CORRELATION FUNCTION FOR ISOVECTOR AMPLITUDES
IN NUCLEI[†]

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The correlation function

$$C_{\lambda}(\vec{q}) = \langle 0 | \sum_{i,j} e^{i\vec{q} \cdot \vec{r}_{ij}} t_{\lambda}^{+}(j) t_{\lambda}(i) | 0 \rangle \quad (1)$$

with the help of the definitions

$$\rho_{\lambda}(\vec{q}) = \sum_i e^{i\vec{q} \cdot \vec{r}_i} t_{\lambda}(i) \quad (2a)$$

$$F_V(\vec{q}) = \langle 0 | \frac{1}{T_3} \rho_3(\vec{q}) | 0 \rangle \quad (2b)$$

$$q^2 S_{\lambda}(\vec{q}) = \sum_{n \neq 0} \langle n | \rho_{\lambda}(\vec{q}) | 0 \rangle^2 \quad (2c)$$

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can be written in the form

$$C_{\lambda}(\vec{q}) = g_{\lambda}(0) |F_V(\vec{q})|^2 - g_{\lambda}(\infty) + q^2 S_{\lambda}(\vec{q}) \quad (3)$$

The coordinates $\vec{r}_i$ refer to the center of mass of the nucleus and t_{λ} are the spherical components of the isospin operator. The quantities g_{λ} are limiting values of the function

$g_{\lambda}(\vec{q}) = \langle 0 | \rho_{\lambda}^{+}(\vec{q}) \rho_{\lambda}(\vec{q}) | 0 \rangle$ and are given by

$$g_{\lambda}(0) = T^2 + \frac{1}{2} \lambda T - \lambda^2 T(T - 1/2) \quad (4a)$$

$$g_{\lambda}(\infty) = \frac{A}{4} + \frac{\lambda T}{2} \quad (4b)$$

The absence of an isotensor term in Eq. (4b) is reasonable since $g_{\lambda}(\infty)$ represents quasi-elastic scattering. We can identify the isovector and isotensor components in S_{λ} by writing

$$S_{\lambda}(\vec{q}) = S_0(\vec{q}) [1 + \lambda \alpha_1(\vec{q}) + \lambda^2 \alpha_2(\vec{q})] \quad (5)$$

The quantities $S_{\lambda}(0)$, $\alpha_1(0)$ and $\alpha_2(0)$ are identical with those defined and evaluated for the electric dipole case in previous work.¹ The symmetry property $C_{\lambda}(\vec{q}) = C_{-\lambda}(\vec{q})$ implies the absence of an isovector term in C_{λ} and leads to

$$\alpha_1(\vec{q}) q^2 S_{\lambda}(\vec{q}) = \frac{T}{2} [1 - |F_V(\vec{q})|^2] \quad (6)$$

The limiting values

$$\begin{aligned} q^2 S_{\lambda}(\vec{q}) &\xrightarrow{q \rightarrow \infty} g_{\lambda}(\infty) ; \quad \alpha_2(\vec{q}) \xrightarrow{q \rightarrow \infty} 0 \\ \alpha_1(\vec{q}) q^2 S_0(\vec{q}) &\xrightarrow{q \rightarrow \infty} \frac{T}{2} ; \quad \alpha_1(\vec{q}) \xrightarrow{q \rightarrow \infty} \frac{2T}{A} \end{aligned} \quad (7)$$

can easily be established.

Finally the isotensor correlation is given by

$$C_{+1}(\vec{q}) + C_{-1}(\vec{q}) - 2C_0(\vec{q}) = -T(2T-1) |F_V(\vec{q})|^2 + 2 \alpha_2(\vec{q}) q^2 S_0(\vec{q}) \quad (8)$$

It contains one term that is always negative and a second which was found to be positive, but rather small. The isovector and isotensor coefficients $\alpha_1(\vec{q})$ and $\alpha_2(\vec{q})$ have been calculated in special cases indicating that α_2 is in general quite small.

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1. S. Fallieros and B. Goulard, Nucl. Phys. A147 (1970) 513.

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