Single-neutron resonance and pairing correlation in neutron-rich nuclei

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Almost all nuclei except for closed shell nuclei have superfluidity which is originated from pairing correlation. In weakly bound nuclei such as neutron-rich nuclei, the pairing correlation causes configuration mixing involving both bound and unbound (continuum) single-particle orbits since the Fermi energy locates near continuum.

This continuum coupling brings about novel features. An interesting example is the possible manifestation of a new type of resonance generated by the pairing correlation and the continuum coupling, called the quasi-particle resonance [1,2]. If one describes a single-particle scattering problem within the scheme of Bogoliubov's quasi-particle theory, even a scattering state becomes a quasi-particle state that has both "particle" and "hole" components. In other words, An unbound particle couples a Cooper pair and a hole orbit, then forms the quasi-particle resonance.

The Hartree-Fock-Bogoliubov theory in coordinate space can describe such weakly bound superfluid system wthin the scattering wave functions [3,4]. It is a mean-field theory including pair condensate field. The quasi-particle resonance is predicted by this theory.

We have focused on the effects of pairing correlation on low-lying p wave quasi-particle resonance in present study. The phase shifts, elastic cross sections, resonance energy, and resonance width are calculated. We have investigated their dependence on the pairing correlation. Through this investigation, we have discovered that the pairing correlation has the effect of reducing the resonance width [5].

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