rica; e por essa mesma razão, é função exclusiva de r *(independente de* θ *e* φ*): logo,*

$$E(r) = \frac{1}{4\pi\varepsilon_0} \cdot \frac{q}{r^2};$$

Mas, de

$$\varphi = a/r \quad \textit{e de} \quad \vec{E} = -\operatorname{grad} \varphi = -\left(-\frac{q}{r^2}\vec{r_0}\right),$$

resulta

$$E(r) = \frac{a}{r^2};$$

e também

$$a = \frac{q}{4\pi\varepsilon_0}$$

A expressão do potencial é, pois,

$$\varphi = \frac{1}{4\pi\varepsilon_0} \cdot \frac{q}{r}$$

432 — Calcule a energia W, que é preciso dar a um sistema de três cargas pontuais para as trazer desde o infinito até aos pontos P_1, P_2, P_3. Dê à expressão obtida uma forma simétrica.

Resoluções de Telles Antunes

Noticiário

Curso de Mecânica Quântica e Física Nuclear

De 8 a 31 do passado mês de Maio, esteve entre nós, a convite do Instituto de Alta Cultura, o Prof. Edmond Bauer, da Faculdade de Ciências de Paris.

Realizou, no Instituto Superior Técnico, nove lições de Introdução à Mecânica Quântica, integradas no Curso de Mecânica Quântica e Física Nuclear que a Comissão de Estudos de Energia Nuclear está levando a efeito, desde Janeiro deste ano.

O Prof. Bauer deslocou-se ainda ao Porto onde proferiu, no dia 29, uma conferência sobre o problema do determinismo em Física Moderna.

Damos a seguir um sumário elucidativo dos assuntos versados naquelas lições:

Introdução histórica; ondas luminosas e fotões. Velha teoria de Bohr; estados estacionários e radiamento. Átomo de hidrogénio. Extensão da teoria por Sommerfeld; dificuldades da teoria. Princípio da correspondência. Ideia da mecânica das matrizes de Heisenberg e Born. Mecânica ondulatória de L. de Broglie; função de onda no espaço; ondas planas. Relações de incerteza; localização no espaço das configurações e no espaço dos momentos. Definição geral de um estado e da sua representação; operadores e funções próprias. Postulados da teoria do fotão; dedução por correspondência da equação de Schrödinger; operadores e grandezas físicas. Postulados gerais da Mecânica Quântica. Alguns problemas a uma variável. Átomo de hidrogénio; níveis de energia e funções de onda.

N.M.M.

Programa dos cursos ministrados na Escola de Isótopos, de Harwell

United Kingdom Atomic Energy Authority — Syllabus of Courses Held at The Isotope School, A. E. R. E. Harwell.

The Isotope School which is part of the Isotope Division at the Atomic Energy Research Establishment and situated outside the Security Fence was started in April 1951 with the object of providing a basic course of instruction in the measurement, handling and uses of radioisotopes. By June of 1955 over 400 students had attended the course.

Scope and'Aims

The courses, which last four weeks and take place about seven times a year, are intended for students of graduate level in a suitable branch of science who wish to use radioisotopes as a tool for research or technology. Specialised training in particular applications of isotopes is not given. The emphasis is on the practical aspects of the work and students are encouraged to discuss their proposed applications with the staff, or with specialists from other groups at Harwell. Details of the lectures, films and visits are given at the beginning of each course. The broad outline of the subjects covered in the lectures and practical work is given in the appendix. The school is open between 9.00 a. m. and 5.30 p. m. from Monday to Friday.

Equipment

The school is well equipped with modern electronic and other apparatus and opportunities are given to make use of equipment of many different types. The ordinary materials required by students, such as note books and laboratory coats are sup plied by the school.

Fees

The fee for the course is £40 and includes the cost of irradiations and other services provided during the course. It does not include accommodation, daily transport or meals. Bills for course fees will be sent out before the start of a course and remittances should be sent to the Isotope School payable to United Kingdom Atomic Energy Authority, Research Group (A. E. R. E. Harwell).

