimum in the Inner and Outer Heliosphere in Solar Cycle 21. *J. Geophys. Res.* 90 (1985): 2905-9.

90. R. L. MUTEL, M. W. HODGES, and R. B. PHILLIPS. The Structure of Three Compact Double Radio Sources at 5 GHz. *Astrophys. J.* 290 (1985): 86-93.

91. R. L. MUTEL and J.-F. LESTRADE. Radio Emission from RS CVn Binaries. I. VLA Survey of Period-Radio Luminosity Relationship. *Astron. J.* 90 (1985): 493-98.

92. E. W. GREENSTADT and M. M. MELLOTT. Variable Field-to-Normal Angles in the Shock Foreshock Boundary Observed by ISEE 1 and 2. *Geophys. Res. Lett.* 12 (1985): 129-32.

93. W. S. KURTH, D. B. STRAYER, D. A. GURNETT, and F. L. SCARF. A Summary of Whistlers Observed by Voyager 1 at Jupiter. *Icarus* 61 (1985): 497-507.

94. JOLENE S. PICKETT, GERARD B. MURPHY, WILLIAM S. KURTH, and CHRISTOPH K. GOERTZ. Effects of Chemical Releases by the STS 3 Orbiter on the Ionosphere. *J. Geophys. Res.* 90 (1985): 3487-97.

95. STEVEN T. MYERS and STEVEN R. SPANGLER. Synchrotron Aging in the Lobes of Luminous Radio Galaxies. *Astrophys. J.* 291 (1985): 52-62.

96. W. CALVERT. Triggered Jovian Radio Emissions. *Geophys. Res. Lett.* 12 (1985): 179-82.

97. S. L. MOSES, F. V. CORONITI, C. F. KENNEL, F. L. SCARF, E. W. GREENSTADT, W. S. KURTH, and R. P. LEPPING. High Time Resolution Plasma Wave and Magnetic Field Observations of the Jovian Bow Shock. *Geophys. Res. Lett.* 12 (1985): 183-86.

98. GUO-ZHENG SUN, D. R. NICHOLSON, and HARVEY A. ROSE. Statistical Theory of Cubic Langmuir Turbulence. *Phys. Rev. Lett.* 54 (1985): 1664-67.

99. E. K. TSIKIS, S. RAYCHAUDHURI, E. F. GABL, and K. E. LONNGREN. On the Excitation of Linear and Nonlinear Ion-Acoustic Waves in a Double Plasma Machine. *Plasma Phys. Control. Fusion* 27 (1985): 419-32.

100. P. D. KLEIBER, A. M. LYYRA, S. P. HENEGHAN, and W. C. STWALLEY. Stimulated Emission in Laser-Pumped Magnesium Vapor. *J. Opt. Soc. Am. B* 2 (1985): 522-26.

101. E. K. TSIKIS, E. F. GABL, F. N. CHOONG, S. RAYCHAUDHURI, N. D'ANGELO, and K. E. LONNGREN. Comments on Probe-Excited Oblique Ion-Acoustic Waves in a Multidipole Plasma Device. *IEEE Trans. Plasma Sci.* PS-13 (1985): 92-95.

102. S. A. FUSELIER, D. A. GURNETT, and R. J. FITZENREITER. The Downshift of Electron Plasma Oscillations in the Electron Foreshock Region. *J. Geophys. Res.* 90 (1985): 3935-46.

103. C. K. GOERTZ, E. NIELSEN, A. KORTH, K. H. GLASSMEIER, C. HALDOUPIS, P. HOEG, and D. HAYWARD. Observations of a Possible Ground Signature of Flux Transfer Events. *J. Geophys. Res.* 90 (1985): 4069-78.

104. S. ORSINI, E. AMATA, M. CANDIDI, H. BALSIGER, M. STOKHOLM, C. HUANG, W. LENNARTSSON, and P.-A. LINDQVIST. Cold Streams of Ionospheric Oxygen in the Plasma Sheet during the CDAW 6 Event of March 22, 1979. *J. Geophys. Res.* 90 (1985): 4091-98.

