

THE UNIVERSITY OF IOWA

IOWA CITY, IOWA 52242



Department of Physics and Astronomy
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RESEARCH IN SPACE PHYSICS
AT THE UNIVERSITY OF IOWA

ANNUAL REPORT 1974

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AT THE UNIVERSITY OF IOWA (Iowa Univ.) 35 p
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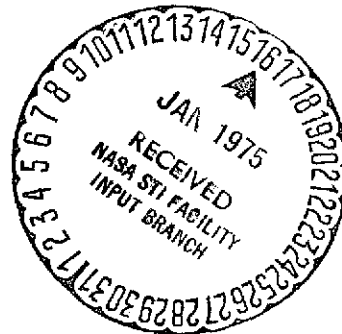
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Prepared by

J. A. Van Allen, Carver Professor of Physics and
Head, Department of Physics and Astronomy

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PRICES SUBJECT TO CHANGE

1.0 General Nature of the Work

1.01 Our broad objective is the extension of knowledge of the energetic particles in outer space and of their relationships to electric, magnetic, and electromagnetic fields associated with the earth, the sun, the moon, the planets, and the interplanetary medium.

1.02 Primary emphasis is (a) on observational work using a wide diversity of instruments of our own design and construction on satellites of the earth and the moon and on planetary and interplanetary spacecraft and (b) on phenomenological analysis and interpretation.

1.03 Secondary emphasis is (a) on closely related observational work by ground based radio-astronomical and optical techniques and (b) on basic theoretical problems in plasma physics.

1.04 Specific fields of current investigation are the following:

(a) All aspects of the energetic particles that are trapped in the earth's magnetic field and are transiently present in the outer magnetosphere including the magnetospheric tail of the earth; and of the solar, interplanetary, and terrestrial phenomena that are associated with these radiations -- solar flares, interplanetary magnetic fields and plasmas, aurorae, geomagnetic storms, corpuscular heating of the atmosphere, electromagnetic waves and

electrostatic fields (both static and variable) in the magnetosphere, and the ionospheric effects of particle precipitation. This field of research was originated to a major extent by this laboratory.

(b) Radio-frequency and soft X-ray emissions from both the quiescent and flaring sun and the implications thereof on the nature of the chromosphere and corona and on the acceleration and emission of energetic particles in solar flares.

(c) Energetic electrons, protons, alpha particles, and heavier nuclei emitted by the sun; the interplanetary propagation of these particles, including the effects of shock waves and the generation of electrostatic and electromagnetic waves in the interplanetary medium; and the access of such particles to the earth's magnetosphere.

(d) Solar modulation and the heliocentric radial dependence of the intensity of galactic cosmic rays.

(e) In situ measurements of the distribution of energetic particles in the magnetospheres of Jupiter, Saturn, Uranus, and Neptune.

(f) Origin and propagation of very low frequency radio waves in the earth's magnetosphere and ionosphere.

(g) Shock waves in the interplanetary medium.

(h) The theory of wave phenomena in turbulent plasmas including

the interplanetary medium and of the origin of super-thermal particles.

(i) Dekametric radio emissions from Jupiter and the relationships of same to its magnetosphere.

(j) Electron density distribution in the solar corona by study of the annual solar-coronal occultation of the Crab pulsar NP 0531 + 21.

(k) Study of pulsars as an extension of our work on planetary magnetospheres.

2.0 Currently Active Projects

2.01 Hawkeye I

Construction and testing of the University of Iowa/Langley Research Center spacecraft Hawkeye I was completed in April 1974. It was launched successfully by a five-stage Scout from the Western Test Range on 3 June 1974. The initial orbit had a perigee altitude of 470 kilometers (over Antarctica), a radial distance to apogee of 20.7 earth radii, an inclination to the earth's equator of 89.8 degrees, and a period of 50.5 hours. Subsequent solar-lunar perturbations have raised the perigee altitude to about 2500 km by December, as expected. The ballistic lifetime is estimated as 3.9 years, before reentry into the atmosphere. The radial distance to apogee exceeds the intended value (16 earth radii) somewhat, but the greater value improves the capability for penetrating into the solar wind for prolonged periods of time and has only slight disadvantages with respect to other objectives.

