Generalized Sequential Decay Approach to Multiple Production.

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Summary. — A set of coupled Volterra-like integral equations is derived for all the quantities of physical interest in the multiparticle decay of a fireball formed in a high-energy collision process. The basic assumptions are: i) the fireball decays sequentially either directly into pions or through the formation of mesonic clusters (these, in turn, are forced to decay sequentially into pions); ii) each elementary decay of either type occurs with an independent probability except for energy-momentum and charge conservation, which are imposed at every single decay step. A graphical method is developed as a short cut to derive the aforementioned integral equations.

1. — Introduction.

The concept of «fireball» (cluster in the modern, more fashionable folklore) is relatively old (1) in the field of high-energy physics but has rightly received

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much attention in a recent revival of the idea as applied to the various problems of multiparticle physics (8).

Without reviewing, in any detail, the previously quoted papers, we shall simply recall that the data are in much better agreement with a picture where an increasingly large number of «clusters» are produced which then decay separately into a more or less energy-independent number of secondaries, rather than with the opposite picture in which the decay into secondaries does not go through any intermediate cluster formation. It is relatively simple to understand this fact if we accept that the most relevant contribution to multiparticle processes comes from pionization rather than fragmentation. This, on the other hand, is supported by the fact that the dominant part of the average multiplicity (the one that grows with energy) comes from the central region. If the decay of the primary fireball goes via direct emission of secondaries, this, essentially, reproduces a fragmentation situation. A pionizationlike picture is obtained, on the contrary, if the decay occurs through the formation of an increasingly large number of relatively light objects that then decay into pions.

This is the reason why (after having learned the rules of the game with the unrealistic case of sequential decay of fireballs into pions) (8) in this paper we discuss the case in which the primary fireball (whatever its actual origin may be) decays in all possible ways in which either other fireballs or elementary particles may be emitted.

In the following, for the sake of clarity, we shall reserve the term «fireball» to the primary object formed in the interaction, which may carry baryonic quantum number. We will denote instead as «cluster» any mesonic composite