105. O. DE LA BEAUJARDIÈRE, V. B. WICKWAR, G. CAUDAL, J. M. HOLT, J. D. CRAVEN, L. A. FRANK, L. H. BRACE, D. S. EVANS, J. D. WINNINGHAM, and R. A. HEELIS. Universal Time Dependence of Nighttime F Region Densities at High Latitudes. *J. Geophys. Res.* 90 (1985): 4319-32.

106. A. NISHIDA, T. HADA, K. A. ANDERSON, R. R. ANDERSON, S. J. BAME, and E. W. HONES, JR. Broadband Electrostatic Noise in the Magnetotail: Its Relation to Plasma Sheet Dynamics. *J. Geophys. Res.* 90 (1985): 4453-60.

107. P. D. KLEIBER, A. M. LYYRA, K. M. SANDO, S. P. HENEGHAN, and W. C. STWALLEY. Far-Wing Absorption Profiles of a Reactive Collision: Mg + H_2. *Phys. Rev. Lett.* 54 (1985): 2003-6.

108. JOHN D. FIX and ROBERT L. MUTEL. A Search for Hydroxyl Masers in M33. *Astron. J.* 90 (1985): 736-37.

109. B. HÄUSLER, R. R. ANDERSON, D. A. GURNETT, H. C. KOONS, R. H. HOLZWORTH, O. H. BAUER, R. TREUMANN, K. GNAIGER, D. ODEM, W. B. HARBRIDGE, and F. EBERL. The Plasma Wave Instrument on Board the AMPTE IRM Satellite. *IEEE Trans. Geoscience Remote Sensing* GE-23 (1985): 267-73.

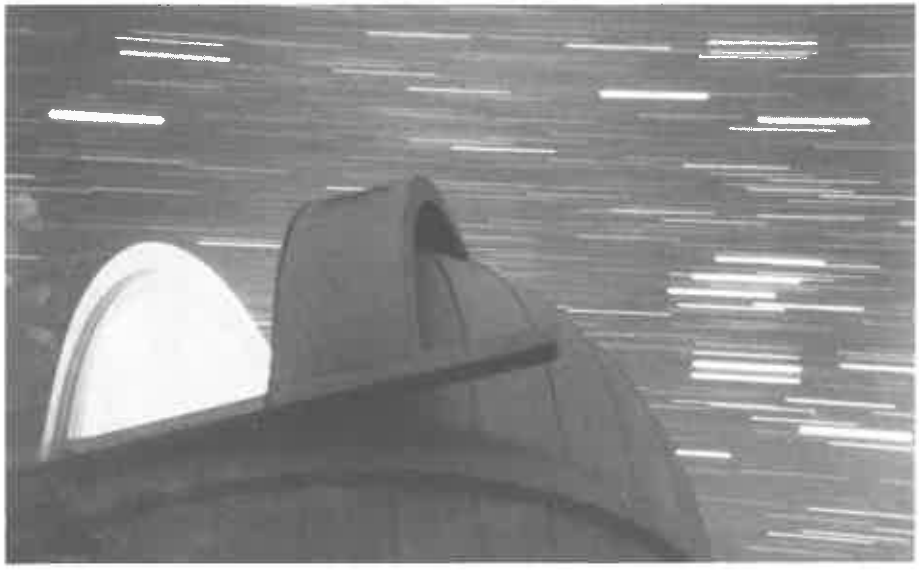
110. C. W. WANG, P. G. ROOS, N. S. CHANT, G. CIANGARU, F. KHAZAIE, D. MACK, A. NADASEN, S. J. MILLS, R. E. WARNER, E. NORBECK, F. D. BECCHETTI, J. W. JANECKE, and P. M. LISTER. $^{9}Be(\vec{p},p\alpha)^{5}He$ Cluster Knockout Reaction with 150 MeV Polarized Protons. *Phys. Rev. C* 31 (1985): 1662-72.

111. E. NORBECK, L. W. LI, H. H. LIN, and M. E. ANDERSON. Rutherford Backscattering (RBS) with Lithium Ions. *Nucl. Instrum. Methods* B9 (1985): 197-200.

