The axis of this dipole intersected the Earth's surface in the regions of what are now central Siberia and southern South America.

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Charged Particles in a Non-uniform Radio-frequency Field

An analysis of the motion of a charged particle in a non-uniform radio-frequency field has been made and has shown that under certain conditions particles of either sign will experience an acceleration towards the position of least electric field strength.

Considering the Lorentz forces upon free electrons, a second-order force arises due to spatial variation of the electric field-strength, which is of the same order as the conventional forces due to motion in the magnetic field and charge density fluctuations. In a continuous but not necessarily homogeneous electron distribution, such as we suppose to exist in a collision-free and neutral plasma, a small-signal theory shows that the time-averaged force per unit volume upon the electrons is, $f = -\frac{1}{2}(\rho e/\omega^2 m)\nabla(\overline{E \cdot E})$, where ρ is the average electron charge density, $\omega = 2\pi \times$ frequency, $\overline{E \cdot E}$ is time-averaged square of electric field, in rationalized M.K.S. units.

The total force upon an isolated body of electrons is the same as that given by conventional theory[1] from the field equations; the force is therefore consistent with the concept of radiation pressure. The internal stresses, or pressure in a fluid, differ, however, from the conventional theory, and appear to enhance the possibility of containing a heated plasma within a resonant cavity by radiation pressure[2].

It is hoped that it will shortly be possible to publish the details of the calculations which we have quoted.

The existence of such a force on electrons has been demonstrated in a 10-cm. slotted anode magnetron having no magnetic field and a cold cathode. Pulses of 10-cm. radio-frequency power were fed into this magnetron and set up electromagnetic fields which decreased towards the cathode. The multipactor effect produced a copious supply of electrons within the slots and limited the radio-frequency voltage there to about 5 kV.

Pulses of electrons arrived at the cathode with energies up to 250 volts, and current of up to 0·1 amp. per cm. length of cathode could be drawn with anode and cathode at the same potential. The anode and cathode diameters were 1·25 and 0·59 in. respectively. A small increase in cathode temperature was observed with a thermocouple, which proves that the current was due to negative particles bombarding the cathode.

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Some Observations of the Infra-red Solar Spectrum from a High-flying Aircraft

The strong absorption bands of water vapour and carbon dioxide in the infra-red obscure much of the solar spectrum from observation on the ground. By working at high altitude, however, it is possible to use measurements of absorption in these bands for obtaining data about the concentration of water vapour and other atmospheric constituents in the upper atmosphere. To make such measurements, an infra-red grating spectrometer with a resolution ~ 2 cm.$^{-1}$ has been installed in a Canberra aircraft. A heliostat maintains a steady image of the sun on the input slit of the spectrometer. The spectrometer and heliostat are installed in the unpressurized part of the aircraft necessitating an elaborate system of remote control for its operation.

Successful ascents have been made in which the spectral region 1·8–2·1μ has been observed using a

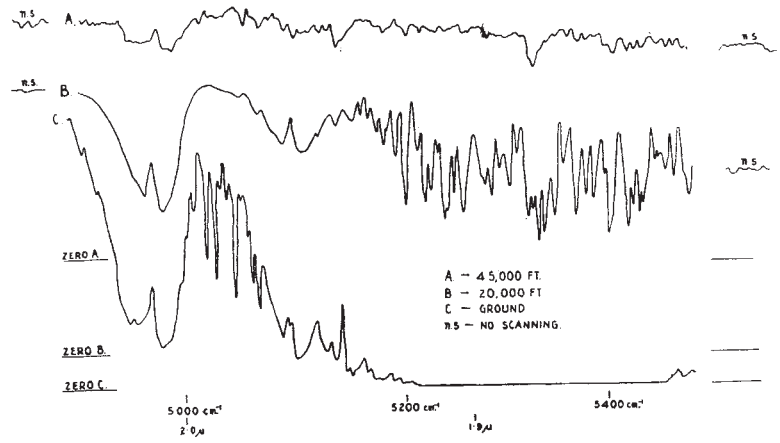

Fig. 1. Solar spectra