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Shell-model applications to gamma-ray strength function and level density

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The nuclear shell model is a very powerful tool to study low-lying level structure in nuclei including very unstable ones, whereas its application to higher excited energy region has been rather limited. This is primarily because a very large model space is required to describe such highly excited levels. Recently, one of my colleagues has developed a large-scale shell-model code named KSHELL which is suited for running on a massively parallel computer such as the K supercomputer in Japan.
In the present talk, I will show some of its recent applications to
gamma-ray strength function and level density for pf-shell nuclei, adopting the full 1-hbar-omega model space or beyond. One of the advantages of the shell-model approach is that one can obtain most of the energy levels including non-collective ones. Indeed, it is demonstrated that nuclear level density is very well described with large-scale shell-model calculations combined with a new stochastic method. As a result, the low-energy tail of the giant resonance, which is composed of the coupling to non-collective levels, is well described. Another advantage of the shell model is that one can easily calculate transition probabilities between excited states. Taking this advantage, we will also discuss some decay properties and
giant resonances on top of excited states.

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