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From: Carmen Vasini <vasini@sif.it>

To: Jens Vigen <Jens.Vigen@cern.ch>

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Carmen Vasini

B. FERRETTI

1957, Marzo

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On the Conservation of Nucleons.

B. FERRETTI (*)

CERN - Genève

(ricevuto il 21 Febbraio 1957)

During a first research into this question it was found that it was not possible to measure the nucleonic four-current independently from the equation of motion by means of a field only, unless the source of the field was not the four-current itself ⁽¹⁾. This conclusion had some bearing on the problem of the conservation of « nucleons ». I have now found that this difficulty might be overcome if, instead of using one field only, one uses two different fields. The idea is roughly the following.

If the « nucleons » do generate two fields Φ and φ , which might even interact with other particles, say X and Y , and if we indicate with $S_\Phi(N)$ the nucleon source of the field Φ , and with $S_\varphi(N)$ the nucleon source of the field φ , and in a like manner with $S_\Phi(X)$, $S_\varphi(Y)$ the sources related to the particles X

and Y , provided that on two points x, x' such that $x-x'$ is a spacelike or zero vector $[S_\Phi(X) S_\varphi(Y)]_- = 0$, the commutator $[S_\Phi, S_\varphi]_-$ will depend only on the nucleons ($S_\Phi = S_\Phi(N) + S_\Phi(X)$.) Now, it is very easy to form with such a commutator expressions which are identical to the nucleonic four-current components. For instance, if we assume that Φ is a scalar and that φ is a « neutrino field », coupled, by means of the anti-symmetrical tensor coupling to the nucleonic field, one can immediately construct, by means of an integration on a spacelike surface, the three first components of the nucleonic four-current, and then an infinitesimal Lorentz transformation will give the fourth component.

Of course, other examples of this kind might be found and, therefore, it seems possible to express the nucleonic four-current by means of the fields created by the nucleons, even if these fields interact with other particles. The bearing of these remarks in respect to the nucleon conservation law is under investigation.

(*) On leave of absence from Istituto di Fisica dell'Università, Bologna.

(1) B. FERRETTI: *Nuovo Cimento*, **4**, 951 (1956)