All antennas and booms were deployed successfully and all scientific instruments and spacecraft subsystems and systems have been operating perfectly for over six months in orbit with one exception -- the command circuit for actuating the optical aspect device ceased functioning on 6 September 1974. The loss of this element makes the measurement of angular distributions more difficult; two alternative systems for roll phase determination

are being developed, using data from the scientific instruments themselves.

The satellite carries three basic scientific instruments for the investigation of energetic particles and electric and magnetic fields associated with the "polar cusp" region of the earth's magnetosphere and in the vicinity of the hypothetical magnetic neutral point:

- (a) A four-range, three-axis Schonstedt flux-gate magnetometer to measure the vector magnetic field. Full scale ranges on each axis are as follows: ± 150 gammas, ± 450 gammas, $\pm 1,500$ gammas, and $\pm 25,000$ gammas -- selectable by ground command.
- (b) A Low-Energy Proton and Electron Differential Electrostatic Analyzer (LEPEDEA) to measure the differential energy spectra and angular distributions of protons and electrons, separately and simultaneously, over the energy range 4 eV to 40,000 eV for a wide range of intensities; and a thin window Geiger tube to measure the integral intensities of ≥ 40 keV electrons and/or > 600 keV protons.
- (c) An ELF-VLF Electric and Magnetic Fields apparatus to study the occurrence, characteristics, and origin of naturally occurring radio noises and plasma instabilities in the earth's polar magnetosphere and magnetosheath. The electric antenna (140 ft. tip-to-tip) and associated receiver operate over a frequency range 1 Hz to 30 kHz. The magnetic antenna (a search coil magnetometer) and its associated receiver cover the frequency range 1 Hz to 3 kHz.

Command and control of the spacecraft are exercised almost exclusively from Iowa City via the U. of Iowa/ONR North Liberty Radio Observatory. NLRO also serves as the principal facility for in-flight data acquisition using the 60-ft. antenna there. Data are transmitted by microwave link to the Univac 418 computers in the Physics Building on the campus and reduced to a preliminary master science data tape in real time.

The entire data acquisition and reduction system is operating very well and setting a new standard for the efficient and rapid handling of data from a satellite. Three preliminary papers on scientific results were given at the December 1974 meetings of the American Geophysical Union in San Francisco.

Hawkeye I is the major single project of the laboratory at present.

(Hardware support by the Langley Research Center/NASA)

(Post-launch data acquisition, spacecraft operations, and macro data reduction support by Goddard Space Flight Center/NASA and Office of Naval Research)

(Micro-data reduction, scientific analysis, and publication support by Langley Research Center/NASA)

[Van Allen, Frank, Gurnett, Rogers, Enemark, Ackerson, Kurth, Kintner, Craven, Oliven, Randall, Clark, Brechwald, Jagnow]

2.02 Pioneers 10 and 11

University of Iowa experiments have obtained detailed data on the absolute intensities, energy spectra, and angular distributions of energetic electrons and protons in the magnetosphere of Jupiter with instruments on the two Ames Research Center/NASA spacecraft Pioneers 10 and 11. The first of these flew by Jupiter in the prograde sense during November-December 1973 with a radial distance of closest approach of $2.84 R_{Jf}$ on 4 December; the second in the retrograde sense during November-December 1974 with a radial distance of closest approach of $1.60 R_{Jf}$ on 3 December. These missions have provided the first in situ observations of energetic particles in the Jovian radiation belts, whose existence was established about 15 years ago by observation of non-thermal radio emission in the decimetric range. The magnetosphere of Jupiter is found to be generally analogous to that of Earth but exhibits several distinctive differences:

- (a) An enormous magnetodisc of plasma and energetic particles, approximately in the magnetic equatorial plane of the planet, with a diameter of about 20 million kilometers (subtends 2° from the earth at opposition);
- (b) Far greater intensities of high energy particles trapped in the magnetic field of the planet (magnetic moment 1.8×10^4 times that of Earth);
- (c) Important particle sweeping, and perhaps particle injection, effects of the four inner satellites JIII, JII, JI, and JV; and

(d) Spin-off of energetic particles into the interplanetary medium.

