feature that it can be understood in terms of the elementary processes occurring in the universe. As regards the concepts of self action and the degrees of freedom of fields, these play an important part in the Maxwellian quantum electrodynamics, and it still needs to be demonstrated how the elementary measurement electrodynamics handles the so-called radiative corrections.

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Received July 4, 1969.

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Free Oscillations of the Earth and the D″ Layer

Bullen and Haddon[1,2] have derived a density model for the Earth (model HB1) which is designed to accord with the observed free oscillation data. Their solution is based on Jeffreys's α and β (P and S velocity) distributions for the mantle and Bolt's α distribution for the core. To avoid the unlikely condition of a constant density throughout most of the lower mantle, they had to postulate an Earth model having a radius 15 to 20 km greater than that of the Jeffreys model. Taggart and Engdahl[3], on the other hand, have used PcP data to determine a core radius of $3,477 \pm 2$ km, only 4 km greater than the Jeffreys value.

This discrepancy is possibly the result of errors in the Jeffreys β distribution for the lower mantle. There have been attempts of an *ad hoc* nature to reconcile the observed theoretical free oscillation periods by varying β in the lower mantle[4,5]. A more definite basis for such a solution has been provided by a determination of β at the core–mantle boundary by J. R. C., using diffracted S data. The value of 6·8 km/s obtained in this way is 0·5 km/s less than that of Jeffreys. Doyle and Hales[7] found no great departures from Jeffreys's β distribution down to a depth of about 2,200 km. As a first approximation, therefore, it is reasonable to assume that the greatest variation from the Jeffreys β distribution occurs in the lowest 200 km of the mantle (the D″ layer).

A simple modification of model HB1 has been constructed on this basis. The core radius of HB1 has been reduced to 3,478 km, and β is assumed to decrease linearly from the Jeffreys value of 7·25 km/s at the top of D″ to 6·80 km/s at the bottom. Elsewhere model HB1 has been retained without modification. We designate this new Earth model as ANU1.

The periods of the various free oscillation modes of ANU1 have been calculated. In Fig. 1, the fundamental spheroidal modes from ${}_0S_0$ to ${}_0S_{12}$, for ANU1 and HB1, are compared with the "best values" chosen from observations of free oscillation periods by Anderson[8] and used by Anderson and Kovach[9]. The small corrections for the rigidity of the inner core given by Alsop[10] have been applied to the periods calculated from both models. The results for both models differ only slightly from the "best values" within this range. For the higher fundamental modes and the overtones of the spheroidal oscillations, and for the toroidal oscillations, the free oscillation periods derived from ANU1 are virtually the same as those of HB1.

Model ANU1 shows that the dilemma encountered by Bullen and Haddon can be resolved by reasonable variations of the β distribution in the lowest part of the mantle. No finality is however claimed for the model in its present form. The modifications to HB1 have produced small

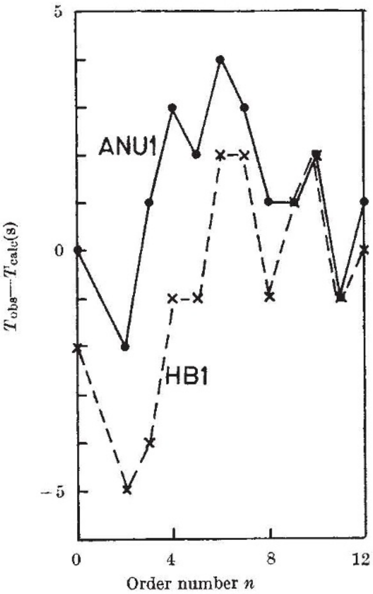

Fig. 1. Deviations of the spheroidal modes ${}_0S_n$ of models HB1 and ANU1 from the "best values" of observed free oscillations chosen by Anderson[8].

changes in the mass and moment of inertia of the model Earth, and these deficiencies require a density redistribution elsewhere in the model. It is likely that β at the base of the mantle is slightly underestimated by the diffracted S velocity because of the influence of core material on the velocity of the long-period diffracted waves. The Jeffreys value for β at the top of D″ may also be slightly in error. Furthermore, the assumed gradient of β in D″ is slightly less than is required for the upward refraction of S waves, implying that no direct S wave energy reaches the surface beyond a distance of about 93°. We are now developing a more sophisticated model which takes better account of these factors.

We thank Professors K. E. Bullen and Don L. Anderson for unpublished information.

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Received June 18, 1969.

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Electrical Resistance of Single Carbon Fibres

SINGLE carbon fibres 25 cm long have been strained at a rate of 0·1 cm/h and their electrical resistance monitored continuously. Three different grades of fibre, each from a different source, have been studied (Table 1); values of Young's modulus were determined from tensile tests on individual fibres. The electrical resistance of the unstrained fibres varied from fibre to fibre even among fibres of the same grade. The variations within the grades