

SOLID STATE PHYSICISTS

IMPORTANT APPOINTMENTS TO BE MADE AT THE AEROSPACE RESEARCH CENTER

Your interest is enlisted in a recently established scientific community entirely concerned with scientific and technical investigations; totally divorced from administrative or development duties.

Studies here are related as closely as possible to urgent needs of government agencies, determined through personal consultation with their representatives. Particular (but not exclusive) emphasis is placed on problems bearing on navigation, guidance and control of upper atmosphere and space vehicles . . . areas where General Precision has long held a leadership position in the development of systems and components.

Principal staff scientists are now sought. Very brief descriptions of these positions follow below. For more detailed information and to discuss your own professional interests, we invite you to communicate directly with Dr. Raymond Guard, Principal Staff Scientist, at the Aerospace Research Center.

SOLID STATE PHYSICIST

Principal staff scientist will be responsible for the development of programs on new materials and new techniques for evaluation of materials. Research programs will encompass work in solid state and crystal physics and experimental analysis using x-ray and electron diffraction techniques and electron microscopy. Background should include experience in electroluminescence and photo-conductivity. PhD plus 3 years' related experience required.

SOLID STATE PHYSICIST

Senior scientist who has specialized in electronic materials research will initiate programs in this field in cooperation with Principal Staff Scientist in the Research Center and with scientists from the Operational Divisions. Solid state background should be extensive—including a knowledge of electro-optical conversion; crystal physics; properties of semiconducting and electro-luminescent materials, fluids, magnetics, and dielectrics. PhD required.



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ical building, which will provide 7000 square feet of space for mechanical and electric service equipment and controls.

The third building will be known as the laboratory building and will have an area of 70 by 277 feet. It will be used for setting up and testing experimental equipment prior to use and will contain a large two-story bay with a crane, plus 6400 square feet of smaller laboratories and offices. Completion of the buildings is scheduled for late next year. Planning for the facility was in the hands of a committee consisting of faculty members of both universities and members of the accelerator staff.

National Magnet Laboratory

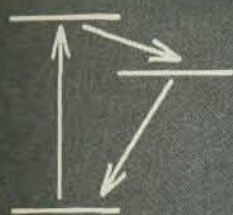
Dedication ceremonies for the new National Magnet Laboratory at Cambridge, Mass., were held on April 30. The laboratory, directed by Benjamin Lax, will be operated by the Massachusetts Institute of Technology and will serve as a center for basic research involving magnetic phenomena and strong magnetic fields. Its facilities will be available to scientists from universities, governmental and industrial laboratories, and other research organizations throughout the United States. The laboratory's research operations will be sponsored by the Air Force Office of Aerospace Research, which also provided the funds (\$6 million) for its establishment. The NML is located in a former bakery at 120 Albany St. The five-story building has been completely remodeled to suit its new occupant.

Central to the Laboratory's experimental capability is its power supply, consisting of two motor-generator units. Coupled together, they can produce a continuous direct current of 40 000 amperes at 250 volts. If fed to a single magnet, this amount of power can produce a continuous field to a maximum of 250 000 gauss. (The strongest magnetic field previously reported was 152 000 G at the Naval Research Laboratory during the summer of 1962.) Each of the motor-generator units is equipped with an 85-ton flywheel, and, when their stored energy is applied, current pulses of a few seconds' duration can be achieved at a power level of 32 million watts. Pulsed magnetic fields of 400 000 gauss or higher are anticipated with this arrangement.

The building is fitted with ten test stations, each with individual power and coolant connections; the magnets are mounted on wheels for easy transport to any desired station. The distilled-water coolant is run through a central piping system, which puts it through a heat exchanger where it passes its heat to water from the Charles River.

Nuclear-Structure Laboratory

The University of Rochester is currently planning the construction of a nuclear-structure laboratory to be equipped with an MP two-stage Van de Graaff accelerator that is now being designed by the High Voltage Engineering Corporation. Funds for the ac-



EPR OF TRIPLT STATES

(ELECTRON PARAMAGNETIC RESONANCE)

EPR study of triplet states in organic molecules is of considerable intrinsic interest and has taken on an added importance because these materials are suitable for optical masers. High sensitivity, provision for uv irradiation, and variable temperature equipment make the Varian V-4502 EPR spectrometer particularly useful in this work.

EXAMPLE

Paramagnetic resonance of some benzophenone derivatives in their phosphorescent state

The observation of the paramagnetic resonance of the triplet or phosphorescent state of complex organic molecules was first demonstrated by Hutchison and Mangum^{1,2} in a single crystal of durene containing a dilute concentration of naphthalene. The anisotropy of the transition $\Delta M = \pm 1$ was so great that resonance could not be observed when randomly oriented naphthalene molecules were irradiated in a rigid glass.

Since their early work Van der Waals and de Groot^{3,4} have shown that a paramagnetic resonance absorption of the triplet state for randomly oriented molecules in a glass can be observed. The absorption they observed corresponded to the $\Delta M = \pm 2$ transition at approximately half the field (1500 gauss, $g = 4$). Recently Yager and Wasserman⁵ have shown that $\Delta M = \pm 1$ transitions of triplets as well, can be observed for randomly oriented molecules in glasses. The experiment demonstrated here is the generation of a triplet state in 4-aminobenzophenone dissolved in a glass of isopropyl alcohol. The sample is contained in a 4-mm OD quartz tube and is immersed in a Dewar of liquid nitrogen. Ultraviolet irradiation is produced with a PEK-109 high-pressure Hg arc with a pyrex filter to cut off light below 3000 Å.

