NOTE ON THE SEPARATION OF THE ELECTRONIC AND NON-ELECTRONIC COMPONENTS OF COSMIC RADIATION

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Received December 14, 1943

Cosmic radiation is known to be composed of two main components which differ greatly in their behaviour. One component consists of electrons, positrons and gamma-rays and is called the soft component. The other, called the hard component, consists of mesons of positive and negative charge, and probably also of neutral mesons. The words soft and hard are used in this paper only in the sense defined above, and carry with them no indication of the energy or penetrating power of the individual particles. There may also exist a certain number of very high energy protons which we will consider here with the hard component. There is in addition a certain number of neutrons, low energy protons and fragments of disintegrated nuclei which do not need to be considered in this paper. The behaviour of the soft component is accurately described by the quantum theory and in particular the cascade theory, while the behaviour of the penetrating component is known both theoretically and experimentally to a much lesser extent. In studying the behaviour of the hard component experimentally, various devices have been used by different authors for excluding the effects of the soft component. The degree of accuracy of the experiments and even the interpretation of some of them depend on the extent to which these devices discriminate against the soft component. The most commonly used method of discriminating between the soft and hard components is to observe or measure their penetration through plates or blocks of different thicknesses of some dense material such as lead. The heavy material then serves either for excluding the soft component due to its greater absorbability, or, as is usual in experiments with a Wilson chamber, as a medium in which the electrons produce showers and can thus be distinguished from the particles of the hard component. We shall show that great caution is required in interpreting the results, and that in many cases the exclusion of the soft component by these methods is much less than has been supposed. Finally we shall describe a new experimental arrangement which makes the maximum use of the shower producing property of the soft component for distinguishing it from the hard component.