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Pairing effect to band termination of Superdeformed band of 36-Ar

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Superdeformed states have been populated exclusively with the fusion-evaporation reactions, which is suitable for a productin of very high-spin states. This is possible through neutron evapolations that do not take angular momentum away from the system. However, as a consequence, such a high-spin states can be produced only for neutron-deficient systems.

A $N = Z$ nucleus near the magic numbers, such as ^{40}Ca, has its ground state with a spherical shape. The Fermi levels sit in the last orbit of the so-called sd-shell, and most of the single-particle levels inside the sd-shell are filled. Hence, any excited states of this nucleus need to cross the shell gap beyond the sd-shell. But, once the gap is broken, substantial amounts of single-particle orbitals are available in the fp-shell, enabling strong collectivity. Consequently and surprisingly, this double-magic nucleus shows a contrasting deformation to the ground-state shape: neutron-richest superdeformation (so far) with $\beta \simeq 0.6$ identified by Ideguchi et al. in 2001 [1].

Prior to the one in ^{40}Ca, a similar superdeformed structure was found in ^{36}Ar [2]. A theoretical analysis based on the cranked Nilsson model predicts quickly growing triaxial deformation of the superdeformed state as the total angular momentum increases. The result was interpreted as the band termination caused by the full alignments of the the active valence orbitals. However, it is known that the rotational alignment is strongly influenced by the pairing correlation, which acts against the Coriolis force. Therefore, it is important to check the pairing effect to the band termination process.

Such an investigation is possible with the Hartree-Fock-Bogoliubov method. Through numerical calcluations the pairing effect is studied in terms of how the band termination process is influenced. In my talk, the details of my analysis will be presented.

[1] E. Ideguchi, et al., Phys. Rev. Lett. 87, 222501 (2001).
[2] C. E. Sevensson, et al., Phys. Rev. Lett. 85, 2693 (2000).

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