Four major papers on Pioneer 10 results have been published and three more are in rough draft form at present. The most recent data from Pioneer 11 are currently under intensive study; two preliminary, oral papers on Pioneer 11 observations were given at the December 1974 meetings of the American Geophysical Union in San Francisco.

[Van Allen, R. Randall, B. A. Randall, Baker, Thomsen, Northrop, Sentman, Goertz, Flindt]

Measurements of the galactic cosmic ray intensity to over 5 a.u. have now been analyzed. The radial gradient of intensity of protons of energy greater than 80 MeV is $0 \pm 2\%$ per a.u. This result is forcing a reconsideration of previous theories of this effect which have predicted a gradient of the order of +5 to 10% a.u.

[Van Allen and Thomsen]

Other Pioneer 10/11 studies are underway on the propagation of solar electrons and protons at great distances from the sun and on "spin-off" particles from Jupiter.

[Flindt and Van Allen]

The Pioneer 10 data on the distribution of plasma in the Jovian magnetosphere as obtained by the Ames Research Center

plasma analyzer have been reduced and interpreted by co-investigators at the University of Iowa.

[Frank and Ackerson]

(Support by Ames Research Center/NASA)

2.03 Explorers 33 and 35

In-flight operation of Explorer 33 (in eccentric earth orbit) was terminated on 1 November 1971 after 5 years 4 months in orbit.

In-flight operation of Explorer 35 (in lunar orbit) was terminated on 24 June 1973 after 5 years 11 months in orbit.

The body of data from Explorers 33 and 35 continues to be a valuable one for study of (a) solar protons, electrons, alpha particles, and $Z > 2$ nuclei, (b) particle bombardment of the moon and the production of short-lived radioisotopes in the lunar surface material, (c) solar X rays and their effects on the earth's ionosphere, (d) the magnetospheric tail, (e) shock waves in the interplanetary medium and the effect of same on energetic particles, (f) access of solar particles into the magnetosphere, and (g) the solar-cycle modulation of galactic cosmic ray intensity.

During the first 14 months of the flight of Pioneer 10, Explorer 35 provided basic data on galactic cosmic ray intensity at 1 a.u. for comparison with that measured by Pioneer 10 over the heliocentric radial range 1.0 to 4.05 a.u.

(Data reduction, analysis, and publication since 1968 supported by ONR)

[Van Allen, Shawhan, Sarris, Spangler, and Randall at University of Iowa; Krimigis at Applied Physics Laboratory of Johns Hopkins University; Armstrong at University of Kansas; Venkatesan at University of Calgary; and Venkatarangan at the National Research Council of Canada]

2.04 Explorer 43 (IMP-I)(1971-019A)

This 635-pound GSFC/NASA spacecraft was launched on 13 March 1971 into an earth orbit with initial inclination 29°, perigee altitude 234 km, and apogee at 31 earth radii. A large array of instruments was intended principally for investigation of phenomena of the outer magnetosphere. Two University of Iowa instruments have yielded very good observations during an extended period of data acquisition. These instruments are a high-dynamic range set of very low frequency radio receivers and antennae and an electrostatic analyzer for the observation of protons and electrons in the energy range from a few eV to several tens of kiloelectron volts.

(Support jointly by GSFC/NASA, ONR, and NASA Headquarters)

[Gurnett, Anderson, and Shaw on VLF Radio Experiment]

[Frank and Yeager on Low Energy Particle Experiment]

2.05 Small Scientific Satellite (S³-A)
(Explorer 45) (1971-096A)

This GSFC/NASA satellite was launched at 05^h UT on 15 November 1971 from the San Marco launching facility (Italian) off the coast of Kenya. The initial orbit had an inclination of 3.5°, a perigee altitude of about 350 km, a radial distance to apogee of 7.3 R_E (earth radii), and a period of 8.6 hours.

