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摘要

Abstract:

1. The β-decay properties of the neutron-deficient nuclei ^{25}Si and ^{26}P ^{22}Al have been investigated at the GANIL/LISE3 facility Radioactive Ion Beam Line in Lanzhou (RIBLL) by means of charged-particle and γ-ray spectroscopy. The decay schemes obtained and the Garrow-Teller strength distributions are compared to shell-model calculations based on the USD interaction. $B(GT)$ values derived from the absolute measurement of the β-decay braching ratios give rise to a quenching factor of the Gamow-Teller strength of 0.6null. A precise half-life of 43.7(6)null ms was detemined for ^{26}P^{22}Al,the β-(2)p decay mode of which is described.
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题目

三作者

2019 年 4 月 26 日

1 introduction

1.1 generalities

$\star\star\star\star background description \star\star\star\star$

1. Over the last decades, β-decay properties of light unstable nuclei have been extensively investigated in order to probe their single-particle nuclear structure and to establish the proton and neutron drip lines.

2.

$\star\star\star\star shell model \star\star\star\star$

Hence, compilation of spectroscopic properites are available for many *sd* shell nuclei from which nucleon-nucleon interactions were derived. β-decay studies of nuclei having a large proton excess are therefore useful to test the validity of these models when they are applied to very unstable nuclei.

$\star\star\star\star reduced transition probability ft \star\star\star\star$

Moreover, in the standard V-A description of β-decay, a direct link between experiment results and fundamental constants of the weak interaction is given by the reduced transition probability ft of the individual allowed β-decays. This parameter,which incorporates the phase space factor f and the parital half-life $t = T_{1/2}/\mathrm{B.R.}$ ($T_{1/2}$ being the total half-life

[*] 脚注

of the decaying nucleus and B.R. the branching ratio associated with the β transition considered), can be written as follow:

$\star\star\star\star$ *equation ft* $\star\star\star\star$

$$ft = \frac{\kappa}{g_V^2 \left|\langle f|\tau|i\rangle\right|^2 + g_A^2 \left|\langle f|\sigma\tau|i\rangle\right|^2} \tag{1}$$

$\star\star\star\star$ *ft explanation* $\star\star\star\star$

where κ is a constant and where g_V and g_A are, respectively, the vector and axial-vector current coupling constants related to the Fermi and Gamow-Teller components of β-decay. τ and σ are the isospin and the spin operators, respectively.

$\star\star\star\star$ *ft meanings* $\star\star\star\star$

Hence, the comparison of the measured ft values and the computed Fermi and Gamow-Teller matrix elements appears to be a good test of nuclear wave fucntions built in the shell-model frame, stressing the role of the overlap between initial and final nuclear states as well as the configuration mixing occurring in parent and daughter states.

$\star\star\star\star$ *mirror asymmetry anomaly and quenching of the GT strength* $\star$ $\star\star\star$

However, two systematic deviations from theoretical predictions shows the limitation of our theoretical understanding and treatment of fundamental interactions. They are reported as the *mirror asymmetry anomaly in* β and the *quenching of the Gamow-Teller strength*.

$\star\star\star\star$ *Mirror asymmetry in* β *decay* $\star\star\star\star$

Mirror asymmetry in β*-decay*: This phenomenon is related to the isospin non-conserving forces acting in the atomic nucleus. If nuclear forces were charge independent, the β^+(EC) and β^- decays of analog states belonging to mirror nuclei would be of equal strength. The deviation from this simple picture is characterized by the asymmetry parameter $\delta = (ft^+/ft^- - 1)$, where the + and - signs are associated with the decay of the proton- and the neutron- rich members of the mirror pair, respectively. Figure 1 presents an updated systematic of δ values measured for mirror nuclei with A $\leq$ 40. Thirty-nine allowed Gamow-Teller mirror transitions with log(*ft*) $\leq$ 6 pertaining to 14 pairs of a mean deviation of about 5% for these nuclei lying in the p and sd shells. The asymmetry reaches 11(1)% if only p shell nuclei are considered, which stresses the interplay between the Coulomb and the centrifugal barriers.