GROUND STATE PROTON EMISSION

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Nuclei far from the line of β-stability are at the focus of the nuclear structure physics community. Recently much experimental work has been carried out on neutron deficient nuclei and the phenomenon of proton radioactivity has been observed in the medium to heavy mass nuclei (A≅100, 150, 160, 190) with Z > 50, where the Coulomb barrier is large enough for the ground state proton emission to occur. In the spirit of Gammon's theory phenomenon of proton emission can be described by proton+core nucleus potential, which consists of an attractive nuclear part combined with Coulomb and centrifugal barrier terms. The potential parameters are fixed from proton nucleus scattering experiments. In most of the earlier studies the half life of the proton emitters have been calculated in the semi classical WKB approximation using the above potential model [1-4]. Earlier studies have shown that for lighter fragment or particle emission outer potential barrier plays an appreciable role and the detailed shape of the inner potential is unimportant. The inner nuclear potential becomes important only for heavy fragment emission. It is likely that the internal degree of freedom of the parent nucleus such as inelastic excitation, collective vibration, deformation etc. may lead to a change in the shape of the barrier. In the present work, based on a potential given by Ginnocchio, we have constructed a smooth realistic analytically soluble potential model to describe the phenomenon of proton radioactivity. The barrier potential has three parameters, height, range and flatness. By varying these parameters barriers of different shapes and sizes are generated. The symmetric nature of Coloumb barrier is created by constructing a composite potential barrier by placing side by side two symmetric barrier potentials. Analytical expression for the transmission coefficient has been obtained which in turn is related to the half life of the proton emitter. The variation in the potential parameters to reproduce the entire range of available experimental data has been studied at length. Possibility of resonance in proton transmission has been investigated.

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