of the wide bandwidths now required for various kinds of data transmission.

Mr R. W. Wilson and Mrs W. L. Manmel (Bell Telephone Laboratories) and Professor D. B. Hodge (Ohio State University) presented data from spaced-receiver measurements of Earth-space attenuation. At a frequency of 16 GHz, receiver separations of 10–15 km in a switched-path network give a significant improvement in reliability for the locations used in the United States. As the results presented by Dr P. G. Davies (Radio and Space Research Station) showed, however, there is a considerable variability from year to year at a given location and also from one climate to another. Results from RSRS illustrated that South-east England has an excellent climate from the point of view of reliable space communication. Even frequencies as high as 100 GHz may be useful there for short-hop terrestrial paths or Earth-space links in or near the vertical.

Several contributors presented results of radiometric measurements of thermal emission noise from the troposphere. This technique affords a simple method of deriving attenuation values of up to 10–12 dB on Earth-space links. Radiometers have also been used to study thermal noise from the local environment around the site of an Earth station. The results of Mr F. V. C. Mendis and Dr T. Pratt (University of Birmingham) and of Mr D. M. Knox, Mr R. G. Howell and Mr J. A. McLeod (Post Office), at 9 and 17 GHz respectively, gave values for the noise radiated from buildings, foliage, and various types of ground surface. In general, however, the contribution from the sky noise is more important than that from local ground-based sources.

For reasons of economy of space in the microwave spectrum, sharing of frequencies by transmissions using orthogonal polarizations has been proposed. Contributions from the universities of Bradford and Essex and from the Post Office dealt with theoretical and experimental work on this topic. Although it seems likely that distortion of the plane of polarization by the constituents of the troposphere will not prove serious on short links at frequencies of about 20 GHz, further work is required at a range of frequencies and in various weather conditions. Studies of the shape and orientation of raindrops are also necessary to extend the theory of cross-polarization. This is one example of a general requirement for basic radio meteorological data to assist future developments in communications. In spite of much important work related to forecasting requirements in meteorology, remarkably little is known about the varying structure of heavy rain over distances important in microwave communication, of the order of a kilometre.

Several contributors demonstrated that, quite apart from communication interests, frequencies greater than 10 GHz have special advantages in remote probing of tropospheric structure. For example, anomalous results, difficult to explain by existing theories, were shown in measurements of atmospheric emission at 15 GHz by Dr M. S. Reid and Mr T. J. Lockhart (California Institute of Technology and Air Associates). Similarly, at 85–118 GHz, the results of Dr C. J. Gibbins, Mr A. C. Gordon-Smith and Dr D. L. Croom (Radio and Space Research Station) showed a greater variability in emission noise than expected on the basis of data on the water vapour content and temperature structure. There are probably features of atmospheric structure (such as molecular complexes and the effect of minor constituents) which are not yet understood. Frequencies greater than 10 GHz will, in this respect, prove a happy hunting ground for radio physicists.

NUCLEAR PHYSICS

Recoil and Transfer

from a Correspondent

VERY many investigations have established the one-nucleon transfer reaction as a powerful way of investigating the single-particle character of nuclear states. Most of this work has used incident particles consisting of rather few nucleons, in particular the familiar (d,p) and (d,n) reactions, and also reactions initiated by tritons, helions and alpha particles.

In recent years, however, heavy ions have come into their own now that they can be accelerated to energies sufficiently high to surmount the Coulomb barrier of the nucleus and interact with the nuclear field. These reactions have several features that make it useful to study their properties in detail. In par-

Time of the Corsica-Sardinia Rotation

THERE is now convincing evidence that Corsica and Sardinia have rotated in an anticlockwise direction from positions adjacent to southern France. Such a rotation is consistent with palaeomagnetic data from Corsican Permo-Carboniferous rocks and from Permian and Oligo-Miocene rocks of Sardinia. Moreover, Corsica makes a good fit with France along the 1,000 m isobath, enabling Permo-Carboniferous outcrops in Corsica to be matched with similar outcrops in Provence and permitting the alignment of offshore magnetic anomalies thought to result from andesitic volcanoes.

But there is perhaps less agreement on precisely when the rotation took place, estimates of the time of rotation having ranged from Triassic to Miocene. Some years ago, Nairn and Westphal (*Palaeogeog., Palaeoclimatol., Palaeoecol.*, **5**, 179; 1968), for example, suggested that the rotation may have occurred during the Mesozoic, although more recently, and in the light of additional data, Alvarez (*Nature Physical Science*, **235**, 103; 1972) proposed a Tertiary rotation. More specifically, Alvarez adduced evidence showing that Corsica-Sardinia could not have separated from France before 11 or 12 million years ago. The completion of the rotation, on the other hand, was less easily timed, although the presence under the Ligurian Sea floor of salt domes derived from upper Miocene evaporites led Alvarez to conclude that rotation must have ended early enough to allow the evaporite deposition during part of the Messinian period, 7–5 million years ago.

In next Monday's *Nature Physical Science* (May 7), Alvarez reports a further attempt to determine the time of completion of the rotation, based on the palaeomagnetism of Plio-Pleistocene basalts from north-west Sardinia. Two distinct generations of basalt (designated β_1 and β_2) were represented in the collection examined. Unfortunately, because of dating problems, absolute ages are available for neither set; but the younger generation (β_2) are associated with cinder cones almost unaffected by erosion and must therefore be late Pleistocene or Holocene, and the older set (β_1) are regarded as Pliocene or possibly late Miocene.

The mean palaeomagnetic direction from the β_2 samples (declination 350°, inclination +51°) agrees closely with that (353°, +53°) recently obtained by Bobier and Coulon (*CR Acad. Sci. Paris*, **270**, 1434; 1970). Both directions, and all other mean palaeomagnetic directions from Sardinian basalts which are definitely post-Miocene, cluster around the present field direction, showing that the rotation must have been completed before the end of the late Miocene (about 10 million years ago). Because samples from one of the three (older) β_1 sites turned out to have an intermediate direction, Alvarez calculated no β_1 mean palaeomagnetic direction from his data alone. The overall mean (354°, +56°) calculated from Alvarez's and other sources of β_1 data is, however, very close to that (352°, +48°) obtained from all β_2 data, showing that, taken at face value and neglecting errors, the (older) β_1 mean is actually closer to the present field direction (0°, +60°) than is the (younger) β_2 mean. Thus, as Alvarez points out, the β_1 data dc not confirm the suggestion from Manzoni *et al.* (*Giornale di Geologia*, **38**, 5; 1972) that the β_1 basalts predate the completion of rotation—both generations of basalt seem to postdate it.