112. D. J. WILLIAMS, D. G. MITCHELL, T. E. EASTMAN, and L. A. FRANK. Energetic Particle Observations in the Low-Latitude Boundary Layer. *J. Geophys. Res.* 90 (1985): 5097-5115.

Professor Robert Mutel and his family at the spring picnic

Star trails photographed at the Riverside Astronomical Observatory



Professor Edward McCliment

113. W. CALVERT. Auroral Kilometric Radiation Triggered by Type II Solar Radio Bursts. *Geophys. Res. Lett.* 12 (1985): 377-80.

114. W. CALVERT. DE-1 Measurements of AKR Wave Directions. *Geophys. Res. Lett.* 12 (1985): 381-84.

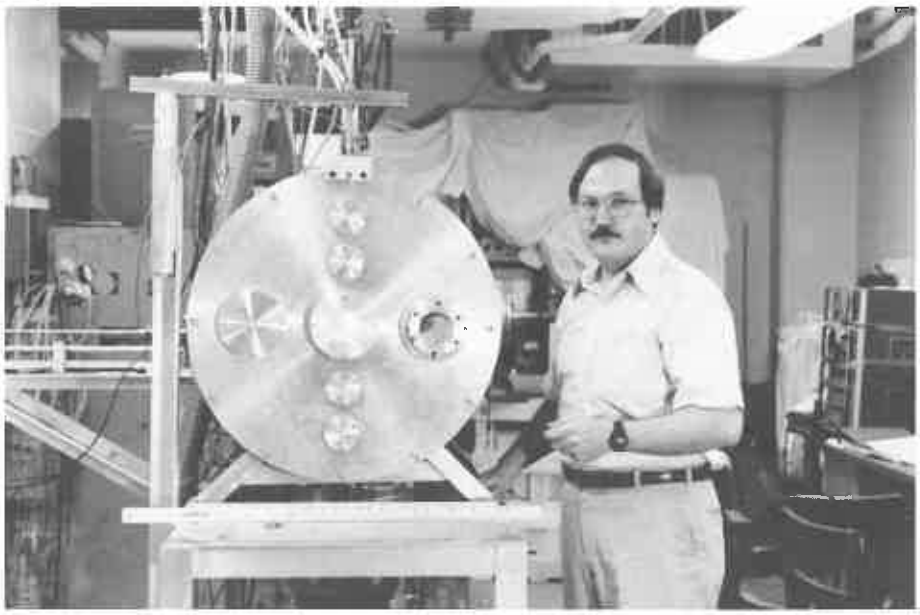
115. C. R. CHEN, G. L. PAYNE, J. L. FRIAR, and B. F. GIBSON. Convergence of Faddeev Partial-Wave Series for Triton Ground State. *Phys. Rev. C* 31 (1985): 2266-73.

116. D. VENKATESAN, R. B. DECKER, S. M. KRIMIGIS, and J. A. VAN ALLEN. The In-Situ Observations of the Cosmic Ray Minimum in the Heliosphere during Solar Cycle 21. In *Proceedings,* International Symposium on Cosmic Ray Modulation in the Heliosphere, pp. 279-83. Morioka, Japan: Iwate University, 1985.

117. C. K. GOERTZ and D. N. BAKER. Polar Cap Photoionization and the Ten-Hour Clock at Jupiter. *J. Geophys. Res.* 90 (1985): 6304-10.

118. T. NAGAI, J. L. HORWITZ, R. R. ANDERSON, and C. R. CHAPPELL. Structure of the Plasmapause from ISEE 1 Low-Energy Ion and Plasma Wave Observations. *J. Geophys. Res.* 90 (1985): 6622-26.

Professor Robert Merlino



119. I. H. CAIRNS and D. B. MELROSE. A Theory for the $2f_p$ Radiation Upstream of the Earth's Bow Shock. *J. Geophys. Res.* 90 (1985): 6637-40.

120. J. D. CRAVEN and L. A. FRANK. The Temporal Evolution of a Small Auroral Substorm as Viewed from High Altitudes with Dynamics Explorer 1. *Geophys. Res. Lett.* 12 (1985): 465-68.

