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1) The average number of neutrons in one event of the reaction $\mu^- + He^4$ is approximately 1.2, from which it follows that the reactions $\mu^- + He^4 = D + 2n + \nu$ and $\mu^- + He^4 = p + 3n + \nu$ constitute less than half of all the cases.

MIRROR REFLECTION SYMMETRY IN THE CASE OF THE SU(3) GROUP

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Not all the concepts used in the theory of representations of the SU(2) group find their generalization in the theory of representations of group SU(3). Among these concepts are the symmetry of mirror reflection, which in the case of SU(2) group was developed in [1-4] 1). In the present note we indicate the possibility of introducing this concept into the theory of group SU(3) representations, and the practical utility of the corresponding symmetry properties for the calculation of the Clebsch-Gordan coefficients.

If we use the system of phases chosen in [5], then the analog of symmetry of mirror reflection in the theory of the group SU(3) can be the relation

$$\varphi(\{N\}II_zY) = (-1)^{I_z + (1/2)Y}\varphi(\{N\}\bar{I}I_zY) \qquad (1)$$

with

$$I \rightarrow \bar{I} \equiv - I - 1 \qquad (2)$$

Here φ is the basis function of the irreducible representation $\{N\} = (pq)$. I is the isospin quantum number, I_z and Y are the quantum numbers of the projection of the isospin and they hypercharge, respectively.

It is seen from (1) that the substitution (2) denotes a transition from the representation $D^{\{N\}}_{II_zY,\ I'I'_zY'}$ to the equivalent representation $D^{\{N\}}_{\bar{I}I_zY,\bar{I}'I'_zY'}$, obtained from the former by adding the phase factor equal to minus unity raised to the power $I + (1/2)Y + I' + (1/2)Y'$. Equation (1) leads to the relation

$$\varphi(\{N^*\},\ \nu) = \varphi^*(\{N\},\ \bar{\nu}) \qquad (3)$$

where

$$\nu = II_zY, \qquad \text{and} \qquad \bar{\nu} = II_zY$$

$$(\bar{I} = - 1,\ \ \bar{I}_z = - I_z,\ \ \bar{Y} = - Y) \qquad (4)$$

Here $\{N^*\}$ is the irreducible representation which is contragradient to the representation $\{N\}$. A direct consequence of (1) is the relation

$$D^{\{N^*\}}_{\nu\nu'} = D^{\{N\}*}_{\overline{\nu\nu'}} \qquad (5)$$

Relations (3) and (5) for the Clebsch-Gordan coefficients of the SU(3) group yield the following property

$$\begin{bmatrix} \{N_1\} & \{N_2\} & \{N\}_\gamma \\ \nu_1 & \nu_2 & \nu \end{bmatrix} = \begin{bmatrix} \{N_1^*\} & \{N_2^*\} & \{N^*\}_\gamma \\ \bar{\nu}_1 & \bar{\nu}_2 & \nu \end{bmatrix} \qquad (6)$$

Here γ is an additional parameter for the separation of repeated representations.

From the practical point of view, an important role is played by the case when the substitution (2) is applied to two columns of the Clebsch-Gordan coefficient with the signs of I_z and Y unchanged. For this case we obtain

$$\begin{bmatrix} \{N_1\} & \{N_2\} & \{N\}_\gamma \\ \bar{I}I_{1z}Y & I_2I_{2z}Y_2 & \bar{I}I_zY \end{bmatrix} = (-1)^{p_1+q_1+p+q+I_{2z}+(1/2)Y_2} \begin{bmatrix} \{\bar{N}_1\} & \{N_2\} & \{N\}_\gamma \\ I_1I_{1z}Y_1 & I_2I_{2z}Y_2 & II_zY \end{bmatrix} \qquad (7)$$

In view of the fact that the Clebsch-Gordan coefficient of the SU(3) group is equal to the product of the Clebsch-Gordan coefficients of the SU(2) group and an isoscalar factor (see [6]), the use of formula (9) in [1] or of formula (4.3e) in [3] leads to the following relation

$$\begin{bmatrix} \{N_1\} & \{N_2\} & \{N\}_\gamma \\ I_1Y_1 & I_2Y_2 & \bar{I}Y \end{bmatrix} = (-1)^{p_1+q_1+p+q+I_2-(1/2)Y_2} \begin{bmatrix} \{N_1\} & \{N_2\} & \{N\}_\gamma \\ I_1Y_1 & I_2Y_2 & IY \end{bmatrix} \qquad (8)$$

The use of the latter relation makes it possible to reduce appreciably the computation labor involved in expressing the isoscalar factor in terms of p_1, q_1, I_1, and Y_1 for specified values of p_2, q_2, I_2, and Y_2. If tables are made up without the use of this property, as is the case in [7], then relation (8) can be used to check the obtained formulas. We note that in [7] the system of phases is such that in the equation corresponding to (8) the phase factor should contain $+ \epsilon/2$ in place of $- Y_2/2$.

The substitution (2) can be interpreted as a mirror reflection of the isospin axis in the plane perpendicular to this axis, as in the case of the group SU(2) (see [2]).

In addition to (2), in the case of the group SU(3) there are also the substitutions

$$p \to q - 2, \qquad q \to - p - 2 \qquad (9)$$

since the eigenvalues of the Casimir operators F^2 and G_3 are invariant against these substitutions. As can be seen from (18) and (19) of [8], if we take it into account only that in [8] rp + q is replaced by p, and q has the same definition as in the present note. It is easy to establish phase relations under the substitutions (9) and to obtain a corresponding geometrical interpretation.

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1) A misprint has crept into [2]. In the fourth line from below of the third paragraph in Sec. 386 "b" and (c) should be replaced by "c" and "d."

SPECTRAL CHARACTERISTICS OF A GAS LASER WITH TRAVELING WAVE

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Data were published recently on the possibility of obtaining single-mode operation of a ruby laser in a resonator with traveling wave in one direction [1]. The results of this experiment, in the author's opinion, prove that the ruby R_1 line is uniformly broadened, the relaxation of the excitation along the crystal is small, and the main cause of the multimode generation conditions in the longitudinal-mode regime is the uneven field distribution of these modes along the ruby axis. The multimode nature of the gas laser is connected principally with the inhomogeneous character of line broadening, when waves of different frequencies interact with groups of excited atoms having different velocities.

This raises the question whether any additional "decoupling" of the longitudinal mode is produced also by the difference in the positions of the nodes and antinodes of the mode fields in the standing-wave resonator. To check on this, we constructed a gas laser for a wavelength $\lambda = 6328$ Å, with a ring resonator, in which a traveling wave was generated with one propagation direction, the second direction being artificially attenuated, thus eliminating to a considerable degree the spatial periodicity of the light-wave field. A diagram of the experimental set-up is shown in Fig. 1.

The laser cavity was made up of three mirrors (2, 3, and 4 in Fig. 1), of which two have a transmission of approximately 0.2% (2 and 3), while mirror 4 had a transmission 3.7%. A discharge tube (1) 4 mm in diameter was filled with a mixture of neon and helium in a ratio 1:5 at a total pressure 0.5 mm Hg. In this system there are generated traveling waves of two directions - clockwise (A) and counter clockwise (B). To obtain a traveling wave in one di-