

has been designed for high ion current and voltage stability. It will be used, among other things, for the laboratory measurement of nuclear cross-sections relevant to the processes of nucleogenesis which are at present uncertain.

But Dr Barbara H. Cooper also outlined a scheme for using the accelerator as a charge spectrometer for checking the claim by William Firkbank and his colleagues at Stanford University that electric charges exist which are a fraction of the electronic charge, and which might represent free quarks. Preliminary estimates suggest that by using an argon beam for sputtering free atoms from solid surfaces, it should be possible to evaporate one of the small niobium spheres used in the Firkbank experiments in about an hour, and that the tandem accelerator should be capable of detecting one fractionally charged particle in as many as 10^{18} niobium atoms.

While astrophysical problems will remain a central part of the Kellogg Laboratory's programme, diversification is also in the air. This is the spirit in which the laboratory is involved with studies of the release of radon-222 as possible predictors of major earthquakes, just now a matter of public interest in California.

According to Professor Thomas A. Tombrello, two of the network of radon monitors maintained by the laboratory near the San Andreas Fault had revealed a substantial increase of radon evolution since the early weeks of August. The



W.A. Fowler at seventy.

increased rate of evolution (which continues) has been closely correlated in time even though the two instruments are separated by 100 kilometres, and is said to resemble that which preceded the 1979 earthquake of magnitude 6.7. That event was marked by a transition from the normal compressive stress across the surface rocks of the San Andreas Fault to an extension — thought to stimulate radon release — but also by a cessation of radon release in the days immediately before the earthquake.

Professor Tombrello prudently avoided prediction last week, saying only that "sometimes, perhaps in 25 or 50 years, one

of these events is going to be a precursor of a major earthquake". He complained, however, that financial support for earthquake studies of this kind in California was less than that in China and Japan. "Since 10 million people would be affected by a major earthquake, it would be worth putting a little money into it."

Albanian development

Hoxha looks ahead

Albania, too, has an urgent need of science and technology, according to party leader Enver Hoxha's speech to the congress of the Albanian Workers' Party last week. But although the "deepening of the technical scientific revolution" has encouraged teaching and research, practice lags behind precept. Mr Hoxha said that the most obvious need is for a mechanism for the gradual transfer of innovation on a "wider front" aimed at the "radical" transformation of technology and production.

Mr Hoxha's criticism came in a speech praising the achievements of Albania's system of education, scientific education in particular. He drew particular attention to Albanian achievements in hydroelectric and railway engineering, the sinking of deep wells, geological prospecting, stock-breeding and the machine tool industry. He emphasized that these had been accomplished by the Albanian people "relying completely on their own forces" — a justification of the country's long standing isolation policy. Although the Academy of Sciences is still the major centre for scientific research in Albania, Mr Hoxha said that the Committee for Science and Technology set up this year was an important instrument for the "better direction and organization" of science.

The targets for the Albanian 1981–85 five-year plan are more ambitious than in any previous quinquennium. Industry will receive some 46 per cent of the total investment budget, with special emphasis on mining and energy resources. Oil extraction is expected to rise by some 60 per cent, coal by 48 per cent and that of proved mineral resources (chromium, copper and iron nickel) from 30 to 200 per cent. The chemical industry will be considerably expanded, with an expected rise in production of some 65 per cent by 1985.

Mr Hoxha was at pains to say that these targets are "scientifically based and fully achievable". Furthermore, to provide the necessary personnel, special attention will be given to higher education. Student admissions during the next five years will rise by 45 per cent, new courses will be introduced and there will be a considerable expansion of postgraduate courses. Publication of "political, scientific, technical and artistic" books will rise by one million copies over the previous quinquennium and educational cinema, radio and television will be expanded. **Vera Rich**

Hoyle on evolution

The serious part of the Kellogg symposium provided Sir Fred Hoyle with an opportunity for a moderate (and self-critical) statement of his case for disbelieving conventional views about the evolution of the Universe, the "big bang" among them. Hoyle has been associated with the Kellogg laboratory since his collaboration in the mid-1950s with W.A. Fowler and the two Burbidges (Margaret and Geoffrey), now known as the gang of four, on the problem of nucleogenesis.

Hoyle said last week that, although content in the mid-1960s to give the supposed connection between the microwave background radiation and the big bang a "good run for its money", he had now lost patience with this approach. Two of his reasons involve the origin of life — the calculated time since the origin of the Universe of 10,000 million years or so is not enough to account for the evolution of living forms, while adiabatic expansion of the Universe would have been inimical to the evolution of highly ordered forms. But Hoyle also said that new evidence in support of the big-bang hypothesis was emerging only slowly. Yet "when people are on the right track, new facts emerge quickly". Hoyle said

he would change his view if it turned out that neutrinos have a mass of between 20 and 30 electron volts.

The essence of his argument last week was that the information content of the higher forms of life is represented by the number $10^{40,000}$ — representing the specificity with which some 2,000 genes, each of which might be chosen from 10^{20} nucleotide sequences of the appropriate length, might be defined. Evolutionary processes would, Hoyle said, require several Hubble times to yield such a result. The chance that higher life forms might have emerged in this way is comparable with the chance that "a tornado sweeping through a junk-yard might assemble a Boeing 747 from the materials therein".

Hoyle acknowledged that steady-state theories of cosmologies, of which he was one of the chief exponents in the 1950s, are not now tenable because of the evidence for evolutionary galactic and stellar processes. But the big-bang view is similarly not tenable because of the way in which it implies the degradation of information. Of adherents of biological evolution, Hoyle said he was at a loss to understand "biologists' widespread compulsion to deny what seems to me to be obvious".