

SCIENCE EDUCATION

Films

Two graduate-level films (16 mm, color and sound, 45 minutes) on nucleon-nucleon scattering have been produced by the University of California's Lawrence Radiation Laboratory at Livermore and have been made available for use by interested physics departments offering graduate work in high-energy physics. Both releases are filmed lectures given by H. Pierre Noyes of the Livermore Laboratory.

The first film ("Analysis of Nucleon-Nucleon Scattering Experiments"), which is intended for use in a graduate course or seminar in nuclear physics, charts the route from scattering experiments to a unique description of the scattering matrix in terms of phase shifts. Although formal mathematics is kept to a minimum, it is presupposed that the student knows what a wave function is, how probability-current is computed from a wave function, and what is meant by a quantum-mechanical state. The film is not intended for use in undergraduate courses unless these concepts have already been introduced.

The second film ("Dispersion Theory Approach to Nucleon-Nucleon Scattering") is aimed at the advanced graduate student and staff level, or for an introductory lecture in a course on dispersion theory. It presupposes some familiarity with scattering solutions of the non-relativistic Schrödinger equation and Cauchy's theorem, and an acquaintance with Feynman diagrams, but does not assume an intimate knowledge of quantum field theory. Topics discussed are:

1. Solution of the S -wave Schrödinger equation for a superposition of exponential or Yukawa potentials by conversion to a Volterra equation, using the method of Andre Martin.
2. Solution of the same equation by partial wave dispersion relations using the N/D method; construction of the potential from the discontinuity in the partial wave amplitude.
3. Mandelstam representation for potential scattering and construction of double spectral function.
4. Relationship between the field-theoretic amplitude and nonrelativistic scattering amplitude.
5. Relationship of nucleon-nucleon scattering to the nucleon-antinucleon amplitude, pion-nucleon scattering, pion-pion scattering, and nucleon electromagnetic structure.

Both films are available on a free loan basis or can be purchased. Further information can be obtained from the Graphic Arts Department, Lawrence Radiation Laboratory, P. O. Box 808, Livermore, Calif., or from the Atomic Energy Commission film libraries at the Washington headquarters and the Chicago and San Francisco Operations Offices.

New Science Building

Dedication ceremonies for a new \$2 million science and engineering building were held February 10 on the campus of Michigan State University Oakland in Rochester, Mich. The building, provided by the State Legislature of Michigan, contains 85 000 square feet of floor space and includes teaching and research laboratories, faculty offices, classrooms, and supporting facilities for instruction in physics, mathematics, chemistry, and the engineering and life sciences.

MSUO has also announced the launching of a new science-engineering program in which majors in the various specific fields of engineering have been abandoned in favor of emphasis on mathematics, chemistry, and physics, supplemented by study of engineering applications—"The purpose is to give students the understanding needed to move in new directions, rather than training them in techniques that will be obsolete tomorrow."

A symposium on improving science education was held in connection with the dedication. Bowen C. Dees, assistant director for scientific personnel and education of the National Science Foundation, served as moderator. The speakers included Arnold B. Grobman of the University of Colorado, Paul F. Chenea of Purdue, G. Baley Price of the University of Kansas, Melvin S. Newman of Ohio State University, and Walter C. Michels of Bryn Mawr College, chairman of the Commission on College Physics.

NSF Programs

A number of changes have been announced by the National Science Foundation in its Graduate-Level Research Facilities Program (formerly known as the Graduate Research Laboratory Development Program). Eligibility requirements have been extended to include institutions having graduate programs in science or engineering leading to at least the master's degree. Previously, only institutions with doctoral programs were eligible. In addition, nonprofit institutions which do not themselves grant degrees are now eligible, provided that they are associated with colleges or universities in graduate research and training.

Funds for general-purpose research equipment (movable items, e.g., microscopes, centrifuges, x-ray diffraction apparatus, calculators, desks, etc.) may now be requested up to a maximum of ten percent of the total amount included in a facility proposal. Under the program's former rules, funds could be provided only for construction and fixed furnishings. No change has been made in the rule that the institution should provide matching funds of at least fifty percent of the total cost of the project. Copies of the brochure announcing requirements for submission of proposals are available

Spectromagnetic Industries N.M.R. detectors with non-frequency determining probe



Spectromagnetic Industries offers a variety of precision Nuclear Magnetic Resonance Detectors for monitoring, measuring, mapping and controlling of magnetic fields, and for measuring fields from 1,000 to 15,000 gauss using proton samples.

All models use a *non-frequency determining probe* as a sensing element, where the operating frequency source is completely isolated. The probe's R. F. coil is wound to encompass the N.M.R. sample. Transversely wound, Helmholtz sweep coils allow the unknown field to be modulated so that resonance observance, by A. M. detection, may be made.

The resultant detected signal is displayed vertically on a 5" Oscilloscope screen along with sweep coil current displayed horizontally. The sweep current is preset by a calibrated panel control.

All electronic circuitry, display and controls (other than probe components) are enclosed in a single chassis which is rack-mounted or set in a cabinet.

Spectromagnetic Industries N.M.R. Detectors are available for almost any application with frequency ranges from 4 to 64 megacycles, allowing use of protons to 15,000 gauss and lithium to 38,000 gauss. Two standard models are described in the next column.

