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Spatially extended coherence induced by pairing correlation in low-frequency vibrational excitations of neutron drip line nuclei

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Study of low-frequency vibrational excitations in neutron drip line nuclei is one of the most interesting issues in nuclear structure physics. In contrast to vibrations in stable nuclei, the contributing single-particle states are loosely-bound states, resonant and non-resonant continuum states in neutron drip line region. Therefore the two-quasiparticle states (or one-particle - one-hole states in closed shell nuclei) have rich variety of the spatial structure, and the correlations among them may bring about qualitatively new aspects of low-frequency vibrational excitations. In my talk, novel effects of pairing correlations for emergency of low-frequency vibrational excitations in neutron drip line nuclei is discussed paying special attentions to neutrons with small orbital angular momentum ℓ. By solving the Hartree-Fock-Bogoliubov (HFB) equation in coordinate space, we discuss the change of the spatial structure of quasiparticle wave functions induced by pairing correlations; the pairing anti-halo effect in the lower component [1] and the broadening effect in the upper component [2]. The resultant broad localization of the two-quasiparticle states of low-ℓ neutrons produces the coherence in the spatially extended region, and the correlations can cause the large transition strength. By performing HFB plus quasiparticle random phase approximation calculation for the first 2^+ states in neutron rich Ni isotopes, the unique role of pairing correlations is examined [2].

[1] K. Bennaceur, J. Dobaczewski, and M. Ploszajczak, Phys. Lett. B **496**, 154 (2000).
[2] M. Yamagami, preprint nucl-th/0504059.