

servatory, and A. H. Thompson from the University of London's King's College are doing postdoctoral research work at the center during the present year.

Closing Date for NSF Program

The National Science Foundation has announced that April 1 has been set as the closing date for the receipt of proposals for the renovation and construction of graduate-level research facilities. Departments of educational institutions are eligible to apply for assistance under the Foundation's facilities program if they offer at least the master's degree in the life, social, or physical sciences, including mathematics and engineering. Proposals received prior to April 1 will be reviewed and notification of the Foundation's action will be made within four months of that date. Proposals received after the deadline will be reviewed after the next closing date, which is August 1.

Graduate Research and the Income Tax

Twice in recent years the United States Tax Court has ruled that a candidate for a higher degree receiving compensation for work performed under a federal research grant could consider his stipend as being exempt from federal income taxation.* In each case, the Court held that research of the type carried out by the graduate student was required by the university of all candidates for that degree. Although the federal withholding tax on wages is generally applied to stipends received in such circumstances, it is understood that the graduate student thus affected can assert on his income tax return that his stipend is exempt from taxation under IRC Section 117, or he may file a formal claim with his District Director of Internal Revenue for the refund of overpayment of his federal income tax.

Summer Programs

A special program in experimental solid-state physics will be offered from June 24 through July 26 by the Electrical Engineering and Metallurgy Departments of Massachusetts Institute of Technology. Intended primarily for faculty members in the materials-science area who wish to obtain first-hand experimental experience, the course will deal with x-ray diffraction, infrared spectroscopy, magnetic resonance, galvanomagnetic effects, excess carriers in semiconductors, crystal growth, ferroelectricity, thermal properties, superconductivity, and the Mössbauer effect. In addition to laboratory work, the program will include background lectures, references to selected literature, and tours of solid-state laboratories at MIT. Further information and application blanks can be obtained from Professor Arthur C. Smith, Experimental Solid State Program, Room 10-079, Massachusetts Institute of Technology,

Cambridge 39, Mass. Applications should be returned by April 15.

Several seminars which may be of interest to physicists will be held during June and July at Pennsylvania State University. Four of these are short courses on applied mechanics and materials science to be given under the general direction of Joseph Marin, professor and head of the Department of Engineering Mechanics. They include an introduction to continuum mechanics (June 9-14), followed by a course on nonlinear theories of continuum mechanics (June 16-21). Paralleling these seminars will be a week's study of viscoelastic behavior of plastics (June 9-14) and a course on dislocations and mechanical properties (June 16-21).

Another offering at Penn State, this one under the chairmanship of Vernon M. Albers, chief scientist of Penn State's Ordnance Laboratory, will be a seminar on underwater acoustics which will meet in two groups, the first from July 21 to 26 and the second from July 28 to August 2. The course will deal with problems of sound transmission in the sea, generation and detection of underwater sound, and the design of transducers.

Further information on the seminars can be obtained by writing to the Continuing Education Information Office, Pennsylvania State Univ., University Park, Pa.

This year's Scottish Universities Summer School in Physics (which is part of the NATO program of Advanced Study Institutes) will be held at Newbattle Abbey near Edinburgh from July 28 to August 17 and will consider strong interactions and high-energy phenomena. The course will consist of about three lectures a day plus occasional seminars. The provisional panel of lecturers includes R. Blankenbecler of Princeton, S. Fubini of Turin and CERN, M. Gell-Mann and F. Zachariasen of the California Institute of Technology, J. Hamilton and A. C. Lovelace of London, A. Martin of CERN, R. Omnes of Saclay, and T. Regge of Turin. The fee for the course is £20 and includes full board and lodging. Further information and application forms can be obtained from Dr. B. H. Bransden, Department of Natural Philosophy, University of Glasgow, Glasgow, W.2, Scotland. The closing date for applications is April 10.

The Catholic University of America will offer an institute on analog computation, which will take place from June 10 to June 21. Inquiries should be addressed to B. P. Shah, Department of Mechanical Engineering, Catholic University of America, Washington 17, D. C.

Three special institutes will be presented by the Oak Ridge Institute of Nuclear Studies this summer. They will be sponsored by the National Science Foundation in cooperation with the US Atomic Energy Commission, and will take place at the ORINS Special Training Division.

