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Maximum J Pairing and Asymptotic Behavior of the 3j and 9j Coefficients[1] DANIEL HERTZ-KINTISH, LARRY ZAMICK, BRIAN KLESZYK, Rutgers University — We investigate the large j behavior of certain $3j$ and $9j$ symbols, where j is the total angular momentum of one particle in a given shell. Our motivation is the problem of maximum J pairing in nuclei, along with the more familiar $J = 0$ pairing. Maximum J pairing leads to an increase in $J = 2$ coupling of two protons and two neutrons relative to $J = 0$. We find that a coupling unitary $9j$ symbol ($U9j$) is very weak as j increases, leading to wavefunctions which are to an excellent approximation single $U9j$ coefficients. Our study of the large j behavior of coupling unitary $9j$ symbols is through the consideration of the case when the total angular momentum I is equal to $I_{\max} - 2n$ and $I_{\max} \equiv 4j - 2$, where $n = 0, 1, 2, ...$ We here derive asymptotic approximations of coupling $3j$ symbols and find that the $3j \propto j^{-3/4}$ in the high j limit. One major analytical tool we used is the Stirling Approximation. Through analytical, numerical, and graphical methods, we show the power law behavior of the coupling unitary $9j$ symbols in the $n/j \ll 1$ limit, i.e. $U9j \propto j^{-n}$. Power-law behavior is evident if there is a linear dependence of $\ln |U9j|$ vs. $\ln j$. We also present some examples of percent errors in our approximations.

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