

## Shell evolution and spectroscopic factors

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The shell evolution can create various structure patterns, of which the closed-shell structure is of particular interest. Obviously, the closed shell appears if the proton and neutron numbers coincide with magic numbers. It has been known that magic numbers vary as a consequence of the shell evolution due to nuclear forces. Thus, it is of much importance to find where the closed shell appears on the nuclear chart. The  $2+$  energy systematics can be a good indicator of the closed shell. On the other hand, the  $2+$  level reflects many aspects of nuclear forces as well as the shell structure. It is therefore crucial to have additional quantity as a measure of the magicity. We recently proposed “magic index”. This quantity implies how much fraction of the ground-state wave function is composed of the closed-shell configuration. Since correlations occur in shell-model wave functions in general, the magic index cannot be 100%. It depends also on the model space. Within a common or similar model space, the magic index can make sense. For instance, the magic index shows interesting variation among three double-magic nuclei  $^{56,68,78}\text{Ni}$ . It shows rather high value for  $^{52,54}\text{Ca}$ , while their  $2+$  level is not as high as  $^{48}\text{Ca}$ . As the magic index can be measured as spectroscopic factors, it may provide many interesting cases with transfer reactions.

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