121. C.-R. CHEN, G. L. PAYNE, J. L. FRIAR, and B. F. GIBSON. Faddeev Calculation of Three-Nucleon Force Contribution to Triton Binding Energy. *Phys. Rev. Lett.* 55 (1985): 374-77.

122. M. M. MELLOTT, R. L. HUFF, and D. A. GURNETT. The Auroral Kilometric Radiation: DE 1 Direction Finding Studies. *Geophys. Res. Lett.* 12 (1985): 479-82.

123. CROCKETT L. GRABBE. New Results on the Generation of Broadband Electrostatic Waves in the Magnetotail. *Geophys. Res. Lett.* 12 (1985): 483-86.

124. D. R. WEIMER, C. K. GOERTZ, D. A. GURNETT, N. C. MAYNARD, and J. L. BURCH. Auroral Zone Electric Fields from DE 1 and 2 at Magnetic Conjunctions. *J. Geophys. Res.* 90 (1985): 7479-94.

125. ALAN L. FEY, STEVEN R. SPANGLER, ROBERT L. MUTEL, and JOHN M. BENSON. VLBI Observations at 22.2 Gigahertz of the Radio Source 0552 + 398 (DA 193). *Astrophys. J.* 295 (1985): 134-38.

126. GUO-ZHENG SUN, D. R. NICHOLSON, and HARVEY A. ROSE. Statistical Theory of Cubic Langmuir Turbulence. *Phys. Fluids* 28 (1985): 2395-2405.

127. A. R. RAJAEI-RIZI, F. B. ORTH, J. T. BAHNS, and W. C. STWALLEY. $A^1\Sigma_u^+$-$X^1\Sigma_g^+$ and $B^1\pi_u$-$X^1\Sigma_g^+$ Fluorescence of $^6Li_2$ and $^6Li^7Li$ Excited by a Krypton Ion Laser. *J. Mol. Spectrosc.* 109 (1985): 122-33.

128. WEI-TZOU LUH, VASSILIS ZAFIROPULOS, PAUL D. KLEIBER, WILLIAM C. STWALLEY, and SHAWN P. HENEGHAN. Fluorescence of Na_2 and K_2 Excited by a Gold Vapor Laser. *J. Mol. Spectrosc.* 111 (1985): 327-43.

129. GORAN PICHLER, JOHN T. BAHNS, and WILLIAM C. STWALLEY. Study of the Shape of the Lithium Diffuse Band by Single and Double Photon Excitation. In *Spectral Line Shapes*, vol. 3, ed. F. Rostas, p. 659. Berlin and New York: Walter de Gruyter & Co., 1985.

130. L. A. FRANK, J. D. CRAVEN, and R. L. RAIRDEN. Images of the Earth's Aurora and Geocorona from the Dynamics Explorer Mission. *Adv. Space Res.* 5 (1985): 53-68.

131. K. BRÜNING, C. K. GOERTZ, and K. WILHELM. Why Does the Perpendicular Electric Field Increase at the Edge of Auroral Arcs? *Adv. Space Res.* 5 (1985): 79-82.

132. W. N. POLYZOU. Manifestly Covariant, Poincaré-Invariant Quantum Theories of Directly Interacting Particles. *Phys. Rev. D* 32 (1985): 995-1003.

133. L. M. DUNCAN and J. P. SHEERIN. High-Resolution Studies of the HF Ionospheric Modification Interaction Region. *J. Geophys. Res.* 90 (1985): 8371-76.

134. A. W. SCHARDT, W. S. KURTH, R. P. LEPPING, and C. G. MACLENNAN. Particle Acceleration in Saturn's Outer Magnetosphere: In Memoriam Alois Schardt. *J. Geophys. Res.* 90 (1985): 8539-42.

135. G. M. KEATING, J. D. CRAVEN, L. A. FRANK, D. F. YOUNG, and P. K. BHARTIA. Initial Results from the DE-1 Ozone Imaging Instrumentation. *Geophys. Res. Lett.* 12 (1985): 593-96.