The principal objective of this mission is to study the physics of the terrestrial ring current and magnetic storms. One of the instruments on board was developed by the VLF radio group at the University of Iowa in collaboration with corresponding groups at the University of Minnesota and the Goddard Space Flight Center. This instrument performed properly throughout the mission. A number of important new results on the plasmasphere of the earth have been obtained. Analysis is continuing.

(Support by GSFC/NASA)

[Gurnett, Anderson, and Shaw]

2.06 British-American Near Earth Satellite
(UK-4) (Ariel 4) (1971-109A)

This satellite was launched on a 4-stage Scout vehicle from Vandenberg Air Force Base in California at 20:47 UT on 11 December 1971. The initial orbit had perigee altitude of 472 km, apogee altitude of 587 km, inclination of 85°, and period of 95.5 minutes.

Low energy particle measurements were made with an electrostatic analyzer system similar to that on Injun V. Emphasis is on the measurement of angular distributions of trapped and precipitating particles in the auroral zone.

A good body of flight data is now in hand. Two papers have been published. Cooperative work with British investigators having other experiments on UK-4 is proving to be fruitful.

(Support by GSFC/NASA and NASA Headquarters)

[Frank and Craven]

2.07 Explorer 47 (IMP-H)(1972-73A)

This GSFC/NASA satellite of the earth was launched on 23 September 1972 into a near-circular orbit of inclination 17° and radius about $35 R_E$ (earth radii). It carries a University of Iowa electrostatic analyzer for low energy particle measurements in the outer magnetosphere, in the magnetotail, and in the interplanetary medium. Emphasis is on accurate spectra and angular distributions of both protons and electrons.

(Support by GSFC/NASA)

[Frank et al.]

2.08 Explorer 50 (IMP-J)(1973-78A)

This 817 lb. GSFC/NASA satellite was launched on 26 October 1973 into an orbit with inclination $28^\circ 2'$ radial distances to perigee and apogee 23.8 and $46.4 R_E$, respectively, and

period 12.2 days. This satellite carries VLF radio receivers and electrostatic particle analyzers from the University of Iowa. A large body of high quality data from both sets of experiments has been acquired, with operations continuing at the present date of writing.

(Support by GSFC/NASA)

[Frank et al. on electrostatic analyzers]

[Gurnett et al. on VLF radio receivers]

2.09 German American Solar Probe
(HELIOS)

This interplanetary spacecraft was launched successfully at the Kennedy Space Center on 10 December 1974 by a Titan Centaur vehicle. The heliocentric trajectory is near the ecliptic plane with perihelion at 0.3 a.u. from the sun. The spacecraft will pass through perihelion on 15 March 1975. The principal scientific purposes of this mission are study of particle and field phenomena in the interplanetary medium at distances closer to the sun than have been reached previously. (The perihelion of Mariner 10's orbit is approximately at the orbit of Mercury at 0.39 a.u.) One of the three American instruments on HELIOS is the University of Iowa plasma-radio wave receiver (10 Hz to 15 kHz).

Based on early quick-look data these receivers are operating satisfactorily. However, one of the two deployable, electric antenna on the spacecraft has jammed in the partly extended state

and is grounded to the spacecraft. This fault degrades the plasma-wave experiment substantially because of loss of sensitivity, and a destructive level of E.M.R. from the spacecraft in certain frequency ranges (lower frequencies). Complete checkout and assessment of the problem have not been completed. Work-arounds are being developed to rescue as much of the capability of the experiment as possible.

A second HELIOS launch is planned for late 1975.

