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Recent shell-model results for exotic nuclei

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Recent studies on exotic nuclei have been demonstrating that the shell structure far from stability is rather different from that of stable nuclei. This phenomenon is often called shell evolution. Despite rapid increase of experimental data, the shell evolution has not been fully understood yet. This is partly because experimental levels in general are not pure single-particle levels but are strongly correlated states (for a review, see [1] for instance), and partly because mechanisms causing the evolution, such as the three-nucleon force, are currently under investigation. Thus, large-scale nuclear-structure calculations and reliable theories of the effective interaction are strongly required.

In this talk, we will report on recent advancement of the description of exotic nuclei using large-scale shell-model calculations, focusing on our activities towards universal description of the shell evolution with the shell-model calculation. As for the large-scale calculation, the Monte Carlo shell model (MCSM) has been further developed recently [2], together with the conventional Lanczos diagonalization method [3]. As for the effective interaction, we have recently proposed the monopole-based universal interaction (V_{MU}) [4] for a universal description of the shell evolution. The V_{MU} works quite well also as an effective interaction for the shell model as seen, for instance, from its success in the description of a large deformation in ^{42}Si due to the tensor-force driven Jahn-Teller effect [5]. Those developments enable one to proceed to medium-heavy nuclei on the same footing. We will also pick up some very recent examples such as a systematic study of antimony isotopes from N=50 to 82 with shell-model calculations employing the V_{MU}.

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