gave the date of this earliest phase as 1848 B.C. ± 275 years.

The narrow, steep-sided ditch surrounding the Heel Stone appears to have been filled up deliberately shortly after it was dug. In this filling was a single chip of unweathered bluestone (rhyolite). As the ditch was presumably dug immediately after the erection of the stone, and as the latter appears to belong to the earliest monument, it follows that at least one foreign stone is likely to have formed part of this monument. There is evidence, however, that at this time the majority of the bluestones stood as a separate monument some twelve hundred yards north-west of Stonehenge and were not moved to their present site until after the erection of the sarsen stones.

The surface of the deliberate filling of the Heel Stone ditch was covered by the tail of the Avenue bank, which shows that the latter, and its ditch, must be later than the stone. The absence of fragments of sarsen and bluestone from the bank material and from the primary silting of the ditch strengthens the hypothesis that the Avenue antedates the erection of the stones of Stonehenge.

The date of the erection of the sarsen stones, hitherto uncertain because based on circumstantial evidence only, can now be placed with some confidence around 1500 B.C. This has been made possible by the chance discovery of representations of Bronze Age weapons on two of the stones. These comprise a hilted dagger and four axe-heads on Stone 53, and at least eleven similar axe-heads on Stone 4. The axes are all of the 'hammer-flanged' type, characteristic of the British Early Bronze Age, and manufactured, chiefly in Ireland, from 1600 B.C. to 1400 B.C. The presence here of these obviously ritual representations points to the existence in Britain of an axe-cult comparable to the cult of the double-axe in the contemporary Minoan civilization of Crete. That there may be some actual connexion between these cults is suggested by the dagger. This is unlike any weapon current in the Bronze Age of Britain or Western Europe, but is an accurate representation of a type used in the central Mediterranean from 1600 B.C. to 1500 B.C. and best paralleled from Shaft Grave VI at Mycenæ. Its exotic nature makes it highly probable that the carving was executed at Stonehenge within the lifetime of someone who was personally familiar with this type of weapon in its homeland; in other words, not later, say, than 1470 B.C. It follows, therefore, that the sarsen stones were erected before this date. It may be added that this dagger affords presumptive evidence that the architect of Stonehenge was himself a Mycenean, a suggestion which has already been prompted by the architectural refinements exhibited by the monument.

The evidence reviewed above, when added to that from previous excavations, makes it possible to set out, with greater confidence than before, the following probable sequence of phases of construction at Stonehenge. (1) 1900–1800 B.C.: Construction of ditch, bank and Aubrey Holes; erection of Heel Stone and at least one bluestone, perhaps in the centre. (2) Construction of the Avenue. (3) 1500 B.C.: Dismantling of bluestone(s) of phase 1; erection of the sarsen stones. (4) Digging of the *Z* and *Y* Holes, possibly for reception of bluestones derived from the dismantled 'Bluestonehenge' twelve hundred yards away. (5) Plan of phase 4 abandoned; bluestones dressed and erected in their present positions.

INTERNATIONAL FEDERATION OF UNIVERSITY WOMEN

ELEVENTH CONFERENCE

"HUMAN Values in the Technical World" was the theme of the Eleventh Conference of the International Federation of University Women held recently at Bedford College, London. The theme is topical and appropriate for a Federation the aim of which is the encouragement of scholarship and the promotion of understanding among university women of the different nations of the world. Two methods of approach were used: a series of three public lectures by distinguished speakers, each of whom dealt with a special aspect of the subject, and discussions by small groups of Conference members of different nationalities and varied interests.

The conference was attended by about 750 members from twenty-eight countries, and included representatives of almost every kind of profession from the director of the Meteorological Office in Iceland to an Italian woman graduate who is a farmer. Conference members were pleased to hear that Dr. Louise Pearce, third vice-president, had recently been honoured by the award of the Order of the Lion and a gift of 10,000 dollars from the Belgian Government. This award was for her share in the discovery of tryparsamide, a drug which has proved extremely valuable in the treatment of sleeping sickness in the Belgian Congo.