(Support by GSFC/NASA)

[Gurnett, Anderson, Oden, and Clark]

2.10 International Sun Earth Explorer

Two University of Iowa experiments were selected for this "mother-daughter" magnetospheric mission (formerly called International Magnetospheric Explorers). Launch is planned for 1977-78. The two spacecraft in this mission will be placed in essentially identical orbits with active stationkeeping to maintain the desired physical separation. The special objective of ISEE is to separate spatial from temporal variations in transient magnetospheric phenomena. Following a year of detailed scientific and instrumental definition work, both sets of instruments are now in the early stages of construction.

(Developmental support by ONR and NASA Headquarters)

(Hardware support by GSFC/NASA)

[Low energy particle experiment -- Frank et al.]

[Plasma-wave experiment -- Gurnett et al.]

2.11 Mariner Jupiter/Saturn

The University of Iowa is a member of the plasma-wave team for an experiment on this planetary fly-by mission. Two missions are planned with launches in August-September 1977; fly-bys of Jupiter, April-May 1979; and fly-bys of Saturn, February-May 1981. The plasma wave instrument is being designed and built at the University of Iowa. The present stage of the work is that of detailed circuit design and breadboard testing.

(Developmental support by ONR and NASA Headquarters)

(Hardware support by Jet Propulsion Laboratory/NASA)

[Gurnett, R. Randall, and Clark]

2.12 Electron Density in the Solar Corona

The occultation of the Crab pulsar NP 0531+21 by the solar corona (closest approach of line-of-sight to center of the sun: 5 solar radii) has been observed in mid-June of five successive years 1969, 1970, 1971, 1972, and 1973 at the Arecibo Radio Observatory at three different radio frequencies (111.5, 196.5, and 430.0 MHz). The observations of dispersion measure as a function of time as the occultation proceeds yield absolute values of coronal electron density over the range 5 to 20 solar radii in an entirely new way and with much improved accuracy over previous values. Results from the 1969, 1970, 1971, and 1972 occultations have been published. A paper on the 1973 results is nearly

completed. There has been a marked change in the coronal pattern over the period of successive observations, presumably connected with the cycle of solar activity.

(Support by ONR, NSF, and NASA Headquarters)

[Rankin and Weisberg]

2.13 Theory

Theoretical studies are continuing on the propagation of solar protons, alpha particles, and electrons in interplanetary space; on the emission of X rays and radio noise by the sun; on the generation and propagation of very low frequency radio waves in the magnetosphere and on the relationship of such waves to particle acceleration, diffusion, and precipitation; on shock waves in the interplanetary medium; and on the radiation belts of Jupiter and Saturn.

(Support by ONR and NASA Headquarters)

[Gurnett, Shawhan, Van Allen, Goertz, and Sarris]

2.14 Solar Radio Noise

Solar radio noise at 1.95 cm is being observed routinely by a radiometer-polarimeter at the North Liberty Radio Observatory. Observations are also being made with the 60 ft. dish at 136 MHz at selected times and with a 15 km baseline interferometer.

(Support by ONR)

[Shawhan and Chen]

2.15 Very-Long-Baseline Radio-Interferometry

A program of VLBI observations is being developed at NLRO in collaboration with Iowa State University/Ames, NOAA/Boulder, GSFC, and the National Radio Observatory in Greenbank, West Virginia. In contrast to most other VLBI experiments, a low frequency, 26.5 MHz, has been selected in order to study the dekametric emissions from Jupiter and the structure of the interplanetary plasma and to search for dekametric emissions from Saturn.

(Support by NASA, NOAA, and NSF)

[Shawhan, Cronyn et al.]

2.16 Large Area Radio Interferometer

During 1972-74 the University of Iowa collaborated with NOAA/Boulder and GSFC in constructing the largest area radio interferometer in the northern hemisphere. Both area and angular resolution exceed those of the Arecibo facility. The array is located at Clark Lake, California. The operating frequency is 34 MHz. An intensive program of observations is underway. Objectives of this array are to study the propagation of solar wind streams through interplanetary space (via interplanetary scintillation of compact radio sources); to observe dekametric radio emissions from Jupiter; and to search for dekametric radio emissions from Saturn.

