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Alternate derivation of the Ginocchio-Haxton relation $[(2j-3)/6]$ ALBERTO ESCUDEROS, LARRY ZAMICK, Rutgers University — We want the number of states with total angular momentum $J = j$ for 3 identical particles (e.g. neutrons) in a j shell. We form states $M_1 > M_2 > M_3$ with total $M = M_1 + M_2 + M_3$. Consider first all states with $M = j+1$. Next form states by lowering M_3 by one. All such states exist because the lowest value of M_3 is $(j+1) - j - (j-1) = -j+2$. So far we have the total number of states with $J > j$ and $M = j$. The additional states with $M = j$ are the states with $J = j$. These additional states have the structure $M_1, M_2, M_2 - 1$ because if we try to raise M_3 we get a state not allowed by the Pauli principle, namely M_1, M_2, M_2. The possible values of M_1, M_2 are respectively $j - 2n$ and $1/2 + n$, where $n = 0, 1, 2 \cdots$. The total number of $J = j$ states is $N = \bar{n} + 1$ (with $\bar{n} = n_{\max}$), while $\bar{n}$ itself is the number of seniority 3 states. The condition $M_1 > M_2$ leads to $\bar{n} < (2j-1)/6$ or $N < (2j+5)/6$. This is our main result. It is easy to show that this is the same as the G-H relation[1] (see also Talmi's 1993 book) $\bar{n} = [(2j-3)/6]$, where [] means the largest integer. Since $2j$ is an odd integer, $(2j-1)/6$ is either $I, I - 1/3$ or $I - 2/3$, where I is an integer. If the value is I, then $\bar{n} = [(2j-3)/6] = [I - 1/3] = I - 1$. It is easy to show agreement in the other 2 cases as well. The number of $J = j$ states for the 3-particle system is equal to the number of $J = 0$ states for a 4-particle system.

[1]J.N. Ginocchio and W.C. Haxton, *Symmetries in Science VI*, ed. by B. Gruber and M Ramek, Plenum, New York (1993)

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