GENERAL PROPERTIES OF HIGHER-SPIN FERMION INTERACTION CURRENTS AND THEIR TEST IN πN-SCATTERING

Yu.V. Kulish, E.V. Rybachuk

Ukrainian State Academy of Railway Transport
(*7, Feyerbach Sq., Kharkiv 61050, Ukraine;*
e-mail: rybachuk_l@mail.ru)

S u m m a r y

The currents of higher-spin fermion interactions with zero- and half-spin particles are derived. They can be used for the $N^*(J) \rightleftarrows N\pi$-transitions ($N^*(J)$ is the nucleon resonance with the J spin). In accordance with the theorem on currents and fields, the spin-tensors of these currents are traceless, and their products with the γ-matrices and the higher-spin fermion momentum vanish, similarly to the field spin-tensors. Such currents are derived explicitly for $J = \frac{3}{2}$ and $\frac{5}{2}$. It is shown that, in the present approach, the scale dimension of a higher spin fermion propagator equals to -1 for any $J \geq \frac{1}{2}$. The calculations indicate that the off-mass-shell N^* contributions to the s-channel amplitudes correspond to $J = J_{\pi N}$ only ($J_{\pi N}$ is the total angular momentum of the πN-system). As contrast, in the usually exploited approaches, such non-zero amplitudes correspond to $\frac{1}{2} \leq J_{\pi N} \leq J$. In particular, the usually exploited approaches give non-zero off-mass-shell contributions of the $\triangle(1232)$-resonance to the amplitudes $S_{31}, P_{31}(J_{\pi N} = \frac{1}{2})$ and $P_{33}, D_{33}(J_{\pi N} = \frac{3}{2})$, but our approach – to P_{33} and D_{33} only. The comparison of these results with the data of the partial wave analysis on the S_{31}-amplitude in the $\triangle(1232)$-region shows the better agreement for the present approach.