136. J. S. NEFF, T. A. ELLIS, J. APT, and J. T. BERGSTRALH. Bolometric Albedos of Titan, Uranus, and Neptune. *Icarus* 62 (1985): 425-32.

137. K. TAKAHASHI, C. T. RUSSELL, and R. R. ANDERSON. ISEE 1 and 2 Observation of the Spatial Structure of a Compressional Pc5 Wave. *Geophys. Res. Lett.* 12 (1985): 613-16.

138. W. CALVERT. Affirmation of Triggered Jovian Radio Emissions and Their Attribution to Corotating Radio Lasers. *Geophys. Res. Lett.* 12 (1985): 625-26.

139. T. E. EASTMAN, B. POPIELAWSKA, and L. A. FRANK. Three-Dimensional Plasma Observations near the Outer Magnetospheric Boundary. *J. Geophys. Res.* 90 (1985): 9519-39.

140. T. E. EASTMAN, L. A. FRANK, and C. Y. HUANG. The Boundary Layers as the Primary Transport Regions of the Earth's Magnetotail. *J. Geophys. Res.* 90 (1985): 9541-60.

141. W. M. FARRELL and D. A. GURNETT. A Statistical Study of Solar Type III Bursts and Auroral Kilometric Radiation Onsets. *J. Geophys. Res.* 90 (1985): 9634-40.

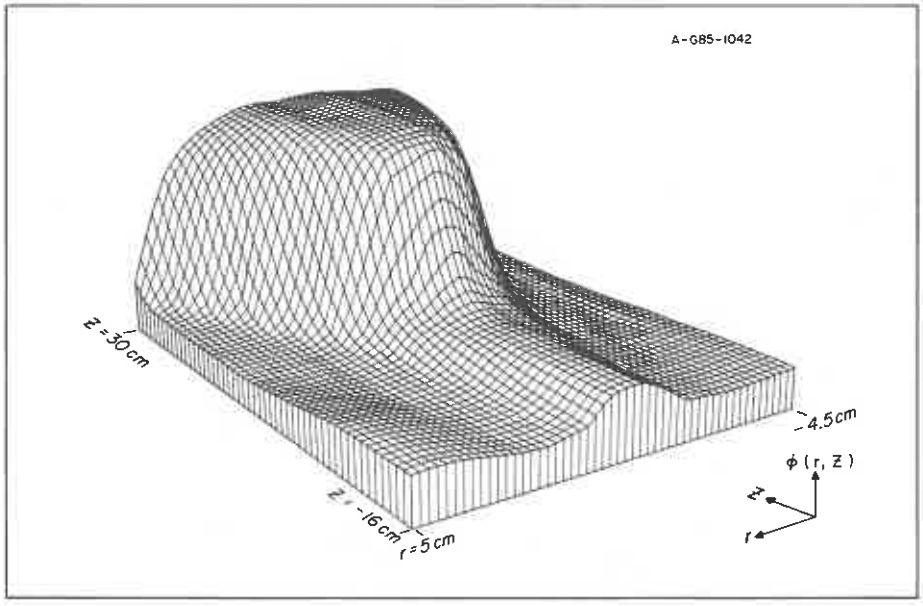
142. STEVEN R. SPANGLER and TAKAYUKI SAKURAI. Limits on Thermal Plasma in the Lobes of the Radio Galaxies 3C 79 and 3C 379.1. *Astrophys. J.* 297 (1985): 84-89.

143. J. GOREE, M. ONO, P. COLESTOCK, R. HORTON, D. McNEILL, and H. PARK. Fast-Wave Current Drive in a Toroidal Plasma. *Phys. Rev. Lett.* 55 (1985): 1669-72.

144. W. N. POLYZOU. Constraints on Hadronic Current Operators in Relativistic Quantum-Mechanical Models. *Phys. Rev. D* 32 (1985): 2216-22.

Professor Paul Kleiber

A three-dimensional double layer potential profile



Professor Charles Newsom

145. J. L. FRIAR, B. F. GIBSON, C.- R. CHEN, and G. L. PAYNE. Scaling Relations for Triton Ground-State Observables. *Phys. Lett.* 161B (1985): 241-47.