The longest course (June 17 through August 9) is designed to provide an opportunity for physics teach-

* The cases of *Bhalla vs Commissioner* (35 USTC —, No. 3, CCH Dec. 24309), October 7, 1960, and of *Spruch vs Commissioner* (USTC Memo. Op., CCH Dec. 24699 (M)) March 6, 1961.

New Career Positions at NASA

Outstanding Opportunities Available Immediately At NASA Centers in Maryland, Texas, Alabama and Ohio

The career positions outlined below bear a direct and significant relationship to the nation's space effort. Respondents should have a BS or advanced degree from an accredited college or university and appropriate experience. Please send your inquiry to the Personnel Officer of the individual NASA center, as indicated below.

NASA GODDARD SPACE FLIGHT CENTER

Dept. NB-2, Greenbelt, Maryland
(Suburb of Washington, D. C.)

Satellite Tracking

Various positions at beginning through senior level involving research, design and development of optical and electronic devices and systems. Also, openings in systems analysis and evaluation and in management of overseas tracking stations.

Communications & Data Acquisition Program Management

Technical management for development of satellite communication and data handling subsystems. Positions require laboratory experience in design of miniaturized electronic flight hardware.

Systems Analysis

For evaluation and systems design of complex data processing facility utilizing special purpose telemetry reduction equipment and large scale digital computers. Background in computer systems design, digital computer programming or data analysis.

Spacecraft Heat & Light Control

Development of thermal analysis techniques; thermal design of spacecraft; design and development of passive and active temperature control systems; research on coatings with precise optical properties; development of techniques for rapid and reliable measurement of optical properties in infra-red, visible and ultra-violet. Involves consideration of effects of the space environment, including vacuum, ultra-violet irradiation, electron and proton bombardment and thermal stress.

Electronic Flight & Support Systems

Design, coordination and integration of all electronic subsystems for satellites. Beginning through senior level openings.

Space Vehicle Project Management

Rocket launching, analysis and evaluation of rocket vehicle flight performance. Includes development of techniques for acquiring and evaluating data, design and modification of rockets for specific payload requirements, trajectory studies, stress and vibration analysis and technical management of rocket vehicles. Beginning through senior level openings.

Flight Systems Test

Test and evaluation in areas of stress, dynamics and vibration. Beginning through senior level openings.

Object Management, Launch Systems

Vehicle and satellite systems preparation, test and checkout, spacecraft integration, trajectory analysis

and vehicle flight performance, and overall project management for launch operations.

NASA MANNED SPACECRAFT CENTER

Dept. NB-2, Houston, Texas

Space Sciences

Development of manned spacecraft mission including simulation of space environment for projects Gemini and Apollo. Intermediate and senior level openings requiring experience in Geodesy, Astronomy, Astro-Science or Geophysics.

Propulsion & Power

Intermediate and senior level openings requiring experience in liquid and/or solid propulsion, with emphasis on nozzle design, flow patterns, gas dynamics and spacecraft design.

Fluid & Flight Mechanics

Thermo dynamics, heat transfer, thermal control, fluid flow, landing systems (parawing, rotor systems, parachute) and spacecraft components. Intermediate and senior level openings.

Data Acquisition Systems

Data acquisition, computer operations, computer programming, and control and guidance systems. Intermediate and senior level openings.

Spacecraft Communications & Instrumentation

Detailed functional analyses of systems installed in both manned spacecraft and booster stages to determine operational aspects of crew-to-earth communication links, problem areas, sources and effects of data system errors, etc.

Spacecraft Guidance & Control

Analyses of manned spacecraft guidance, navigation, stabilization and control systems to determine operating modes for all mission phases, sources and effects of system errors, etc. Provide liaison between flight crews and applicable project office. Monitor developments.

Spacecraft Thermo Systems

Analyses of manned spacecraft environmental control systems to determine operating modes, optimum controls and displays, manual vs. automatic allocation, and operating safety margins. Provide crew training on systems. Intermediate and senior level openings.

Power Systems

Analyses of spacecraft power systems to establish operating and failure modes, automatic vs. manual allocation, and optimum controls and displays for the mission. Provide flight crew training on systems. Intermediate and senior level openings.

