LETTERS TO THE EDITOR

GEOPHYSICS

Space Density of Dust in the Stratosphere

THE Smithsonian meteoritic dust programme has included a number of aerosol collections made by various aircraft in different altitude ranges. These include collections in the range 40,000–48,000 ft. by a *B*-52; roughly 60,000 ft. by a *U*-2; and 51,000–87,000 ft. by an *F*-104*A*. The purpose of these collections was to obtain samples of meteoritic material, both so that we could estimate the rate of accretion by the Earth of extraterrestrial matter and analyse it chemically.

Our first step has been to investigate the space density of dust particles of all types as a function of height and of time. The space density was calculated simply by dividing the total number of particles of a certain size-range by the volume encountered by the opening of the collector, taking into account the efficiency of the collector. Wind-tunnel tests provide us with a set of values for the efficiency of the collector under various conditions of velocity and altitude.

Table 1. MEAN SPACE DENSITIES

Aircraft	Height (ft.)	Mean space densities (particles > 3μ diam./m.³)
B-52	40,000–48,000	4,000
U-2	60,000	2,800
F-104*A*	51,000–87,000	1,000

The true space densities for atmospheric particles are given in Table 1. The values for the lower altitude flights were computed from the counts of particles of all types, from which background counts as determined from unexposed (but flown) filters were subtracted. The original counts were for particles with mean dimensions greater than 6μ. These we transformed into counts for particles larger than 3μ by means of the known size distribution[1]. To derive the space densities tabulated, we then divided the counts by the effective volume of air encountered. The tabulated results clearly show a decrease of particle space density with altitude.

Meteoritic spherules. Small, spherical particles that strongly resembled, both in appearance[1] and chemical composition[2], meteoritic droplets such as are found surrounding falls of larger meteorites[3], were discovered on five *B*-52 filters. Because of recent wind tunnel tests, the previous calculations of the rate of fall of such particles to the surface must be revised upward. The correct space density of these particles is approximately 3/m.³ at 45,000 ft. If, as Stokes's law would indicate, they fall at the rate of approximately 1 cm./sec. from this altitude, the expected rate of fall on the Earth's surface is 0·3 spherule/cm.²/day. This is not significantly different from the actually observed rate of fall of such particles in the Arctic[4], which is approximately one spherule/cm.²/day. We believe that the essential agreement of these greatly different experiments is good evidence that our conclusions about the meteoritic origin of the particles are correct. Furthermore, the present results indicate that approximately 2 × 10⁸ kgm. of this kind of meteoritic material fall to the Earth a year (using standard assumptions[2]). This is not inconsistent with our previous value of 5 × 10⁸ kgm./yr. (ref. 4) and is in excellent agreement with the results of Crozier[5] and Thiel and Schmidt[6], who collected spherules from land and ice sediments, respectively.

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Equatorial Micropulsations and Ionospheric Disturbance Currents

THE early evening maximum of occurrence of regular geomagnetic pulsations, *pc*, of period 20–30 sec., was first detected on the Earth current recordings obtained at Legon, Ghana, during the International Geophysical Year[1]; but more recently, Cardus[2] has confirmed that the occurrence of evening *pc* is also a feature of micropulsational activity at other equatorial stations. No satisfactory hypothesis has yet been proposed to explain why this type of geomagnetic activity is a day-time phenomenon at all mid-latitude stations, with a maximum of occurrence and amplitude at approximately mid-day, while, in the region of the magnetic equator, there is an evening maximum of both occurrence and amplitude, with lesser maxima at mid-day and early morning[3]. Several attempts have, however, been made to relate the occurrence of *pc* pulsations with ionospheric disturbances, and interesting results have recently been obtained by Campbell and Matsushita[4], who suggest that the onset of micropulsation storms is associated with an increase in ionospheric disturbance, and by Hope[5], who puts forward the proposal that the movement pattern of the ionospheric disturbance currents produces maximum geomagnetic activity at different times of the day at high, middle and low latitudes.

So far as the Legon micropulsation results are concerned, it has been considered for some time that the evening maximum of *pc* activity must be associated in some way with the other known equatorial disturbance phenomena, but previous attempts at correlation of *pc* occurrence at Legon with the ionospheric parameters from a neighbouring station have proved unfruitful. However, following the ideas suggested by Campbell, Matsushita and Hope, the correlation between *pc* activity and the disturbance daily variation, S_D, has recently been determined and, in this case, the results are encouraging.

Using the continuous recordings of the Earth current potential gradients at Legon between April 1958 and March 1959, the disturbance daily variation of the Earth currents has been determined, and in Fig. 1 the resultant amplitudes of the S_D potential gradients for each hour are given. The daily variations of (*a*) the