FACULDADE DE FILOSOFIA, CIÊNCIAS E LETRAS
DA UNIVERSIDADE DE S. PAULO
DEPARTAMENTO DE FÍSICA

Letter to the Edictor of Physical Review.

On the explosion - shower's.

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Let us consider a high-energy collision betweentwo particles of initial impulses (where are referred to a barycentric frame: , and is a univeṙsal length).

Heisenberg, starting from a half-classical theory of explosion-showers, showed that the number of particles created by collision must be sensibly proporcional to the initial energy

Our purpose is to examine whether it is allowed to apply the second quantisation method and to assume the existence of a suitable relativistic interaction-operator in order to obtain some more approximated information about this kind of showers. We arrive to the samm description of showers obtained by Heisenberg, and this seems to support the consistency of our tentative. Moreover our method leads to the result that the cross-section for explosion-showers decreases for and tends to when .

In analogy to Heisenberg's Lagrangian we shallconsider here, as a plausible and typical example, an interaction-operator which is a function of

We suppose also that this operator corresponds to some kind of short range forces, e.g. we conśider of the type or (ōr Yukawa-forces), or other types used for"cutting of" purposes.

The general term of interaction, which in the formalism of second quantisation, corresponds to an explosion-shower, is:

where represent plane waves with impulses and are the usual operators representing the creation and the anhilation of particles.

are normalised in volume , and thus a ssume the form

where are only spin dependent factors. We have:

Applying the usual perturbation method in order to obtain the Fourier coeffécients of the function which represents a state:

(with obvious signification of the symbols) we obtain:

where

is the number of quantum states referred to unit energy interval. In a barycentric frame we have , and results proportional to

In order to study how this probability varies with and with the spatial distribution of vectors , we make use of the conservation law:

and find that this probability is the maximum in the case

Thus is proportional to the initial energy and the frequency of explosion-showers results reduced by the factor for incident energies greater than .

Following a remark of Mario Schenberg, the operators of the type applied to a function gives in the corresponding Fourier-development a cut-off factor.

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(1) ZS. f. Phys. B. 110, p. 251 ; B. 113, p. 61 .

(2) Ricerca Scientifica, April 1.938

(3) Following a remark of Mario Schenberg, the operators of the type

applied to a function gives in the corresponding Fourier-development a cut-off factor.

(4) Nature Vol. 142, p. 393, August 1.938. C.R. August 1.938.