It was announced at the conference that nine international fellowships will be awarded in 1954. There will be two international federation fellowships, named the Ida Smedley Maclean Fellowships in memory of the late Mrs. Smedley Maclean, an English biochemist and the originator of the Fellowship Fund. A new Irish Fellowship is to be given in honour of Prof. F. E. Moran, president during 1950–53 and the first Irish president of the Federation, and six fellowships have been endowed by members of the American Association. A fund for the provision of one or more fellowships and grants to be called the Winifred Cullis Fund is to be established in honour of Prof. Winifred Cullis, one of the founder members of the Federation. Since its foundation in 1920 the International Federation has awarded seventy-eight fellowships and eighteen grants to scholars of twenty-four different countries.

The officers of the International Federation for 1953–56 were elected at the conference, and the new president is Miss Dorothy Leet, of the American Association of University Women, who is president of Reid Hall, the American Education Centre in Paris. Since 1949 Miss Leet has been the International Federation's consultant to Unesco. The three vice-presidents are: Dr. E. C. Batho, principal of Royal Holloway College, University of London, Mrs. Schouwenaar-Franssen, of the Netherlands, and Mrs. Dorothy Forsaith, of Australia. The new honorary treasurer is Ing. Adèle Racheli, of Italy, whose special field of study is mechanical engineering and who is a patent agent with offices in Milan, Rome and Switzerland.

The three public lectures on the theme, "Human Values in the Technical World", accepted as a fact the interdependence of the nations of the world, brought about by science, and the problem studied was the means whereby man might reach his highest excellence in these conditions. Speaking on "London

Town", Sir Henry Self, president of the British Electrical Development Association, traced the part London has played towards scientific development in its impact on human thought and values. He expressed the fear that science has made this earth so worth-while a habitation that it opens up the menace of "soft living" and has at the same time produced devastating means of destructive war. Scientific achievement has been attained by self-sacrificing effort, stirring adventure and resolute pursuit of truth for its own sake; these are precisely the human values threatened to-day. The sweeping advances made in the study of astronomy, mathematics and physics at the time of the Renaissance prepared the way for the revolution of the following century which produced a scientific interpretation of life and the world in terms of mechanistic determinism and materialism. At the same time the Reformation asserted the responsibility of the individual. The movement began as an adventure of man's personality responding to his intellectual confidence that truth must prevail. But gradually during these centuries God was reduced successively to the role of maintaining order, and then to the point where there was "no need of such a hypothesis". Gradually, however, the idea that the universe is made up of living objects in full and intimate interaction took shape. Sir Henry traced the history of experimental work in the nineteenth century, mentioning particularly work in spectrum analysis. He mentioned the controversy about the theory of evolution and said that scientists to-day recognize a fundamental harmony of things. Science, concluded Sir Henry, is one channel by which God speaks to man and conscience is another. This is the way whereby human values might be preserved in the technical world.

The second lecture, "Science and the Discovery of Human Values", was given by Prof. Arthur H. Compton, chancellor of Washington University. He does not support Sir Henry Self's fear of the threat of barbaric power. Technology in itself, he said, gives its distinctive meaning to life by revealing the interdependence of all men and all nations. The goal of the scholar is the vision of excellence; technology gives him the power to make the lives of others excellent and to enable them to grow to their best, thus finding his own fulfilment. Long ago Pythagoras said that the scholar sought to learn how the world was made in order to find a better way of life. We of this age have been brought face to face with the vastness of the universe; thanks to the advances of technology it is in our power, and, indeed, it is our responsibility, to affect the lives of others. It is a matter of vital significance that adaptation to life in the modern world demands increasing emphasis on the human virtues: success in science means loyalty to truth, concern for reliable knowledge; technology calls for the skilled expertness that comes from experience combined with specialized knowledge; work in any social organization requires willingness to co-operate, consideration for one's fellows and a desire to promote the task on which the group is engaged. Banishing the spectres of starvation and premature death from disease is not enough: the essential dignity of man is all-important and each individual must have the opportunity of playing his part and taking responsibilities. Science improves the means with which we work towards our goal and enlarges our choice of goal. Losing ourselves in the effort to give others the opportunity to find each his own excellence is a condition of survival; so can we find our own souls and so can the humanities be preserved.