Application

The official form should be completed and returned to the Isotope School. Applications are submitted to the Management Committee of the Isotope School which decides whether applicants can be accepted. Since the number of students who can be accommodated on a course is limited, there is often a waiting list, and it is advisable to consult the school about vacancies.

Accommodation

Accommodation in the neighbourhood of the Atomic Energy Research Establishment is limited, and where requested to do so the Isotope School will make initial arrangement for living accommodation. Any particular requirements in this respect should be stated when returning the completed application form.

Transport

Students are collected from Didcot Station on the evening before the start of a course. In most cases it is possible to arrange daily transport between the hotels and the school at the normal rates payable by the staff at Harwell.

Reals

Midday meals are available at Harwell.

Other Courses

Enquiries about courses on Reactor Engineering should be addressed to The Reactor School A. E. R. E. From time to time short courses on Electronics are held by the Electronics Division to whom enquiries should be addressed.

APPENDIX I

SYLLABUS OF LECTURES

1. *Nuclear Physics*

Nuclear structure; nuclear reactions; the production of radioisotopes.

2. *Radioactivity*

Radioactive decay. Nature and properties of radiations and their interaction with matter.

3. *Radiochemistry*

Chemical considerations, in particular as applied to tracer techniques. Use of radioisotopes in analysis and research.

4. *Instruments*

Methods of detection and measurement of ionising radiations. The scope and limitation of various methods of measurement.

5. *Health Physics*

Dosimetry, Shielding. Maximum permissible levels. Design of laboratories. Radiation and contamination monitoring.

6. *Miscellaneous*

a) Feasibility of experiments and the preparation of sources.

b) Industrial applications of isotopes.

c) Availability of Isotopes and irradiation facilities.

d) Additional specialised lectures according to demand and available time.

Training, industrial and medical films are used, and, visits are arranged to certain laboratories and installations, in particular to the Radiochemical Centre at Amersham.

APPENDIX II

BASIC EXPERIMENTS

Each experiment is preceded by a lecture describing the object of the experiment and the techniques employed.

1. Geiger counters, the plateau. The preparation of uranium reference sources.
2. Geiger counters, statistics.
3. Beta particle absorption curves. The preparation of phosphorous 32 sources, dilutions, pipetting.
   The use of monitors to find contamination.
   Cleaning of contaminated glass ware. Determination of the range of beta particles. Corrections for paralysis time and background.
   Preparation of Feather analyser.
4. Gamma ray absorption from a gold 198 source.
   Comparison of beta and gamma counting efficiency of a geiger counter.
   Use of a Feather analyser to determine beta particle range.
5. Backscattering with beta particle sources using phosphorus 32 and sulphur 35.
6. Self absorption of a beta particle source.
   Preparation of calcium 45 sources.
7. Szilard Chalmers reaction on ethyl iodide. The use of liquid counters.
   Determination of the half life of iodine 128.
8. The absorption of phosphorus 32 on ferric hydroxide.
9. The secondary activities produced by irradiation of sodium chloride. The radiochemical separation and identification of phosphorus 32, sulphur 35 and chlorine 36 using carriers and hold back carriers.
10. Radioactivation analysis. Estimation of copper in various specimens.
11. Paper chromatography coupled with autoradiography to show the separation of sodium, potassium and bromine. Identification by absorption curves and half lives.
11. Use of a proportional counter to measure carbon 14 and other low energy beta emitters.
13. Use of a scintillation counter to measure gamma emitters.

Students are encouraged to discuss individual problems with the staff, and in the latter part of the course it is sometimes possible for them to do a small amount of preliminary work in connection with their own particular applications of radioisotopes. A number of additional experiments are available, giving practice in other techniques e. g. Autoradiography, Gamma Radiography, Gas counting, Use of liquid scintillators, and Gamma spectrometry.