The $\Delta M = \pm 2$ transition for the triplet state is observed at 1491 gauss and has a line width of 33 gauss. In addition a $\Delta M = \pm 1$ transition is also observed at 2449 gauss. The $\Delta M = \pm 2$ resonance is illustrated in Fig. 1. These field measurements were read directly from the VFR-2503 Fieldial* magnetic field regulator.

In addition to the $g = 4$, $\Delta M = \pm 2$ transition, a strong phosphorescence emission with a maximum at 470 mμ, occurs. The phosphorescence decay of the triplet state can be measured simultaneously when utilizing the V-4534 optical transmission cavity. The two signals decay at the same rate (0.41 sec).

A resonance is also observed at $g = 2$ for this mixture and is attributed to decomposition of the solvent and not associated with the triplet state of the 4-aminobenzophenone. It is observed that this isopropyl free radical $\text{CH}_3-\dot{\text{C}}\text{OH}-\text{CH}_3$ decomposition is enhanced in the presence of the 4-aminobenzophenone and can probably be accounted for by an energy transfer reaction between the excited triplet state and the solvent molecule resulting in a hydrogen abstraction from the solvent. Fig. 2 illustrates the solvent free radical.

*Trademark

1. C. A. Hutchison and B. W. Mangum, *J. Chem. Phys.* 29, 952 (1958).
2. C. A. Hutchison and B. W. Mangum, *J. Chem. Phys.* 34, 908 (1961).
3. J. H. Van der Waals and M. S. de Groot, *Mol. Phys.* 2, 233 (1959).

4. J. H. Van der Waals and M. S. de Groot, *Mol. Phys.* 3, 190 (1960).
5. W. Yager and E. Wasserman, *J. Chem. Phys.* 37, 1148 (1960).

FIGURE 1
TRIPLT STATE
 $g = 4.0$



FIGURE 2
I.P.A. FREE RADICAL
 $g = 2.0$



For literature which fully explains the 100 kc EPR Spectrometer and its application to basic and applied research in physics, chemistry, biology and medicine, write the Instrument Division.



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Leading Midwest Research and Development organization seeks broad gauge Scientific Executive to work with economic and planning specialists in the development of long range technical programs in graphic communications.

Candidate employed will be responsible for coordination, evaluation, and interpretation to Management of various active research projects within the company relating principally to solid state physics and physical chemistry.

Will work with the company's staff in motivating them to development of new and/or expanded programs as well as maintain active liaison with customers' technical staffs at all levels. Must maintain a broad surveillance of a number of technical "areas of potential interest." Will be responsible for preliminary investigation into new technical areas and making recommendations for further investigation.

Requirements include Ph.D.

Requirements include Ph.D. in Physics plus heavy experience in solid state physics and experience in planning and direction of programs involving several projects and other disciplines. R&D experience in as many of the following fields as possible:

- (a) Photoconductivity
- (b) Luminescence
- (c) Magnetism
- (d) Masers and Lasers
- (e) Photochemistry
- (f) Preferably experience in Optics or Electrostatics

Company Prefers

Company prefers a man who has contributed to the literature of his field and is active in technical societies. Candidate's personal goals and interests should be: desire to develop generalist rather than specialist capabilities; to enjoy working with people and helping them develop ideas; with strong interest in the "business" side of research and its relation to corporate growth and strategy.

IF YOU are interested in knowing more about this exceptional opportunity but do not have a prepared resume, jot your home address and phone number on the back of your business card and mail with full assurance that all activity will be on a confidential basis and all expenses paid by employer.

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celerator (more than \$3 million) have already been provided under a grant to the University from the National Science Foundation. In addition, the Foundation and the State of New York have each allocated sums of \$425 000 to defray part of the construction costs of the laboratory buildings, which are expected to amount to more than \$1.7 million.

The laboratory will consist of four buildings covering about an acre. Tentative plans call for the preliminary design of the buildings to be undertaken next year, with construction scheduled to be complete before the first parts of the accelerator are delivered in 1965. The University expects to have the laboratory in operation sometime in 1966.

The Case of Channel 37

According to a rule proposed early this spring, the Federal Communications Commission would provide limited and temporary protection of radio astronomy observations on the waveband 608–614 Mc (UHF TV channel 37) from interference by commercial broadcasts. The proposed rule, which at the time of this writing has not yet been formally adopted, is framed with specific reference to the welfare, as viewed by the FCC, of the University of Illinois' radio telescope at Danville, Ill. The University of Illinois was the principal petitioner for protection.

The proposed rule would ban broadcasting on channel 37 from any point within 600 miles of Danville until January 1, 1968. It would further restrict licensees in the area outside the 600-mile limit from broadcasting between the hours of midnight and 7:00 A.M. local time, thus providing about four hours of the night during which there would be no interference on channel 37 originating anywhere in the United States. The provisions of the rule appear to be based on a statement (quoted by the FCC) made by G. C. McVittie, the director of the University of Illinois Observatory, in the course of an article on the Danville installation which appeared in the magazine *Sky and Telescope* (December 1962). Dr. McVittie wrote that, because of the effects of solar interference, observations involved in the telescope's first project (a five-year program to develop a map of discrete sources) would be confined to night hours. The FCC has before it four applications for assignment of channel 37, all originated by parties in Paterson, N. J., where, according to the FCC, no other channel is available for assignment. The Commission is delaying action on these applications until final adoption of the proposed rule since it feels that a change in the 600-mile protection zone might be made.

The University of Illinois originally sought an unqualified deletion of channel 37 from the list of assignable television frequencies. It had built its receiver for this band in the hope that the 1959 conference of regulatory agencies held at Geneva would make such protection a world-wide requirement. The conference did not so rule, but it did recommend that na-