After the above study was made [17, 18] we have learned of similar results in recent work by Kleinert [20*, 21]. Beyond (35), Kleinert's method for getting "charges" now consists in projecting out of $F_a^{(+)}(\zeta)$ and $F_a^{(-)}(\zeta)$ the coefficients $F_a^{(\pm)J}(0)$ in a Taylor expansion in powers of ζ^{-J}

$$F_a^{(\pm)}(\zeta) = \sum_J \zeta^{-J} F_a^{\pm J}(0) .$$

The new Kleinert charges are thus identical to (32)–(34) only if $J = \alpha$, $J' = \alpha'$. For $\alpha \neq 0, 1$ the Kleinert charges project out only pieces of (32)–(34). Both sets contain all "daughters", as explicitly shown by Kleinert.

Summing up, we note the following conclusions of our analysis:

(a) The vertex strengths (factorized residues at zero momentum-transfer) do form the postulated Lie algebra, as derived in (32)–(34). This involves the assumptions of scaling and of analyticity in the J-plane. It would hold true for more general functions of $1/\zeta$ than the usual power behavior. The Lie product can always be assumed to exist.

(b) If the function of $1/\zeta$ is known, one can extract the vertex-strength directly, through (23). This is then the "charge".

(c) We are allowed to assume an idealized picture in which there is no leakage from the relevant multiplets in the intermediate states, since there are no Coleman theorems on the null plane-light-cone intersection where we have worked. On the other hand, we can also estimate the actual leakage, by observing departures from universality in the experimental results.

One of the authors (Y.N.) is grateful to Prof. H. Kleinert for illuminating discussions and correspondence.

References

[1] J.J.J. Kokkedee, The quark model (Benjamin, N.Y., 1969);
H.J. Lipkin, Phys. Reports 8 (1973) 173.
[2] N. Cabibbo, L. Horwitz and Y. Ne'eman, Phys. Letters 22 (1966) 336.
[3] A. Kantorovich, I. Stumer and Y. Ne'eman, Nucl. Phys. B46 (1972) 190.
[4] H. Harari, Phys. Rev. Letters 20 (1968) 1385;
P.G.O. Freund, Phys. Rev. Letters 20 (1968) 235.
[5] H. Harari, Phys. Rev. Letters 22 (1969) 563;
J. Rosner, Phys. Rev. Letters 22 (1969) 689.
[6] Y. Ne'eman, Nucl. Phys. B43 (1972) 623.

* See the cut-off dependent commutator (4.24), the $\zeta = 1/\omega \equiv \xi$ "local" algebra (2.24), the expression (2.18) and the J-projected charges (2.26). Note that Kleinert's notation is inverted relatively to ours, ± denoting signatures.