New clues for the B(E2: $0_1^+ \rightarrow 2_1^+$) behavior around ^{68}Ni : seniority and p-n interaction

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The B(E2: $0_1^+ \rightarrow 2_1^+$) (B(E2)↑) reduced transition probability of an even-even nucleus is correlated to the possibilities to perform, from the single-particle level spectrum of the ground state, excitations leading to the 2_1^+ state. Its value is then very sensitive to the (sub-)shell structure. The difference of B(E2)↑ behavior observed in ^{66,68}Ni and ^{68,70}Zn [1] is important to understand since concerning the still discussed N=40 sub-shell closure.

In recent theoretical papers [2,3] the ^{66,68}Ni B(E2)↑ decrease is discussed using different calculations performed on Ni isotopes only, in relation with the size of the N=40 sub-shell closure. In another paper [4] the $^{62-70}$Zn B(E2)↑ values are analysed on the basis of shell-model calculations performed only in $^{62-70}$Zn. Nevertheless, the Ni and Zn B(E2)↑ curves exhibit features, also observed in heavier nuclei wih N, Z≃40, that a N=40 gap does not allow to explain.

Taking into account these common features, we have analysed the experimental B(E2)↑ values as a function of N using curves obtained in an approximation of the generalized seniority which gives a very simple expression of the B(E2)↑.

Our analysis casts a new light not only on the Ni and Zn B(E2)↑ difference but on the whole B(E2)↑ evolution from the Ni up to the Se isotopes. The reproduction of this evolution requires a complex sub-shell structure in which the p-n interaction plays an important role [5]. It suggests a scenario locating the sub-shell closure at N=38, and a small spacing at N=40 which diminishes with Z as indicated by the excited spectra in the odd-Ni and Zn isotopes.

It is worth noting that the predictions ensuing our calculations have been very recently confirmed by results obtained recently at Ganil on the ^{70}Ni and ^{74}Zn B(E2)↑ [6], at Isolde on $^{74-78}$Zn (preliminary) [7,8]. The results obtained at Riken on the $^{78-80}$Ge [8] fit also pretty well with our scenario. All these new results will be discussed and compared with the predictions of other theoretical approaches.

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