Spectromagnetic Industries N.M.R. Detector Model PD-64S has minimum number of controls. Probe tuner is integral part of built-in tuning system. Probe line is restricted to five (5) feet maximum. This model is best suited for field mapping, general N.M.R. experimentation and finding resonances in fixed magnetic fields. With Model PD-64S, small "penny size" probes can be utilized in a gap of $\frac{1}{4}$ " minimum (above 4000 gauss using proton sample).

PD-64L has the same operating principal as PD-64S except that it employs a special coupling circuit to allow the use of any length of coaxial R. F. cable (to probe) up to 150 feet without a serious reduction in signal strength (on both protons and Lithium samples). This coaxial cable is terminated by a close impedance match coupling into the tuned R. F. probe coil. Remote tuning of the probe may be accomplished by a simple non-calibrated control system (optional). This unit is best suited for remote monitoring, comparison or control of magnetic fields.

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The Foundation has also announced two series of grants to aid summer study by teachers. Amounts totalling \$711 500 have been given to colleges and universities this year to support 21 summer institutes for elementary-school teachers, supervisors, and principals who are concerned with science instruction in grades 1-6. The program provides opportunities for about 700 individuals to obtain supplementary training in science and mathematics with a view to improving the quality of elementary instruction. The grants cover all costs, including subsistence stipends to the participants.

To aid teachers at an advanced level, approximately \$405 000 has been awarded by NSF for 25 summer conferences for college teachers of science, mathematics, and engineering. The conferences are of short duration (up to four weeks) and are intended for college staff members who must teach during the summer session. Participants will be selected by the individual conference directors, to whom inquiries and applications should be addressed. Conferences on physical subjects include the following:

Case Institute of Technology, Cleveland, Ohio: Molecular Structure and Spectroscopy (Gordon M. Barrow, Dept. of Chemistry)

University of Florida, Gainesville: Nuclear and Electron Spin Resonance (Wallace S. Brey, Jr., Dept. of Chemistry)

Georgetown University, Washington, D. C.: Recent Advances in Astro-Geophysics (Rev. Matthew P. Thekaekara, S.J., Dept. of Physics)

Princeton University, Princeton, N. J.: Non-Ideal Mechanical Behavior of Solids and Liquids (A. J. Maruca, Office of Dean of Graduate School).

The full list of conferences is available from the National Science Foundation, Washington 25, D. C.

Grants

The DuPont Company has announced that grants amounting to more than \$1.69 million have been awarded to 161 colleges and universities in the company's annual aid-to-education program. A total of \$654 700 was expended in direct support of teaching, including funds for assistantships and scholarships. Fundamental research grants totaled \$490 000 for unrestricted research in physics, chemistry, chemical engineering, mechanical engineering, and metallurgy. Ranging in amount from \$5000 to \$20 000, they may be used in any way desired, including the support of graduate students and thesis research. An additional \$48 600 was awarded by DuPont for summer research activities this year, and capital grants amounting to \$500 000 were made to help with the cost of new buildings, equipment, or renovation of existing facilities.

The Division of Radiological Health of the US Public Health Service has awarded a grant to the De-

partment of Radiology of Columbia University's College of Physicians and Surgeons. The award will provide financial aid to qualified students in the department's master's-degree program in radiological physics. Preference will be given to candidates sponsored by public-health agencies for work in their areas of responsibility or in closely related fields. Inquiries about the graduate program should be addressed to W. Gross, 630 W. 168th St., New York 32, N. Y.

Summer Programs

Massachusetts Institute of Technology will offer as one of its special summer programs a one-week course on "Signal Detection and Identification: Theory of Human Observers" from July 30 to August 3. The program is intended for those interested in research in psychophysics, in the design of man-machine systems, and in teaching general and engineering psychology. It will be directed by John A. Swets of the MIT Psychology Section and the Research Laboratory of Electronics. Lectures will be given by members of the MIT faculty and by guests from other universities.

Other summer courses to be conducted this year at MIT include two-week programs on radio astronomy, infrared spectroscopy, the structure of materials, and optical masers.

The course on radio astronomy (July 23 to August 3) is planned for engineers and scientists who desire a general survey of the techniques, results, and interpretations of radio astronomical observations. Discussions of the application of radio methods to atmospheric physics, planetary atmospheres, and space experiments will be included. Among the lecturers will be D. S. Heesch (National Radio Astronomy Observatory), A. E. Lilley (Harvard), A. Maxwell (Harvard—Fort Davis), K. Menon (Ohio State), H. J. Smith (Yale), J. Evans and J. W. Meyer (MIT Lincoln Laboratory), and J. W. Graham, R. P. Rafuse, and A. H. Barrett of the MIT faculty. The program is under the direction of Prof. Barrett.

Two consecutive one-week courses at MIT will be devoted to infrared spectroscopy. The first, with the emphasis on technique, will be held from August 6 through August 10; the second, on the applications of infrared spectroscopy, will take place during the week of August 13-17. The course on technique will cover optical and electronic systems of infrared spectrometers, infrared spectrophotometry, techniques used to obtain spectra, and qualitative and quantitative analytical procedures. The course on applications will be devoted to a systematic study of the applications of infrared spectroscopy to the solution of chemical problems. Both programs will be directed by Dana W. Mayo, lecturer in chemistry at MIT. Lecturers will include Richard C. Lord (MIT), Foil A. Miller (Mellon Institute), Ellis R. Lippincott (University of Maryland), and, for the second course only, Lionel J. Bellamy (British Ministry of Aviation) and Robert S. McDonald (General Electric Research Laboratory).