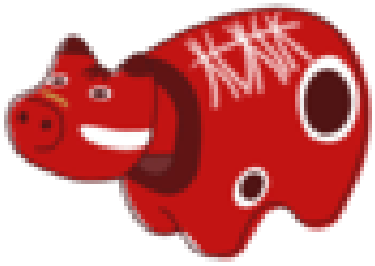

Contribution ID: **3** Type: **not specified**

# Quenching of Gamow-Teller and forbidden transition strength

*Tuesday, 4 March 2025 10:55 (20 minutes)*

Gamow-Teller (GT) strengths in medium and heavy nuclei in the giant-resonance region are suppressed compared to the Ikeda sum rule [1,2]. GT strengths in low-lying states in sd-shell and pf-shell nuclei, for example, have also been found to be suppressed: the quenching factors for the axial-vector coupling, $q_A = g_A^{eff}/g_A^{free}$, are $\sim$0.77 and $\sim$0.74 for $sd$-shell [3] and $pf$-shell [4], respectively. The origin of the quenching of the GT strength can be attributed to the restriction of the configuration space and the contributions from two-body currents, for example, those from the coupling to non-nucleonic degrees of freedom such as $\Delta_{33}$ resonance [5]. The contributions from the two-body current were studied in the GT $\beta$-decay in selected $sd$-shell nuclei with the valence space in-medium renormalization group (VS-IMSRG) method [6] and their effects were found to be important in enhancing the quenching factor by $\sim$0.07.

Here, we study the effects of extending the configuration space: pf-shell components are included to evaluate GT $\beta$-decay strengths in $sd$-shell nuclei. An effective interaction in the $sd$-$pf$ shell obtained by the extended Kuo-Krenciglowa (EKK) method starting from chiral interactions is used [7,8]. The effective interaction proves to be successful in descriptions of the structure of the island of inversion [7]. It also reproduces the GT strength distribution in $^{40}$Ar in the $sd^{-2}pf^{2}$ +$sd^{-4}pf^{4}$ shell-model space with $q_A$=1 [8]. The extension of the model space to the $sd$-$pf$ shell, including up to 2p-2h excitations, in the study of the GT $\beta$-decay in the $sd$-shell is found to enhance the quenching factor by $\sim$0.05 compared to the conventional Hamiltonians in the sd-shell [9]. The effects of more than 2p-2h excitations are estimated by including second-order core polarization contributions [5,10].

Next, we discuss the quenching of the strength in forbidden transitions. $\beta$-decay rates in the $^{208}$Pb region, including the waiting-point nuclei with N=126, are important for r-process nucleosynthesis. In this region of nuclei, there are considerable contributions from first-forbidden transitions. Large quenching in $g_A$ and $g_V$ (vector-coupling constant), or matrix elements of spin-dipole and Coulomb operators, in the first-forbidden transitions are found in the study of beta-decays in N=126 isotones [11,12], in nuclei in the south region of $^{208}$Pb [13], and in N=125 and 126 isotones [14].

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## Type of contribution

## Are you a student or postdoc?

no

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