Strength Distributions of Neutron Two-Quasiparticle Excitations in ^{208}Pb

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Using DWBA calculations [1–3] for the analysis of angular distributions of excited states from neutron transfer experiments ^{207}Pb($\vec{\mathrm{d}}$,p)/(d,p)^{208}Pb we derived spectroscopic factors G_{lj} of neutron subshells $\nu \mid nlj\rangle$ in the $6\hbar\omega$ neutron main shell coupled to the $3p_{1/2}^{-1}$ hole of ^{207}Pb.

As a preliminary result of this analysis fig. 1 shows the distribution of the spectroscopic factors G_{lj}^{λ} of all $\nu \mid nlj3p_{1/2}^{-1}\rangle$ two-quasiparticle configurations (further called nlj-transitions) versus the excitation energy in ^{208}Pb. Also indicated in fig. 1 are the cumulative sums $\sum G_{lj}^{\lambda}$ and the sum rule limits $\sum G_{lj} = 2j+1$ according to ref. [4].

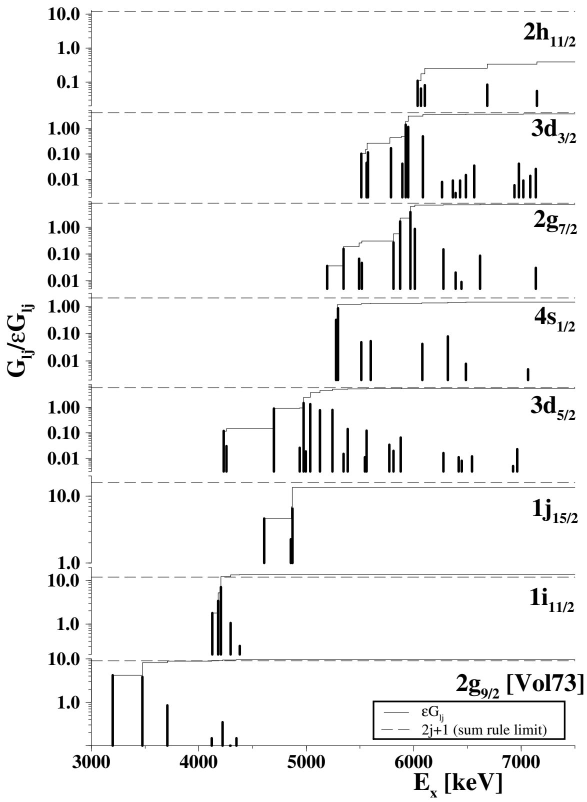

Fig. 1: Strength distribution G_{lj}^{λ} and cumulative sums $\sum G_{lj}^{\lambda}$ and $\sum G_{lj}$ of the neutron $\nu \mid nlj3p_{1/2}^{-1}\rangle$ two-quasiparticle configurations in ^{208}Pb as a function of the excitation energy. The distribution of the $2g_{9/2}$ strength is taken from ref. [5].

Due to configuration mixing and core coupling effects (see e.g. ref. [6]) the nlj transitions in part are considerably fragmented. As a consequence of that the $3d_{3/2}$ and $3d_{5/2}$ strengths are running into each other (see fig. 1) a feature that cannot be obtained from unpolarized (d,p) experiments. The summed strengths of all nlj transitions derived from DWBA calculations are approximately 90% of the corresponding sum rule limits. Since the absolute values of spectroscopic factors depend on optical parameters used in these calculations [7] we also compared the sum of our experimental cross sections for each fragmented nlj transition with the cross section of the corresponding non fragmented one observed in the ^{208}Pb($\vec{\mathrm{d}}$,p)^{209}Pb experiment of N. Seichert [7] of the same incident deuteron energy. Here the agreement is in the present accuracy. We conclude that we observed the complete strength of the investigated two-quasiparticle configurations in excitation range below the neutron emission threshold. Above 4.1 MeV we derived spectroscopic factors G_{lj}^{λ} for 70 excited states - 30 more than M. Schramm extracted from a ^{207}Pb(d,pγ) study [8] in the same excitation range.

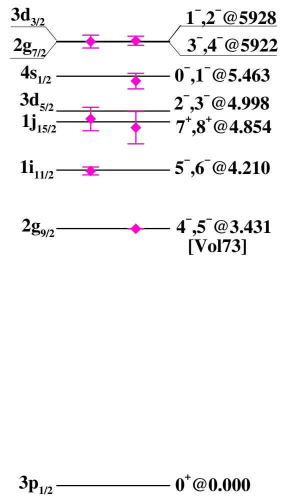

Fig. 2: The values of the mean excitation energy of the observed two-quasiparticle configurations in comparision with corresponding experimental single particle energies of ^{209}Pb with respect to the ^{208}Pb core. The data point of the $2g_{9/2}$ strength is taken from ref. [5].

In fig. 2 we compare mean excitation energies of our observed nlj transitions $E_{lj} = \sum_{\lambda} E_{lj}^{\lambda} G_{lj}^{\lambda} / \sum_{\lambda} G_{lj}^{\lambda}$ with experimental single particle energies of $nlj \otimes ^{208}$Pb configurations which had been used in self-consisent shell-model calculations of refs. [6,9] as zeroth order neutron single particle energies. Also indicated is the spreading $\Delta E_{lj} = \sqrt{\sum_{\lambda}(E_{lj} - E_{lj}^{\lambda})^2 G_{lj}^{\lambda} / \sum_{\lambda} G_{lj}^{\lambda}}$ of the distributions. The further evaluation of the data is in progress.

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