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Obituaries

VICENZO CONSOLATO ANTONINO FERRARO

Professor V.C.A.Ferraro, who died suddenly during the night of 1974 January 3, had been a Fellow of the RAS since 1931 January. He was a member of Council 1952–57 and 1966–69 (Vice-President 1967–69) and served on the Geophysical Committee 1952–72.

As a research student, Ferraro became joint author of the Chapman–Ferraro theory of geomagnetic storms (1930). This theory, based on the assumption of discrete plasma streams emitted from the Sun at flares, had as its essential concept that such a stream behaves like a perfectly conducting fluid. Thus, on nearing the Earth, the stream pushes the geomagnetic field lines before it and is itself retarded in the process, so that a (temporary) magnetospheric cavity is produced in the front surface of the stream. This picture is readily interpreted in terms of magnetohydrodynamics (MHD). However, the science of MHD had not been developed in 1930, and Chapman and Ferraro had to work out a number of illustrative problems so as to satisfy themselves that their fundamental idea was correct.

The Chapman–Ferraro theory dealt only with the initial phase of a geomagnetic storm—the phase which is still explained in terms of the compression of a geomagnetic cavity. Even as regards this phase, the theory has had to be modified considerably because of the recognition that there is a continously flowing solar wind. Nevertheless, in treating a solar stream essentially as a conducting fluid, and not as a collection of particles moving independently, the Chapman–Ferraro theory introduced a new concept which has profoundly influenced all subsequent work on geomagnetic disturbance.

In 1937 Ferraro discovered his isorotation theorem. This asserts that a non-uniformly rotating cosmic mass of plasma permeated by a magnetic field rapidly approaches a state in which the angular velocity is constant along a field-line. This result, later much used in the theory of star formation, is an almost self-evident illustration of the principles of MHD; once again one must stress that these principles were not understood when Ferraro made his discovery. Thus he can fairly be claimed as one of the pioneers of MHD.

Ferraro's work on diffusion in the ionosphere (especially after 1945) was also of considerable significance, and has materially influenced later workers. However, his chief post-war work, especially after coming

to Queen Mary College in 1952, was on applications of MHD to cosmical problems. Among the problems treated by him and his research students were the structure and oscillations of a magnetic star, and the magnetic braking of the sun because of the solar wind. He also did much to foster interest in MHD, by organizing regular seminars of wide appeal, and by writing a book on the subject with Plumpton (1961).

He was a person of continuous activity and great kindliness. He impressed his research students by his physical insight, which enabled him to see at a glance the truth (or falsehood) of conclusions they had reached by laborious analysis; he also impressed them by the way he showed appreciation of their efforts. He was essentially modest; his reluctance to push himself forward may have prevented the value of his work from being fully recognized.

He remained active to the last, though his activity was a little circumscribed after a heart attack in 1965. He was due to retire in 1974 September, and spoke of taking up again the artistic interests of his younger days. (Those who attended Professor Chapman's 1942 presidential address to the RAS on the sources of stellar energy will remember the marvellous illustrations prepared by Ferraro for Chapman, showing, *inter alia*, dinosaurs clamouring for more!) His hopes were not to be realized. He will be mourned by many friends.

He leaves a wife and one son.

T.G.COWLING.