146. R. L. MUTEL, J.-F. LESTRADE, and D. J. DOIRON. Radio Polarization Characteristics of Two RS CVn Binaries. In *Radio Stars*, ed. R. M. Hjellming and D. M. Gibson, pp. 259-65. Dordrecht, Holland: D. Reidel Publishing, 1985.

147. R. L. MUTEL. High-Angular Resolution Studies of Stellar Radio Sources. In *Radio Stars*, ed. R. M. Hjellming and D. M. Gibson, pp. 359-69. Dordrecht, Holland: D. Reidel Publishing, 1985.

148. W. H. KLINK. Scattering Operators on Fock Space. I. Compact Groups and Internal Symmetries *J. Phys. A: Math. Gen.* 18 (1985): 3141-50.

149. S. L. CARTIER, N. D'ANGELO, and R. L. MERLINO. Electrostatic Ion-Cyclotron Waves in a Nonuniform Magnetic Field. *Phys. Fluids* 28 (1985): 3066-73.

150. M. M. MELLOTT. Subcritical Collisionless Shock Waves. In*Collisionless Shocks in the Heliosphere: Reviews of Current Research*, ed. B. Tsurutani and R. Stone, pp. 131-40, Geophysical Monograph 35. Washington, D.C.: AGU, 1985.

Professor Edwin Norbeck in the nuclear accelerator building

151. DONALD A. GURNETT. Plasma Waves and Instabilities. In *Collisionless Shocks in the Heliosphere: Reviews of Current Research*, ed. B. Tsurutani and R. Stone, pp. 207-24. Geophysical Monograph 35. Washington, D.C.: AGU, 1985.

152. R. C. OLSEN, C. R. CHAPPELL, D. L. GALLAGHER, J. L. GREEN, and D. A. GURNETT. The Hidden Ion Population: Revisited. *J. Geophys. Res.* 90 (1985): 12,121-32.

153. C. K. GOERTZ, S. MACHIDA, and R. A. SMITH. An Asymptotic State of the Critical Ionization Velocity Phenomenon. *J. Geophys. Res.* 90 (1985): 12,230-34.

154. STEVEN R. SPANGLER. Nonlinear Astrophysical Alfvén Waves: Onset and Outcome of the Modulational Instability. *Astrophys. J.* 299 (1985): 122-37.

155. HONG-YOUNG CHANG, CHUONG LIEN, SUDEWO SUKARTO, JACQUELINE HILL, SANTWANA RAYCHAUDHURI, and KARL E. LONNGREN. Spectral Analysis of Ion-Acoustic Soliton Excitation. *Appl. Phys. Lett.* 47 (1985): 1274-75.

156. D. A. GURNETT, R. R. ANDERSON, B. HÄUSLER, G. HAERENDEL, O. H. BAUER, R. A. TREUMANN, H. C. KOONS, R. H. HOLZWORTH, and H. LÜHR. Plasma Waves Associated with the AMPTE Artificial Comet. *Geophys. Res. Lett.* 12 (1985): 851-54.

157. E. L. TOMUSIAK, M. KIMURA, J. L. FRIAR, B. F. GIBSON, G. L. PAYNE, and J. DUBACH. Trinucleon Magnetic Moments. *Phys. Rev. C* 32 (1985): 2075-86.

158. L. A. FRANK. Plasmas in the Earth's Magnetotail. *Space Sci. Rev.* 42 (1985): 211-40.

159. C. K. GOERTZ. Auroral Arc Formation: Kinetic and MHD Effects. *Space Sci. Rev.* 42 (1985): 499-513.

160. CROCKETT L. GRABBE. Resonance Cone Structure in a Warm Inhomogeneous Bounded Plasma with Lower-Hybrid Resonance Layers. *J. Plasma Phys.* 33 (1985): 321-57.

161. C. K. CHU, A. DENIZ, G. E. GEORGIOU, R. A. GROSS, A. A. GROSSMAN, A. HOLLAND, R. IZZO, C. KOSTEK, F. M. LEVINTON, H. C. LUI, M. MACHIDA, T. C. MARSHALL, R. L. MERLINO, D. OEPTS, G. A. NAVRATIL, and P. G. WEBER. High-Beta Tokamak Research. *Nucl. Fusion* 25 (1985): 1109-12.