"Organization and Personality" was the subject of the address given by Prof. P. C. Mahalanobis, statistical adviser to the Government of India and vice-chairman of the United Nations Statistical Commission. He said that the technical world and the advances of science must be accepted; there is no retreat, but the problem is to adapt the personality of man so as to attain its highest perfection in a world of ever-increasing power. The basis of the development of personality lies in the relationships of human beings; these relationships develop gradually, from the home to the school, and widen from the national to the international level. Social organization in the machine age is tending to the submergence of personality: skilled labour gives place to unskilled, craftsmanship is displaced, automatic controls take over. This is the price we are paying for technical power. Conflicts arise on every level—between capital and labour, town and village, between nations and blocks of nations. Science can enable us to provide more food, more clothes and medicines. At every new stage of scientific development humanity is faced with a crisis, and a growth of personality is needed to meet it. We have to learn to use our power for the general good. Some of the basic biological and emotional human values remain unchanged everywhere. Our "institutional values", such as means of preparing food, can develop, and here science increases the scope greatly. Cultural unities, such as that of Europe, represent a "national value". International contacts and values have become a necessity of the modern world as we are drawn ever closer together by technology. The danger to modern society lies in making a social merit of having more and more things, but herein lies a source of unbalance and greed. We must learn to grow into that wholeness of personality which finds its self-expression in a joy in things and not merely in possessing. Our goal must be to transcend the little cell and to work towards a unity in diversity, not by eliminating our differences as nations, but by creating a deeper harmony in humanity and friendship.

The main theme was divided into various aspects for study by groups of conference members—a balanced education for full citizenship, methods of mass education, the ethical basis of human values in a technical age, the human factor in the organization of work and the impact of modern techniques on non-industrial communities. In reporting the findings, Dr. Marguerite Henrici, organizer of the groups, said that they are not yet the official opinions of the Federation, but the results of discussions during the conference. Once again, naturally, the importance of the individual was emphasized. The first group recommended that each individual should be educated to think clearly and effectively, to form critical judgments, to practise a concern for the welfare of others, since citizenship demands a realization of a duty to others near and far. A balance between intellectual and social education should be maintained, and in the living community of the school each individual should have his rights and responsibilities. While a just pride in the national heritage is to be encouraged, the obligation to the wider international community must not be forgotten. Small classes and more teachers are desirable.

Mass education entails education through life: any kind of rich and varied experience which evokes a

greater appreciation of life contributes to this. Again, the value of the individual was stressed and it was recommended that the Federation should use its influence to make mass media such as films and radio less sensational and more inspiring to the individual. Cheap means of printing and the suppression of over-nationalistic text-books would be helpful, too, as would schemes for the exchange of students and teachers between rural schools and others. It was further recommended that the value of the humanities in general education should be emphasized, while recognizing the importance of scientific and technological factors.

The group which discussed the ethical basis of human values came to the conclusion that the essential value at which man ought to aim is the increasing development of those powers of soul and spirit which contribute to build up a harmonious personality and society. Special efforts should be made to counteract the levelling tendencies of technology by stressing the necessity of individual decision.

In studying the organization of work, a further group considered it should be so arranged as to protect the personality of the individual. Suggested practical means to this end were: vocational guidance for all, and an effort to find ways of overcoming the effects of monotonous work.

The fifth group, in dealing with the impact of modern techniques on non-industrial communities, reached the conclusion that the greatest precaution should be used in the introduction of foreign ways and standards of living into non-industrial countries. Accepting the fact that technology's greatest contribution lies in the service of others, this group stressed that this service can be performed on the spiritual plane as well as on the material.