(Support by NASA, NSF, GSFC/NASA, and NOAA)

[Shawhan, Cronyn, Erskine, Benson et al.]

2.17 Hawkeye II Proposal

After several months of work during the summer and autumn, a major proposal was submitted to NASA on 5 November 1974 for a Hawkeye/Auroral Physics Explorer mission.

This proposal describes plans for the design, construction, testing, and launch of a spacecraft and a full complement of scientific instruments, together with the reduction and analysis of flight data and the publication of results therefrom. The scientific objectives are to advance the understanding of the complex plasma physical phenomena in the earth's magnetosphere that cause the acceleration of charged particles and the production of the polar aurorae. Comprehensive measurements of basic plasma parameters will be made point-by-point along the orbit; in addition, broad scale imaging of the auroral emission in the upper atmosphere will be done and the two bodies of data will be combined in a composite interpretation.

For these purposes a closely integrated set of eight scientific instruments is proposed. It is found feasible to incorporate this set of instruments within a spacecraft of gross mass 47.5 kg. Such a spacecraft can be launched by a four-stage Scout vehicle from the Western Test Range into the desired orbit about the earth having the initial parameters $a = 2.5086 R_E$, $e = 0.58125$, $i = 75^\circ$, $\omega_0 = 225^\circ$, $P = 5.595$ hours.

The proposal is currently under review by NASA Headquarters. A preliminary assessment is expected by March 1975. If this program is approved, it will become the major developmental work of the laboratory for a number of years. A launch in late 1978 is envisioned. A major effort has been made in developing a new type of sensitive spot-scanning camera for broad scale imaging of auroral emissions and other low-light-level emissions in selected wavelength bands from the earth's atmosphere. It is believed that this scheme may have much wider applicability, including planetary imaging.

(Developmental support by ONR and NASA Headquarters)

[Van Allen, Frank, Gurnett, Shawhan, Enemark, Craven, Ackerson, Carpenter, Brechwald, Rogers, R. Randall, B. A. Randall, Jagnow, Anderson, and France, all of the University of Iowa; Hanson, Hoffman, Lippincott, and Zuccaro of the University of Texas, Dallas; and Carovillano and Eather of Boston College]

3.0 Senior Academic Staff in Space Physics
 [1 October 1974]

<u>Van Allen, James A.</u>	Carver Professor of Physics and Head of Department of Physics and Astronomy
<u>Frank, Louis A.</u>	Professor of Physics
<u>Gurnett, Donald A.</u>	Professor of Physics
<u>Heacock, R. R.</u>	Visiting Research Scientist
<u>Shawhan, S. D.</u>	Associate Professor of Physics
<u>Ackerson, Kent L.</u>	Assistant Research Scientist [Research Associate]
<u>Craven, John D.</u>	Assistant Research Scientist [Research Associate]
<u>Oliven, Melvin N.</u>	Assistant Research Scientist [Research Associate]
<u>Randall, Bruce A.</u>	Assistant Research Scientist

Also in closely related work
 (astronomy and plasma physics)

<u>Montgomery, David C.</u>	Professor of Physics
<u>Knorr, Georg</u>	Professor of Physics
<u>Hershkowitz, Noah</u>	Associate Professor of Physics [On leave 1974-75]
<u>Joyce, Glenn R.</u>	Associate Professor of Physics [On leave 1974-75]
<u>Neff, John S.</u>	Associate Professor of Astronomy
<u>Fix, John D.</u>	Associate Professor of Astronomy
<u>Goertz, C. K.</u>	Assistant Professor of Physics

Senior Academic Staff in Closely Related Work (continued)

<u>Salu, Yehuda</u>	Assistant Research Scientist [Research Associate]
<u>Kintner, Paul M.</u>	Research Investigator [Research Associate]
<u>Rodriguez, Paul</u>	Research Investigator [Research Associate]