162. HEINRICH HORA. The Transient Electrodynamic Forces at Laser-Plasma Interaction. *Phys. Fluids* 28 (1985): 3705-6.

163. N. D'ANGELO. On Wåhlin's Mechanism of Cloud Electrification. *Ann. Geophys.* 3 (1985): 755-60.

164. P. E. T. JORGENSEN and W. H. KLINK. Quantum Mechanics and Nilpotent Groups I. The Curved Magnetic Field. *Publ. RIMS* 21 (1985): 969-99.

165. JAMES A. VAN ALLEN. Space Science, Space Technology and the Space Station. *Scien. Amer.* 254 (1986): 32-39.

166. S. RAYCHAUDHURI, J. HILL, H. Y. CHANG, E. K. TSIKIS, and K. E. LONNGREN. An Experiment on the Plasma Expansion into a Wake. *Phys. Fluids* 29 (1986): 289-93.

167. H. Y. CHANG, S. RAYCHAUDHURI, J. HILL, E. K. TSIKIS, and K. E. LONNGREN. Propagation of an Ion-Acoustic Soliton in an Inhomogeneous Plasma. *Phys. Fluids* 29 (1986): 294-97.

168. B. HÄUSLER, L. J. WOOLISCROFT, R. R. ANDERSON, D. A. GURNETT, R. H. HOLZWORTH, H. C. KOONS, O. H. BAUER, G. HAERENDEL, R. A. TREUMANN, P. J. CHRISTIANSEN, A. G. DARBYSHIRE, M. P. GOUGH, S. R. JONES, A. J. NORRIS, H. LÜHR, and N. KLÖCKER. Plasma Waves Observed by the IRM and UKS Spacecraft during the AMPTE Solar Wind Lithium Releases: Overview. *J. Geophys. Res.* 91 (1986): 1283-99.

169. D. A. GURNETT, T. Z. MA, R. R. ANDERSON, O. H. BAUER, G. HAERENDEL, B. HÄUSLER, G. PASCHMANN, R. A. TREUMANN, H. C. KOONS, R. HOLZWORTH, and H. LÜHR. Analysis and Interpretation of the Shocklike Electrostatic Noise Observed during the AMPTE Solar Wind Lithium Releases. *J. Geophys. Res.* 91 (1986): 1301-10.

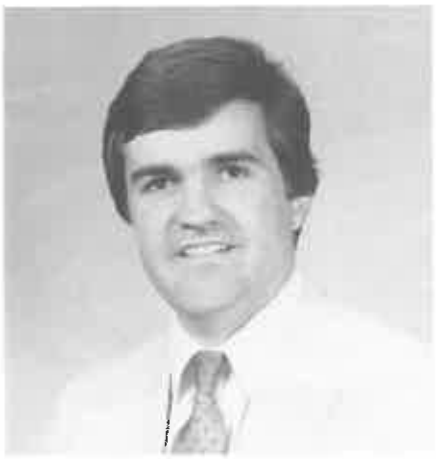
170. S. R. SPANGLER, R. L. MUTEL, J. M. BENSON, and J. M. CORDES. Interstellar Scattering of Compact Radio Sources Near Supernova Remnants. *Ap. J.* 301 (1986): 312-19.

171. C.-R. CHEN, G. L. PAYNE, J. L. FRIAR, and B. F. GIBSON. Nucleon-Deuteron Doublet Scattering Lengths with Three-Nucleon Potentials. *Phys. Rev. C* 33 (1986): 401-5.

172. M. J. ALPORT, S. L. CARTIER, and R. L. MERLINO. Laboratory Observations of Ion-Cyclotron Waves Associated with a Double Layer in an Inhomogeneous Magnetic Field. *J. Geophys. Res.* 91 (1986): 1599-1608.