NASA LEWIS RESEARCH CENTER

Dept. NB-2, Cleveland, Ohio

Propulsion Components & Systems

Experience with cryogenic tanks and valves, turbo-machinery, dynamic controls, thrust chambers, gas generators, heat exchangers, systems analysis and

systems testing. Research on heat transfer, lubrication and bearings, fundamental flow processes, tank pressurization and turbopumps. Intermediate and senior level openings.

Reliability & Quality Assurance

Analysis and appraisal of specific hardware and systems designs. Develop standards to judge reliability and performance, together with appropriate test plans for materials and equipment rating. Establish procedures and systems to assure conformance of hardware and equipment to specifications. Failure analysis of defective components and systems.

Facilities Engineering

Design and construction of large scale engine test and space environment facilities; analyze test requirements; develop test chambers, support systems, handling facilities, operating techniques; instrumentation and control systems for specific tests. Beginning to senior level openings.

Project Development Engineering

Engineering analysis of project requirements; develop schedules and test plans; analyze test results, contractor reports, project review data; liaison with contract representatives and other technical management responsibilities.

Mission Analysis & Application

Analysis of mission requirements in terms of flight paths, orbits, payloads, propulsion, control, and guidance; configuration and matching studies of vehicles, boosters, and their combinations; energy management studies, studies related to orbital rendezvous and landings on planetary bodies. Beginning to senior level openings.

Vehicle Structures

Conceive and design vehicles to meet particular space flight requirements. Includes structural analysis, size and weight studies, systems layout, power and propulsion requirements, materials selection.

Ground Support Equipment

Design and development of ground support systems for checkout and launching of specific payloads and stages.

Nuclear Propulsion & Power Systems

Scientists and engineers skilled in Nuclear Reactor Technology, radiation and shielding, materials deterioration and nuclear rocket heat transfer studies. Other work specialties concerned with the operation and performance of experiments in a 60 megawatt experimental test reactor at Plum Brook Station at Sandusky, Ohio. Intermediate and senior level openings.

Space Power Generation

Mechanical fuel cell and solar cell systems. Research Engineers and Physicists skilled in liquid metals technology, magneto-hydrodynamics, refractory coatings, turbomachinery, fluid dynamics and heat transfer, electric generators, power conditioning, thermionics, physical metallurgy and fabrication, environmental testing, system controls. Research on direct conversion of thermal, solar or nuclear energy to electrical energy. Involves semiconductor and plasma

energy conversion devices. Beginning to senior level openings.

Gas Turbine R&D

Research and development on turbine and pump components for rocket propulsion and space power systems. Research areas include: pumps for cryogenic propellants; liquid metal pumps and vapor turbines; gas turbines, axial, radial, and re-entry; axial-flow compressors; alkali metal test facilities.

NASA MARSHALL SPACE FLIGHT CENTER

Dept. NB-2, Huntsville, Alabama

Automated Control Systems

Research in Theoretical Physics, Aerodynamics and Mathematics including establishing trajectories for space vehicles and evaluating flight mechanical parameters. Includes pre-flight and post-flight evaluation of space vehicle or spacecraft flight and systems. Beginning and senior level openings.

Fluid & Flight Mechanics

Solution of advanced theoretical space vehicle and spacecraft problems in one or more of these areas: aerodynamics, flight mechanics, guidance and control and vehicle performance with emphasis on system conceptualization. Advanced degree preferred.

Space Sciences

Participate in space vehicle and spacecraft theoretical atmospheric physics studies in one or more of these areas: wind turbulence, wind shear, model atmosphere and terrestrial and space environmental conditions.

Flight Mechanics

Theoretical research studies for space vehicle in one or more of these areas: optimization of space orbits, sensitivity of orbits to celestial influence, development of analytical formulation of space flight orbits, atmospheric re-entry flights, stability and control of rigid bodies, guidance control systems and flutter and vibration.

Measurement & Control Systems

Solution of aerodynamic, electronic and instrumentation problems requiring analysis and evaluation of electronic measurement and instrumentation systems for experimental aerodynamic wind tunnels, space simulators and allied facilities.

Guidance & Control Systems

Several positions available. Control system component integration. Accelerometer, rate gyro and other control sensor performance testing and evaluation. Coordination of programming efforts for the Saturn automatic checkout system. Design, development, test and evaluation of flight control systems and/or associated components—electrical, mechanical, hydraulic or pneumatic. Senior and intermediate level openings.