4.0 Senior Engineering and Administrative Staff
 [1 October 1974]

<u>Enemark, Donald C.</u>	Adjunct Associate Professor
<u>Brechwald, Robert L.</u>	Manager, Systems and Programming
<u>Rogers, John E.</u>	Senior Engineer [Project Manager]
<u>Robertson, Thomas D.</u>	Contracts Administrator
<u>Yeager, David M.</u>	Senior Research Assistant
<u>Anderson, Roger R.</u>	Research Assistant III
<u>Owens, Harry</u>	Research Assistant III
<u>Oden, Dan</u>	Engineer IV
<u>Randall, Roger F.</u>	Engineer IV
<u>Anderson, R. D.</u>	Engineer III
<u>Baker, Keith R.</u>	Engineer III
<u>Clark, Scott A.</u>	Engineer III
<u>English, Michael</u>	Engineer III
<u>Jagnow, Paul G.</u>	Engineer III
<u>Kruse, Elwood A.</u>	Engineer III [R and QA]
<u>Freund, Edmund A.</u>	Supervisor, Technical Services [Departmental Machine Shop]
<u>Robison, Evelyn D.</u>	Project Assistant [Supervisor of Publications]
<u>Davison, W. Rollin</u>	Computer Operations Manager
<u>Dunlavy, D. David</u>	Engineer II: Station Manager, North Liberty Radio Observatory
<u>Flishler, Robert</u>	Engineer I: Hawkeye Magnetometer
<u>France, Richard J.</u>	Senior Program Analyst

5.0 Junior Academic Staff in Space Physics [1 October 1974]

All of those listed below are graduate students, engaged in research in space physics.

	<u>Appointment</u>	<u>Principal Research Project</u>
Anderson, Roger R.	Research Assistant III	VLF Radio (S ³ -A)
Baker, Daniel N.	NSF Fellow and Research Assistant	Pioneer 10/11
Baumbach, Mark M.	Research Assistant	VLF Radio (IMP-J)
Benson, John C.	Research Assistant	Large Area Radio Interferometer
Callahan, Timothy J.	Research Assistant	IMP-J, UK-4, Mass-Energy Analyzers for Low Energy Particles
Chen, Henry Sha-Lin	Teaching Assistant	Solar Radio Emissions
Erskine, Fred T.	Research Assistant	Large Area Radio Interferometer
Flindt, Herbert R.	Graduate Student	Pioneer 10
Green, James L.	Graduate Student and Computer Operator	--
Kurth, William S.	Research Assistant	VLF Radio (HAWKEYE)
Lee, James A.	Research Assistant	Electrostatic Analyzers
Pesses, Mark E.	Research Assistant	Spacecraft Trajectories
Saflekos, Nicolaos A.	Research Assistant	Diffusion of Particles in the Magnetosphere (Theoretical)

Junior Academic Staff in Space Physics (continued)

	<u>Appointment</u>	<u>Principal Research Project</u>
Sentman, Davis D.	Research Assistant	Pioneer 10/11
Scott, Janet L.	Graduate Assistant	Pioneer 10/11
Shaw, Robert R.	--	VLF Radio (IMP-I)
Spangler, Steven R.	Research Assistant	Flare Stars
Thomsen, Michelle N.	Research Assistant and Link Foundation Fellow	Pioneer 10/11
Weisberg, Joel M.	Teaching Assistant	Pulsar Study of Solar Corona (Arecibo)
Yeager, David M.	Senior Research Assistant	Magnetospheric Particles (UK-4, IMP-I, H, and J)