173. L. A. FRANK, J. D. CRAVEN, D. A. GURNETT, S. D. SHAWHAN, D. R. WEIMER, J. L. BURCH, J. D. WINNINGHAM, C. R. CHAPPELL, J. H. WAITE, R. A. HEELIS, N. C. MAYNARD, M. SUGIURA, W. K. PETERSON, and E. G. SHELLEY. The Theta Aurora. *J. Geophys. Res.* 91 (1986): 3177-3224.

174. C. K. GOERTZ, G. E. MORFILL, W. IP, E. GRUN, and O. HAVNES. Electromagnetic Angular Momentum Transport in Saturn's Rings. *Nature* 320 (1986): 141-43.



Professor John Goree

Professor John Neff

Professor Charles Newsom in the elementary particle physics laboratory

Professor Emeritus James A. Van Allen

175. I. H. CAIRNS. New Waves at Multiples of the Plasma Frequency Upstream of the Earth's Bow Shock. *J. Geophys. Res.* 91 (1986): 2975-88.

176. D. A. GURNETT, W. S. KURTH, J. T. STEINBERG, P. M. BANKS, R. I. BUSH, and W. J. RAITT. Whistler-Mode Radiation from the Spacelab 2 Electron Beam. *Geophys. Res. Lett.* 13 (1986): 225-28.

177. N. H. STONE, K. H. WRIGHT, JR., K. S. HWANG, U. SAMIR, G. B. MURPHY, and S. D. SHAWHAN. Further Observations of Space Shuttle Plasma-Electrodynamic Effects from OSS-1/STS-3. *Geophys. Res. Lett.* 13 (1986): 217-20.

178. D. A. GURNETT, T. F. AVERKAMP, F. L. SCARF, and E. GRUN. Dust Particles Detected near Giacobini-Zinner by the ICE Plasma Wave Instrument. *Geophys. Res. Lett.* 13 (1986): 291-94.

179. W. M. FARRELL, W. CALVERT, and D. A. GURNETT. AKR Signal Increases Caused by Triggering. *Geophys. Res. Lett.* 13 (1986): 370-72.

The Voyager spacecraft which visited Jupiter, Saturn, and Uranus and will reach Neptune in 1989

180. GUO-ZHENG SUN, D. R. NICHOLSON, and HARVEY A. ROSE. Statistical Approach to Cubic Langmuir Turbulence. *Phys. Fluids* 29 (1986): 1011-23.

181. F. L. SCARF, F. V. CORONITI, G. F. KENNEL, D. A. GURNETT, W.-H. IP, and E. J. SMITH. Plasma Wave Observations at Comet Giacobini-Zinner. *Science* 232 (1986): 377-81.

182. L. A. FRANK, J. B. SIGWARTH, and J. D. CRAVEN. On the Influx of Small Comets into the Earth's Upper Atmosphere: I. Observation. *Geophys. Res. Lett.* 13, (1986): 303-06.

183. L. A. FRANK, J. B. SIGWARTH, and J. D. CRAVEN. On the Influx of Small Comets into the Earth's Upper Atmosphere: II. Interpretation. *Geophys. Res. Lett.* 13 (1986): 307-10.

184. D. L. GALLAGHER, J. D. MENIETTI, J. L. BURCH, A. M. PERSOON, J. H. WAITE, JR., and C. R. CHAPPELL. Evidence of High Densities and Ion Outflows in the Polar Cap during the Recovery Phase. *J. Geophys. Res.* 91 (1986): 3321-27.

185. C. A. CATTELL, F. S. MOZER, E. W. HONES, JR., R. R. ANDERSON, and R. D. SHARP. ISEE Observations of the Plasma Sheet Boundary, Plasma Sheet, and Neutral Sheet, 1, Electric Field, Magnetic Field, Plasma, and Ion Composition. *J. Geophys. Res.* 91 (1986): 5663-80.

186. C. A. CATTELL, F. S. MOZER, R. R. ANDERSON, E. W. HONES, JR., and R. D. SHARP. ISEE Observations of the Plasma Sheet Boundary, Plasma Sheet, and Neutral Sheet, 2, Waves. *J. Geophys. Res.* 91 (1986): 5681-88.