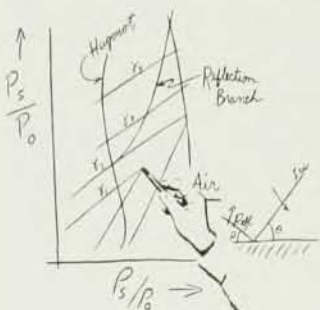
NASA is an equal opportunity employer. All positions filled in accordance with Aerospace Technology Announcement 252-B.



CAREER OPPORTUNITIES FOR THEORETICAL PHYSICISTS

PHD OR EQUIVALENT

AT
KAMAN
OF
COLORADO



$$\frac{(P_2 - P_1) K_2}{P_1 \mu_1^2} = \frac{\cos^2 \theta}{\omega^2 \phi}$$

$$\frac{P_2}{P_0} = \frac{P_s}{P_0} = \gamma \frac{(1 + \mu_1^2 \beta_1^2)}{(\mu_1 + \beta_1^2)}$$

**NUCLEAR WEAPONS EFFECTS
SOLID STATE PHYSICS
WEAPONS SYSTEMS ANALYSIS
NUCLEAR PHYSICS
RE-ENTRY PHYSICS
SHOCK WAVE PHENOMENA**

Dr. Don Sachs, right, scientist with Kaman Nuclear is currently active in the study of nuclear weapon effects to determine feasible methods of hardening re-entry nose cones against anti-ICBM attack. In connection with this work, Dr. Sachs authored several technical reports on Plasmas, Radar Augmentation, and Weapon Effects. Dr. Sachs received his PhD from UCLA and is a member of the American Physical Society, American Rocket Society, American Geophysical Union, and Sigma Xi.



Write Personnel Director for Information About Permanent Positions

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ers from small or liberal-arts colleges to review and learn concepts that are fundamental to an understanding of modern physics. A considerable portion of the instruction will be given by members of the staff of Oak Ridge National Laboratory.

A four-week institute, limited to twelve participants, will take place from July 29 to August 23 and is intended to provide its students with facility in the safe and efficient use of isotopes, to teach and undertake tracer work, and to increase the subject-matter competence of participants in specialized areas.

From June 17 to July 26, an institute in isotope technology for engineering teachers will be offered. Limited to 24 participants, it is designed to give sufficient facility in handling isotopes to utilize them safely and efficiently and to teach and undertake applications in a wide variety of engineering fields.

Stipends, including allowances for dependents and travel, will be provided for participants in all summer institutes. Further information and application materials are available from Dr. Ralph T. Overman, Special Training Division, Oak Ridge Institute of Nuclear Studies, P. O. Box 117, Oak Ridge, Tenn.

For the second summer in succession, the Thayer School of Engineering of Dartmouth College will sponsor an intensive course on the uses of information theory in science and engineering. This year's dates are July 1 to 12. The objective of the course is to acquaint scientists with the approach to probability and statistical inference originally developed and applied in physics by Professor E. T. Jaynes of Washington University and applied in engineering by Dean Myron Tribus of the Thayer School, both of whom will collaborate in teaching the course. It will cover applications in kinetic theory, thermostatics, thermodynamics, reliability engineering, communications theory, decision theory, and game theory. Applicants should have bachelors' degrees in physics, mathematics, chemistry, or engineering; prior preparation in statistics, although it would be helpful, is not a prerequisite. The course has a registration fee of \$600 and will be limited to 50 participants.

Information and application forms (which must be returned by April 15) can be obtained from D. E. Canavan, Director of Thayer School Summer Courses, Room 201 Cummings Hall, Dartmouth College, Hanover, N. H.

Two one-week courses in x-ray analysis will be offered this summer by the Illinois Institute of Technology. Both will be given under the direction of Leonid V. Azároff, professor of metallurgical engineering. The first, to be held during the week of June 10, is on the powder method in x-ray analysis and is designed to familiarize beginners with the use of x-ray diffraction in analyzing polycrystalline materials. No previous experience in such techniques is assumed. The second course, on advanced methods in x-ray analysis, will take place from June 17 to 21 and is intended for persons already familiar with the fundamentals of x-ray dif-

fraction. Both courses will be limited to 20 students, and enrollment preference for the advanced course will be given to those who also take the introductory one. Further information can be obtained from the Illinois Institute of Technology, 35 West 33rd St., Chicago 16, Ill.