6.0 Research Reports and Publications
in Space Physics
1 September 1973 -- 1 October 1974

- *JOE L. LUTHEY and DAVID B. BEARD
 Analysis of the Jovian Electron Radiation Belts
 I. The Electron Energy and Number Densities of the
 Jovian Radiation Belt
Astrophys. J., 183, 671-678, 1973
- *DAVID B. BEARD and JOE L. LUTHEY
 Analysis of the Jovian Electron Radiation Belts
 II. Observations of the Decimetric Radiation
Astrophys. J., 183, 679-689, 1973
- J. A. VAN ALLEN
 Heliocentric Radial Dependence of Galactic Cosmic Ray
 Intensity To and Beyond 3.3 A.U.
13th International Cosmic Ray Conference Papers, Vol. 2,
 pp. 750-1 -- 750-6, 1973
- D. B. BEARD and J. L. LUTHEY
 The Source and Structure of the Jovian Radiation Belt
Planet. Space Science, 21, 1593-1699, 1973
- CHARLES P. CATALANO and JAMES A. VAN ALLEN
 Height Distribution and Directionality of 2 - 12 Å
 X-Ray Flare Emission in the Solar Atmosphere
Astrophys. J., 185, 335-349, 1973
- JOE L. LUTHEY
 Possibility of Saturnian Synchrotron Radiation
Icarus, 20, 125-135, 1973
- ROGER D. ANDERSON
 Telescopic Booms for the HAWKEYE Spacecraft
NASA Technical Memorandum X-2934, 59-68, 1973
 [8th Aerospace Mechanisms Symposium, Langley
 Research Center, Hampton, Virginia,
 October 18-19, 1973]

*Not included in report of 7 November 1973; information not then available.

- DANIEL W. SWIFT and DONALD A. GURNETT
 Direct Comparison Between Satellite Electric Field
 Measurements and the Visual Aurora
J. Geophys. Res., 78, 7306-7313, 1973
- D. A. GURNETT and R. R. SHAW
 Electromagnetic Radiation Trapped in the Magnetosphere
 Above the Plasma Frequency
J. Geophys. Res., 78, 8136-8149, 1973
- JAMES A. VAN ALLEN
 The Trip to Jupiter
Bulletin of The Atomic Scientists, pp. 52-56
 [December 1973]
- STANLEY D. SHAWHAN, DONALD A. GURNETT, RICHARD F. HUBBARD,
 and GLENN JOYCE
 Io Accelerated Electrons: Predictions for Pioneers 10
 and 11
Science, 182, 1348-1350, 1973
- STANLEY D. SHAWHAN, RICHARD F. HUBBARD, GLENN OYCE, and
 DONALD A. GURNETT
 Sheath Acceleration of Photoelectrons by Jupiter's
 Satellite Io
 R. J. L. Grard (ed.), Photon and Particle Interactions
 with Surfaces in Space, pp. 405-413 [D. Reidel Publishing
 Company, Dodrecht-Holland]
- J. A. VAN ALLEN, D. N. BAKER, B. A. RANDALL, M. F. THOMSEN,
 D. D. SENTMAN, and H. R. FLINDT
 Energetic Electrons in the Magnetosphere of Jupiter
Science, 183, 309-311, 1974
- J. A. VAN ALLEN, P. VENKATARAMAN, and D. VENKATESAN
 Variability of Intensity Ratios of H to He and He to
 Z \geq 3 Ions in Solar Energetic Particle Events
J. Geophys. Res., 79, 1-8, 1974
- WILLIAM W. L. TAYLOR and STANLEY D. SHAWHAN
 A Test of Incoherent Cerenkov Radiation for VLF Hiss
 and Other Magnetospheric Emissions
J. Geophys. Res., 79, 105-117, 1974
- RICHARD F. HUBBARD, STANLEY D. SHAWHAN, and GLENN JOYCE
 Io as an Emitter of 100 keV Electrons
J. Geophys. Res., 79, 920-928, 1974

- DAVIS D. SENTMAN and STANLEY D. SHAWHAN
 A Search for 5 Min Periodic Structure in Solar 2 cm
 Emission
Solar Physics, 35, 83-103, 1974
- D. A. GURNETT and L. A. FRANK
 Thermal and Suprathermal Plasma Densities in the Outer
 Magnetosphere
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8.0 Advanced Degrees Awarded in Space
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M.S. Degree

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