three different heights corresponding to the above three values of N from which we can get reflections. But usually only a doublet is observed corresponding to conditions (a) and (b) of formula (2). Corresponding to (a) we get an extraordinary ray (shorter delay component) and corresponding to (b) we get an ordinary ray (the longer delay component). Reflections corresponding to (c) or N_3 (which is the highest concentration of electrons for which μ is again zero) are not usually observed, since the amplitude of the disturbance when it reaches the greatest height is very small, or even if it is reflected with sufficient amplitude from these heights the amplitude falls during its passage through the lower layer. (See Mary Taylor[2] who considers this possibility.)

As already reported in NATURE[3], a systematic investigation of the heights of the ionosphere is being carried out in this laboratory, and on several occasions different observers[4, 5] have independently noticed the appearance of a very close triplet set of the first reflected echo; two of these can be easily identified with those corresponding to N_1 (2,a) and N_2 (2,b), but the third can only be identified with N_3 (condition 2,c). The most favourable time for the occurrence of the triplet seems to be after sunset, when the first echo from the F-layer just begins to resolve into the ordinary and extraordinary ray. The triplets occur rather irregularly and have not been found to exist for more than a minute. On most favourable occasions when the measurement could be taken from visual observations, the separation of the components corresponded to an equivalent height of about 15 km.

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[1] E. V. Appleton, U.R.S.I. papers (Washington, 1927). Appleton and Builder, *Proc. Phys. Soc. Lond.*, **45**, 208; 1933.
[2] *Proc. Phys. Soc. Lond.*, **45**, 261; 1933.
[3] G. R. Toshniwal and B. D. Pant, NATURE, **133**, 947; 1934.
[4] G. R. Toshniwal and B. D. Pant, see appendix of a paper read before the first meeting of the National Institute of Sciences on Jan. 8, 1935 (in the press).
[5] R. R. Bajpai, Thesis for M.Sc. Examination. T. D. Bausal, Thesis for M.Sc. Examination.

Absorption of Cosmic Rays

THE Klein-Nishina formula, which is based on the scattering and absorption of X- and γ-radiation by extra-nuclear electrons, has been widely used in the calculation of the absorption coefficients of high-frequency quanta. But recent experimental work and theoretical deductions have shown that this formula is not applicable to the absorption of γ-radiation of energy greater than $1 \cdot 0 \times 10^6$ e.v., since for higher energies there is additional absorption due, in the main, to interactions between the radiation and atomic nuclei, these interactions giving rise to electron pairs. This nuclear absorption, which becomes of greater importance as the energy of the quanta increases, and is probably the predominant type of absorption which would occur with any ultra γ-radiation arising from actions such as the condensation or annihilation of protons and electrons in space, is not accounted for by the Klein-Nishina formula. The latter cannot, therefore, be directly applied to the cosmic ray problem as has been previously assumed, and the wave-lengths of supposed photon components calculated by means of this formula must be inaccurate, since the formula does not take into account the nuclear absorption.

Even assuming that the primary rays are photons, the agreement which has been obtained between the absorption coefficients calculated by assuming some hypothesis as to the process giving rise to the quanta, and the experimentally observed coefficients, is fortuitous, since nuclear absorption is neglected by the Klein-Nishina formula. Thus, before any postulation as to the origin of the rays which utilises agreement between calculated and observed absorption coefficients of ultra γ-radiation can be accepted, a theory of absorption which takes account of nuclear interactions must be developed.

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Random Distribution of Parasite Progeny

RECENT work by Salt[1] led him to question the validity of the hypothesis of the random distribution of progeny by parasites. In this connexion, experiments at Farnham House Laboratory with *Schedius kuvanæ*, a chalcid egg-parasite of the gipsy moth (*Porthetria dispar*), will be of interest. Although no figures are given here, those obtained in the experiments were such as to leave no doubt as to their significance.

Subject to controlled environmental conditions, and given a sample of host eggs all equally exposed to attack, the female almost invariably parasitises each available host with a single egg. If no healthy (unparasitised) hosts are present, the rate of laying (per diem) is approximately halved, that is, she tends to retain her eggs rather than deposit them in parasitised hosts. There is considerable individual variation in this ability to refrain from ovipositing in parasitised hosts—a feature which was also indicated in the table of Salt's work on *Trichogramma evanescens*.

The discriminating faculty is not due to memory, and seems to be of a qualitative rather than a quantitative nature. When a series of *Porthetria* eggs, containing respectively 0, 1, 2, 3 and 4 eggs deposited by a given female, are exposed to another female for a given time, at least 80 per cent of the progeny are placed in the hosts that contained no eggs when first offered to the female, these often being superparasitised with three or four eggs. This peculiarity of laying the great majority of additional eggs in hosts which a given female had herself parasitised in the original instance, in preference to hosts parasitised by other females, has been noticed in numerous cases where superparasitism was enforced by the experimenter.

The selective faculty is of a surprisingly high order, enabling the insect to choose the best of available host material. Thus, given a choice between—

(1) dead and alive gipsy moth eggs, she selects chiefly live eggs;

(2) dead healthy eggs and dead eggs, each containing a single dead parasite, she selects the healthy host;

(3) dead healthy eggs and dead eggs, each containing a single live parasite, again the healthy eggs;