In summing up the findings of the groups, Dr. Henrici said that in this time of transition and crisis the threat to human values comes not only from external nature but also from civilization itself. It is the task of educated people everywhere to seek the truth with fervour and to follow it with courage. It is a more difficult task than to live according to the precepts of the loud-speaker. The power of decision lies with each individual and therefore with the human race. The individual is not himself responsible for the decisions taken by the race, but in living his daily life he can influence them for good or ill.

PARTICLES OF COSMIC RADIATION

An international conference on cosmic radiation, organized by the University of Toulouse and under the patronage of the International Union of Pure and Applied Physics, was held at Bagnères de Bigorre during July 6–12. The president of the conference was Prof. P. M. S. Blackett, and the secretary-general Prof. L. Leprince-Ringuet. In opening the conference Prof. Blackett said that it had been decided to restrict the discussion in the main sessions to the narrow but important field of V-particles and heavy mesons. It was hoped thus to make an effective contribution to a subject of great contemporary interest for the development of our knowledge of elementary particles. This aim was reflected in the attendance at the conference, and among the two hundred members were representatives of many of the laboratories actively engaged in the subject.

The main sessions of the conference were divided into two groups. In the first seven, the experimental facts were described and discussed; in the last three, the whole body of evidence was reviewed, and an estimate made of the present state of knowledge. In describing the most important results and conclusions, it will be convenient first to consider particles more massive than the neutron; and secondly, those intermediate in mass between the π-meson and the proton.

Particles Heavier than the Proton

It is now established that the heavy neutral V-particles discovered by Rochester and Butler (V_1^0) decay into a proton and a negative π-meson with an energy release of about 37 MeV.:

$$V_1^0 \rightarrow P + \pi^-; \quad Q = 37 \pm 3 \text{ MeV}.$$

The mean lifetime of the particles is $\sim 3{\cdot}3 \pm 1{\cdot}0 \times 10^{-10}$ sec. There is good evidence that they can be produced in nuclear interactions in which the available kinetic energy is insufficient to provide all their rest-mass. They are therefore believed to result from the transformation of nucleons, and, in this sense and since they decay into protons, they may be termed 'excited nucleons'. An outstanding problem of great interest is whether the particles are commonly produced singly or in pairs, a question which it may be possible to resolve by determining the minimum energy required for their production in the collision of protons and π-mesons with nuclei.

There is now strong evidence from work with photographic plates for the existence of charged particles more massive than the proton, each of which decays into a neutral particle and a π-particle according to the equation:

$$J^{\pm} \rightarrow N + \pi^{\pm}.$$

If the secondary neutral particle is a neutron, the release of energy, Q, is ~ 130 MeV., and the mass of the parent particle, m_J, $\sim 2{,}360\ m_e$. Five examples have now been observed in photographic emulsions, in three of which the primary particles decay in flight. The mean lifetime appears to be of the order 4×10^{-11} sec. There is tentative evidence for an alternative mode of decay $J^+ \rightarrow P^{\pm} + \pi^0$, but this remains to be confirmed.

There is good evidence from experiments with Wilson chambers, but also not decisive, for a massive charged particle which decays into a negative π-meson and a neutral V_1^0-particle according to the equation $\Lambda^- \rightarrow V_1^0 + \pi^-$. In addition to the original event, which can be interpreted in this way, found by Armenteros *et al.*, three similar examples have been observed by Leighton and his colleagues. It is possible that the particles J and Λ are identical, in which case their mass is $\sim 2{,}700\ m_e$.

Further examples have now been observed of the process, first observed by Danysz, in which a heavy nuclear fragment ejected from a nuclear explosion reaches the end of its range and disintegrates. It appears that π-mesons are frequently emitted as one of the products of the secondary disintegration. It is possible that these events are due to the presence, in the nuclear fragment, of a nucleon in an excited state; but alternative explanations cannot at present be excluded.