Table 1 The radiative and pionic open-charm decay widths of Y(4274) with typical values of *h* and *Λ*

h	Λ (GeV)	Γ_γ(keV)	Γ_π(keV)
−1.60	1.35	0.049	0.29
−1.50	1.55	0.050	0.30
−1.40	1.85	0.050	0.29
−1.30	2.50	0.049	0.30

Our calculation indicates that the decay widths of Y(4274)→$D_s^+ D_s^{*-} \gamma$ and Y(4274)→$D_s^+ D_s^- \pi^0$ can reach up to 0.05 and 0.3 keV, respectively. In addition, the result of the line shape of the photon spectrum shows that there exists a very sharp peak near the large end point of photon energy. The line shape of the pion spectrum is similar to that of the photon spectrum, where we also find a very sharp peak near the large end point of pion energy. According to our calculation, we suggest further experiment to carry out the search for the open-charm radiative and pionic decays of Y(4274).

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1 - 15 Spin-flip Response Function of Finite Nuclei in a a Fully Self-consistent RPA Approach

Wen Peiwei and Cao Ligang

It is well-known that a better description of the spin-flip response, such as the magnetic dipole response and Gamow-Teller response shall enable more reliable predictions for neutral-current neutrino nucleus cross sections for supernova explosion[1] and β-decay half-lives of very neutron-rich nuclei. In this report, we study the spin-flip response of finite nuclei in a fully self-consistent Hartree-Fock plus random phase approximation within the SLy5 Skyrme parameter set[2−3]. We discuss the effect of J^2 terms and spin-orbit interaction on the response function. The J^2 terms are included/excluded both at the mean field and the excited state for self-consistency.

In the past, most of the existed Skyrme interactions, such as SIII and SLy4 parameter sets, have neglected the so-called J^2 terms or the spin-gradient term when one fits the Skyrme parameters. One reason is that it is difficult to include it in the ground state calculations of the deformed nuclei; On the other hand it vanishes for spin saturated systems where the spin density J is equal to zero. But those terms are included in RPA for the excited states calculations automatically; this breaks the self-consistency in the calculation[4]. As mentioned above, the J^2 terms vanish in the ground state calculation of spin-saturated nuclei, but those terms contribute to properties of ground state for spin-unsaturated nuclei, the J^2 terms also contribute to the response function of the finite nuclei, especially in spin-flip response, by acting as part of the particle-hole residual interaction.

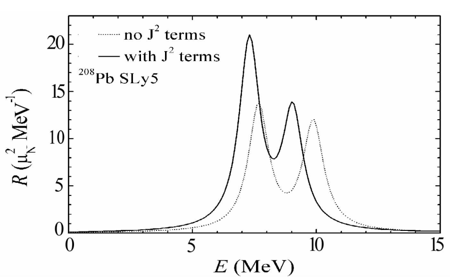

Fig. 1 RPA response functions of ^{208}Pb for M1 mode calculated by the Skyrme HF plus RPA approach with SLy5 interaction.

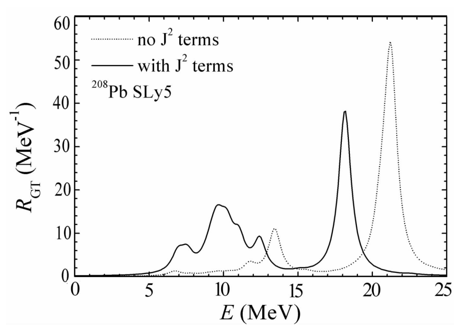

Fig. 2 The same as in Fig. 1 but for GT giant resonance.

In the natural parity response of finite nuclei, the spin-orbit residual interaction gives an attractive contribution in medium and heavy nuclei; it shifts the response function to lower energy region by several hundred keV. In the past, the spin-orbit term is not included in the RPA calculation in the case of spin-flip response, in this work we make the fully self-consistent calculation and study the effect of spin-orbit interaction on the spin-flip response.

In Fig. 1 we show the response functions for the magnetic dipole resonance of ^{208}Pb For the RPA results, the proton $1h_{11/2} \rightarrow 1h_{9/2}$ configuration contributes mainly to the lower energy peak of the response function, and the neutron $1i1_{3/2} \rightarrow 1i_{11/2}$ configuration plays main role in the higher energy peak. It shows that the inclusion of J^2 terms has a strong effect on the distribution of response function; it decreases the excitation energies for both the low-lying state and the higher energy state. The effect comes mainly from two sides, one is due to that the J^2 terms decreases the spin-orbit splitting of the spin-orbit partner states in the mean filed level. In the case of SLy5 force, $\alpha_C = 80.2$ MeV fm^5 and $\beta_C = -48.9$ MeV fm^5, the last occupied state is $1h_{11/2}$ for proton and $1i_{13/2}$ for neutron, the spin density of Eq. (3) is positive for those two states, finally they give a repulsive contribution to spin-orbit potential, the spin-orbit splitting of their partner states is reduced if considering the J^2 terms. which shifts the Hartree response function to lower energy region. The lower and higher peak energies of Hartree response are 6.102 (5.851) MeV and 8.247 (7.492) MeV in the case of excluding (including) J^2 terms. On the other hand, it is obviously that the residual interaction related to J^2 terms plays a role to shift the response function, it gives an attractive contribution, the average value of the matrix elements is about -0.1 MeV by analyzing the numerical results, this can be understood as that the Landau parameter G_0 becomes smaller (from 1.375 to 1.122) when the J^2 terms are included.

Fig. 2 displays the results for the GT giant resonance of ^{208}Pb within SLy5 parameter set. As one can see from Fig. 2, the effect is quite obvious for the magnitude of both excitation energies and excitation strength. The inclusion of J^2 terms tends to decrease the high-lying strength on the one hand and increase the low-lying excitation strength on the other hand, while the excitation energies are reduced both for lower and higher strengths. There are several configurations contribute to the GT response function. Without the J^2 terms, the centroid energies of the two peaks are about 13.5 and 21.3 MeV, respectively. Including the J^2 terms, the centroid energies are moved downwards, the shift being -3.5 MeV for the lower energy peak, and about -3.0 MeV for the higher energy peak. It is obvious that the J^2 terms gives an strong attractive contribution to the matrix elements in RPA because the Landau parameter G_0' becomes negative (from 0.902 to -0.139) when the J^2 terms are included in the GT calculation.

We also investigate the effect of spin-orbit residual interaction on the M1 and GT giant resonance in the RPA calculations. It gives an neglected contribution to the excited energies. The absolute value of the difference between the RPA strengths with/without spin-orbit residual interaction is less than 1.0 MeV^{-1} and 0.3 μ_{N2} MeV^{-1} for GT and M1 giant resonances, respectively.

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