τ (E2) of the level at $\Delta E = 1.01$ Mev is 1.7×10^{-11} sec, while the lifetime of the level at $\Delta E = 0.84$ Mev is 1.7×10^{-11} sec. Previously only an upper limit of $\tau < 10^{-10}$ sec was known[6] for these levels in Al^{27}.

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LIFETIME OF THE FIRST EXCITED STATE OF Mg^{24}

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THE study of Coulomb excitation of nuclear levels enables us to calculate their lifetimes. For even-even nuclei the formula relating the lifetime τ of the excited state and the reduced probability $B(E2)\uparrow$ for transition from the spin 0 ground state to the first excited state (which has spin 2), has the form:

$$1/\tau = 2.46 \cdot 10^{-3} (\Delta E)^5 B(E2)\uparrow,$$

where ΔE is the energy of the level in kev, and $B(E2)$ is in units of $e^2 \times 10^{-48}$ cm^4.

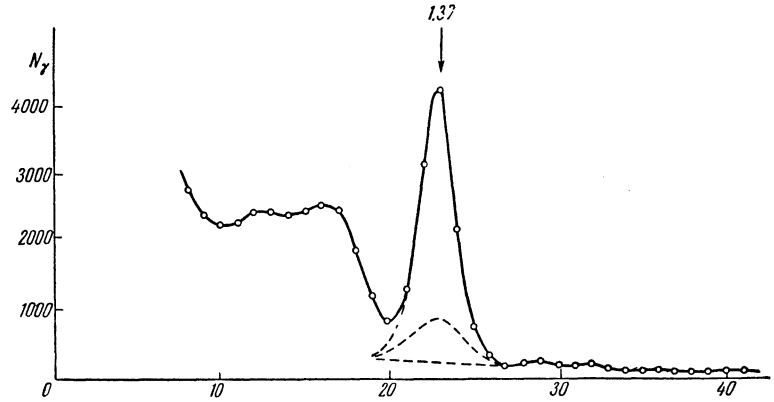
Previously all attempts to excite the first level in Mg^{24} have been unsuccessful, because in this case $\Delta E = 1.37$ Mev and the energies of the α particles or protons necessary for Coulomb excitation of the level are so high that there is a marked increase in the interfering background from nuclear reactions.

In our work we used triply-charged ions of nitrogen and oxygen with energies of 15.9 and 18.1 Mev, respectively, and also quadruply-charged nitrogen ions having energies of 25.6 and 36 Mev.

The investigation of the Coulomb excitation of the first level of Mg^{24} using nitrogen and oxygen ions is made more complicated by the fact that, in the γ spectra we have investigated from Coulomb excitation of various elements, a parasitic line is always present at 1.37 Mev, i.e., a line coinciding with the one we are studying here. This line is apparently related to nuclear interaction of the nitrogen and oxygen ions with carbon deposited on the target during the operation of the cyclotron. We showed that if a target of carbon is irradiated with nitrogen or oxygen ions the intensity of the peak corresponding to a 1.37-Mev γ line increases approximately a hundredfold. We noted that, despite the spread of values of absolute yields of γ lines in the parasitic peaks, the ratio of the peak amplitude to the background changed only slightly during irradiation of targets of various materials with heavy ions.

The figure shows the γ spectrum from bombardment of natural magnesium by 15.9-Mev nitrogen ions. The dotted curve is the parasitic peak calculated on the basis of the observations mentioned above. We estimate that the maximum error in the determination of the area of the parasitic peak does not exceed $\pm 5\%$ of the area of the true peak. The average value of $B(E2)\uparrow$, determined from six different experiments, is $0.054\, e^2 \times 10^{-48}$ cm^4. This gives a value of $\tau = (1.5 \pm 0.4) \times 10^{-12}$ sec.

The lifetime of the first excited state of Mg^{24} was determined in reference 1 from data on inelastic scattering of 187 Mev electrons. According to reference 1, $\tau = 1.9 \times 10^{-12}$ sec; however the author points out that the method is not very accurate and that the result could be changed by a factor of the order of unity. At the Eighth Annual Conference on Nuclear Spectroscopy there were two reports[2,3], of measurements of τ (Mg^{24}). The lifetime of the first excited state of Mg^{24} was determined in these experiments by studying resonance scattering of γ-rays. The results of references 2 and 3 differ from one another by about a factor of 10. Our value of τ is close to the value of $\tau = (1.7 \pm 0.4) \times 10^{-12}$ sec reported in reference 2.



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FOCK'S CYCLIC SYMMETRY CONDITION AND YOUNG'S PATTERNS

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In constructing the wave function of an n-electron system by Fock's method,[1] the following conditions are imposed on the coordinate wave function Ψ:
(1) antisymmetry in the first k arguments,
(2) antisymmetry in the remaining n-k arguments,
(3) the cyclic-symmetry condition

$$(1-\sum_{i=k+1}^{n} P_{ik})\Psi = 0 \tag{1}$$

(P_{ik} is the operator for transposition of the arguments i and k.) It is assumed that $k \leq n-k$; then $s = n/2 - k$ is the total spin of the system.

It is known[2] that every function constructed from a Young pattern with two columns satisfies these conditions. In other words, it has been shown that the Young operator

$$Y_{n-k,k} = A(1,\ldots,k)\,A(k+1,\ldots,n)\prod_{m=1}^{k} S(m, k+m) \tag{2}$$

(where S and A are the operators for symmetrization and antisymmetrization with respect to their arguments), corresponding to the pattern with two columns shown in Fig. 1, satisfies the cyclic symmetry condition

$$(1-\sum_{i=k+1}^{n} P_{ik})\,Y_{n-k,k} = 0. \tag{3}$$

In the present note we want to show that this result is easily generalized to Young patterns of arbitrary shape, containing any number of columns.

Let us consider a Young pattern of the most general type (Fig. 2), having p columns of lengths $\lambda_1, \lambda_2, \ldots \lambda_p$, where

$$\lambda_1 \geqslant \lambda_2 \geqslant \ldots \geqslant \lambda_p > 0 \text{ and } \lambda_1 + \lambda_2 + \ldots + \lambda_p = n.$$

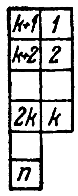

FIG. 1

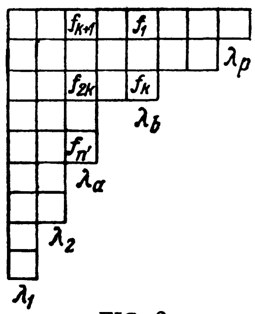

FIG. 2

In this case the Young operator consists of a symmetrization with respect to the arguments in the rows followed by antisymmetrization with respect to columns. We shall show that this operator satisfies the cyclic symmetry condition with respect to any pair of columns, say the columns a and b ($\lambda_a \geq \lambda_b$). For convenience of comparison with the case of two columns, we shall set $\lambda_b = k$ and $\lambda_a = n' - k$, and denote the arguments in the cells