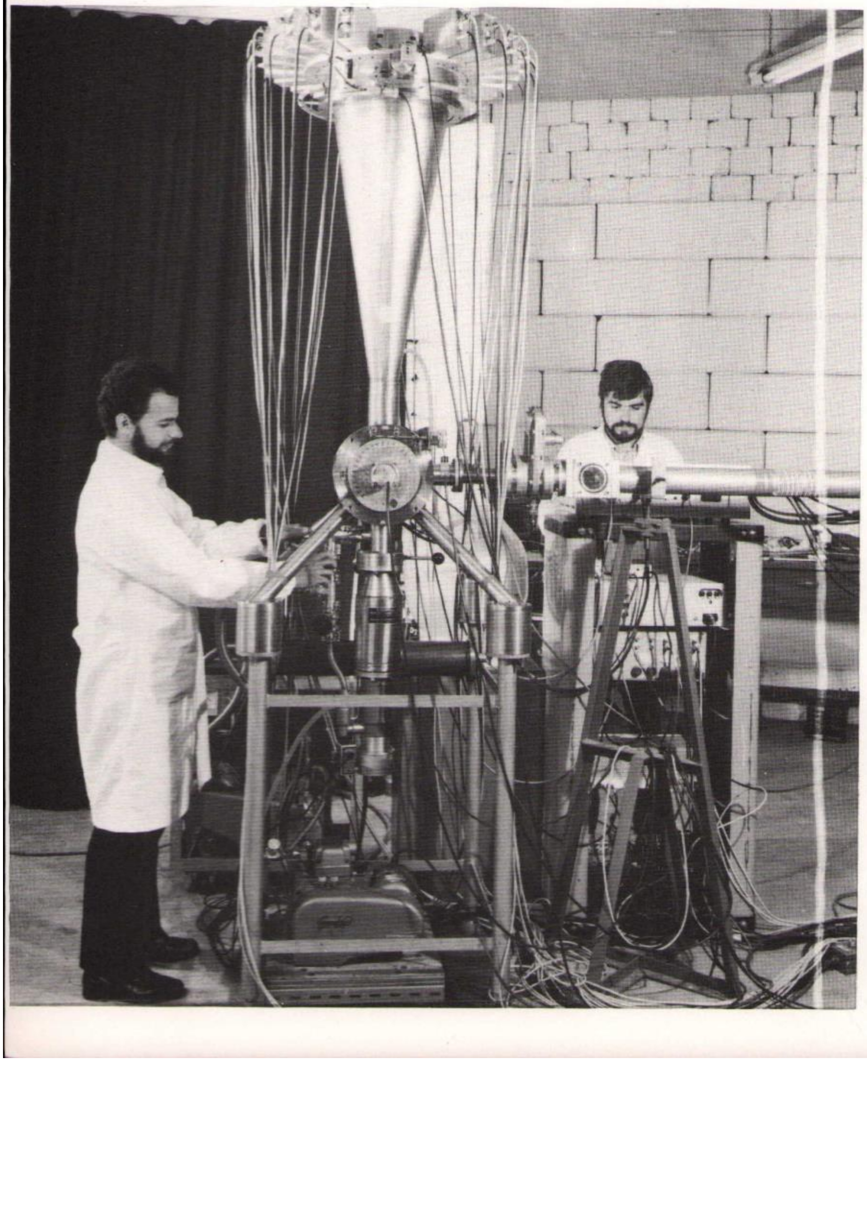
Fundamental research

Harwell is uniquely equipped to provide facilities for research in many branches of physics, chemistry and the materials sciences, at all levels from 'pure' to 'applied'.

Extensive collaboration exists with Universities (directly and through the Science Research Council) and other research and teaching organisations. This consists of the provision of facilities and services, either on a collaborative basis or under contract, and in arranging studentships and research fellowships at Harwell.



Solid-state physics

The structure and dynamics of condensed systems can be studied by the elastic and inelastic scattering of neutrons and charged particles.

Lattice dislocation and disorder in alloys, diffused or implanted surface layers, or epitaxial specimens can be measured by channelled ion beams.

Atomic physics

The wide variety of ion species and particle energies available from Harwell's accelerators permit a very wide range of research in atomic physics. For example, using beam foil spectroscopy, atomic spectra and lifetimes of atomic states can be studied. Such measurements can be made for neutral atoms and ions of up to charge state 10 or more, and in addition allow study of Lamb shift, Stark effect, etc. Studies of charge state distributions and photo-electron spectra are also possible.

Scientists from the University of the Bologna setting up an apparatus for the measurement of the lifetime of the compound nucleus ^{75}As. This is found to be about 10^{-17}s, probably the shortest time interval ever measured directly.

Nuclear physics

Using the Harwell accelerators a great variety of nuclear physics problems can be studied. The few-body problem can be studied at energies up to 150 MeV. Nuclear structure measurements can be pursued over the whole range of nuclear species, and facilities for heavy ion nuclear physics are particularly extensive. Associated with the accelerators there are multi-gap and single-gap magnetic spectrographs, beta spectrometers, pulsed beam facilities for isomer studies and lifetime and time-of-flight measurements. In these areas work is in progress on, for example, nuclei far from the stability line, single and four particle transfer in heavy ion reactions, and isomers produced in spallation reactions among light elements.

The accelerators are equipped to permit investigation of all aspects of the fission process using neutrons, charged particles, and photon beams.

A special interest of the laboratory has been neutron physics in all its aspects. Time-of-flight facilities for neutrons of energies from thermal up to over 100 MeV are available with intense continuous spectrum sources of neutrons. Pulsed and D.C. sources of monoenergetic neutrons are also provided. Important investigations carried out in these fields include studies of cross-sections (total, capture, scattering and fission) in the resonance region (especially for the actinides), of inelastic neutron scattering, and of γ-spectra associated with all these processes.

Extensive on-line computer facilities for data-acquisition and analysis are available on all the major accelerators.

Radiation chemistry

Studies are carried out on linear energy transfer in liquids and solids, and on the chemical consequences of surface and bulk radiation damage in solids.

Studies of radiolytic reaction mechanisms have been carried out on water (in the liquid, vapour and supercritical states), on liquid ammonia and on organic systems; the reactivity of irradiated solids and reactions occurring at solid surfaces in the presence of radiation have also been investigated. These studies are relevant to problems in fundamental radiation physics, in radiation biology and in the commercial applications of high energy radiation.

The availability of intense beams in pico-second pulses makes it possible to study radiation phenomena occurring in the time-interval of 0·01 to 1 nanosecond.

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Harwell Design Studio 62/1974