

Wigner's SU(4) spin-isospin symmetry and MNT & fragmentation nuclear reactions

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In the case of exact Wigner spin-isospin SU(4) symmetry, the energies of Isobar Analog Resonance (IAR) and Gamow-Teller Resonance (GTR) are degenerate, and we can expect that $E_{IAR} \approx E_{GTR}$. In experimental and theoretical analysis of GTR data, a tendency of convergence of GTR and IAR energies (Fig. 1) with increasing $(N-Z)/A$ has been noticed [1], [2]. This fact may be interpreted as an approximate realization of SU(4) symmetry in a certain nuclear region, namely for nuclei with large $(N-Z)/A$, where spin-isospin SU(4) symmetry determines nuclear properties (the SU(4) region). From a simple estimate (Fig. 1), it follows that the value $Z/N \approx 0,6$ corresponds to the SU(4) region [2].

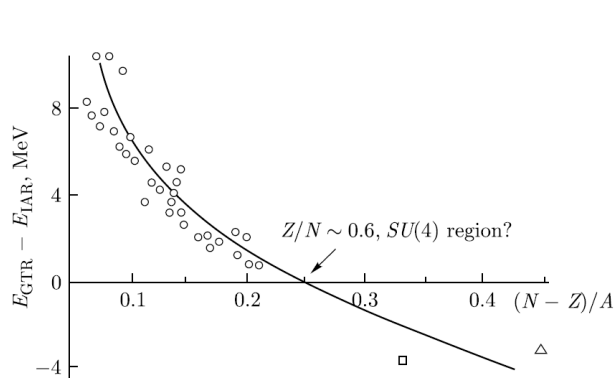


Fig.1. The difference $E_{GTR} - E_{IAR}$ as a function of the neutron excess [1]. Data for ^{11}Li (triangle) and ^6He (square) were added [2]

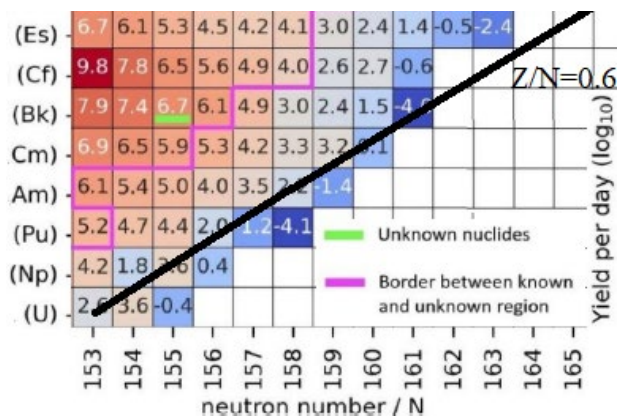


Fig.2. Expected yields ^{48}Ca ($E_{\text{lab}} = 293 \text{ MeV}$, $1.2 \text{ p } \mu\text{A}$) + ^{251}Cf ($500 \mu\text{g}/\text{cm}^2$) at 1% transmission efficiency [3]

Based on theoretical predictions, multinucleon transfer (MNT) reactions offer an approach to these SU(4) region for heavy nuclei [3] and fragmentation reactions for light nuclei [4]. In this report the peculiarities of the β - and γ -decays for light (Fig.1) and heavy (Fig. 2) nuclei in the SU(4) region are discussed.

References

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