Fisk University will hold its fourteenth annual infrared spectroscopy institute from August 13 to 23 in the form of two five-day sessions. The first session will review the fundamentals of infrared spectroscopy and the second will deal with the interpretation of infrared spectra and new techniques for the benefit of experienced workers in the field and provide advanced material for those who have taken the first session. Chemical interpretation of infrared spectra will be stressed.

Concurrently with the first session, Fisk will again offer a summer program in gas chromatography to provide training in the use of gas-chromatography units, the preparation of columns and samples, and the interpretation of chromatograms.

Application forms and information concerning tuition and course content can be obtained from Professor Nelson Fuson, Director, Fisk Infrared Institute, Fisk University, Nashville 8, Tenn.

Teaching Aids

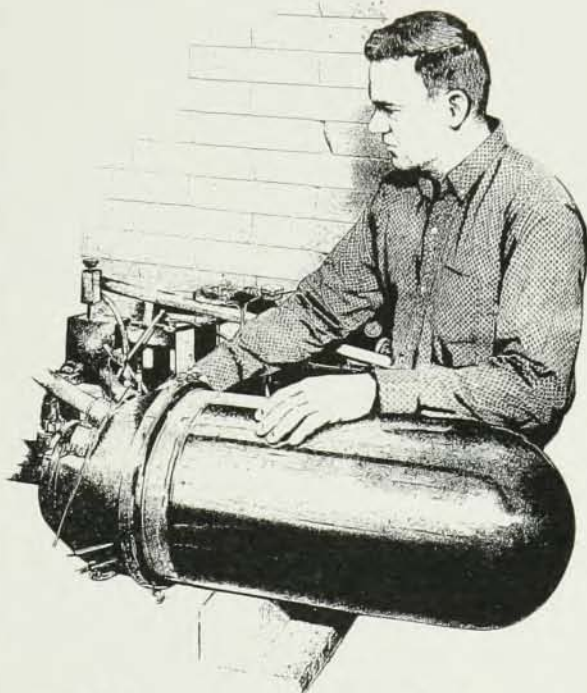
Bell Telephone Laboratories, which developed the silicon solar cell in 1954, has made available for high-school use a solar-energy experiments kit which contains the necessary materials for constructing an energy-conversion cell. An accompanying booklet gives instructions on the cell's preparation and the measurement of its performance and describes the underlying principles of the cell and three experiments that can be performed with it. The kits can be obtained by qualified high-school science teachers, without charge, from any local Bell Telephone office.

Atomic Laboratories, Inc., a subsidiary of the Cenco Instruments Corporation, has announced the development of a set of physics-teaching and demonstration apparatus in which each individual component can be linked to every other component. Described as a "building-block" design, the modular nature of the set makes it possible to use each instrument either separately or in combination with other instruments for the demonstration of various physical effects and experiments. Components now available include a high-field aluminum-foil electromagnet, a vacuum system with an ion gauge and a mercury diffusion pump, an electron spin-resonance spectrometer, a combination beta-ray and mass spectrometer, a flip-coil magnetometer, a direct-reading gauss meter, and apparatus for demonstrating both the Faraday effect and the Zeeman effect. Additional units are being planned. Each piece of equipment is accompanied by a descriptive book providing information on experiments that may be performed with the instruments.

CAREER OPPORTUNITIES FOR EXPERIMENTAL PHYSICISTS

PHD OR EQUIVALENT

AT KAMAN OF COLORADO



Dr. Herb Hollister, above, of Kaman Nuclear is presently engaged in experimental research on various aspects of high voltage and ion physics and activation analysis. Dr. Hollister received his PhD from Cornell University and is a member of Tau Beta Pi, Sigma Tau, Sigma Phi Epsilon and Sigma XI.

NEUTRON PHYSICS
ACCELERATOR PHYSICS
SHOCK WAVE PHENOMENA
BARE CRITICAL ASSEMBLIES

PRESSURE TRANSDUCERS
GAMMA RAY
DENSITOMETERS
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