c) The structure of the ground state wave function in the particle-hole representation is more convenient for various approximations (truncation) than in the qp representation.

This illustrates that the BCS-model cannot be interpreted as an approximation method in shell-model calculation.

In Fig. 2 the occupation probability for the second level $j=15/2$ is drawn as a function of ε/G. The straight line corresponds to the BCS ground state $|\bar{o}\rangle$ and the curved line to the shell model seniority zero ground state. It is seen that the BCS-model nicely reproduces the ground state distribution of particles. This suggests the interpretation of the BCS-model as a semi--phenomenological model, simulating the ground state particle density distribution by violating the total number of particles.

Analysis of more realistic calculations shows that the variational procedure for finding the amplitudes v_a sometimes does not reproduce the true ground state occupation probabilities[3], which is the source of disagreement with the shell-model results. Therefore, a new method for calculating the coefficients v_a should be developed, otherwise additional validity criteria for the BCS-model must be established.

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C8 Some Open Problems in the 2s 1d Shell

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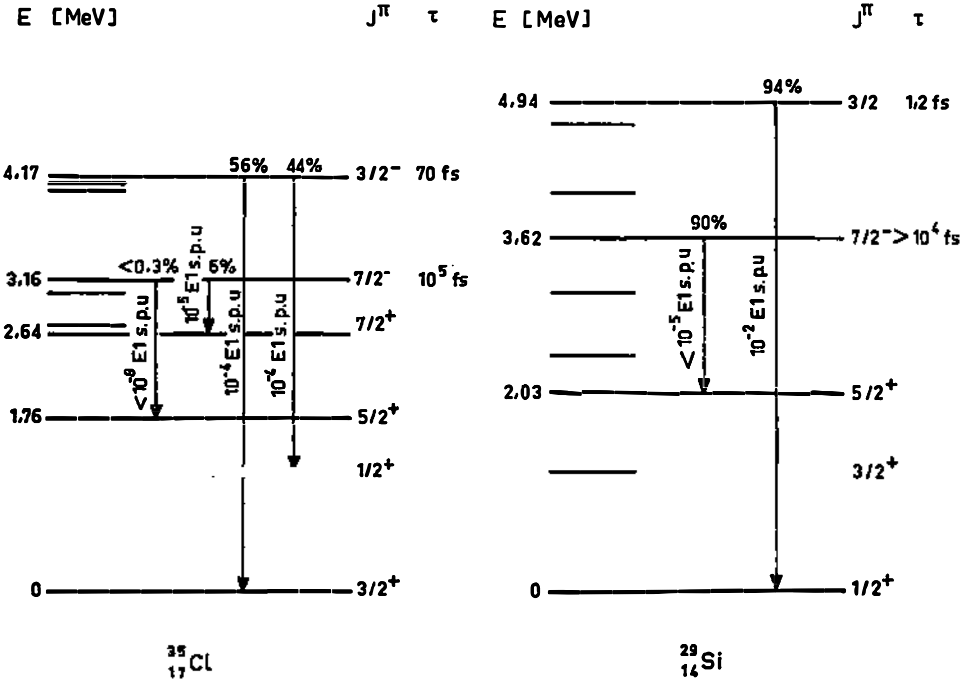
1. Lifetime measurements of the low excited states in ^{35}Cl and ^{29}Si provide evidence for strongly inhibited $E1$ transitions, with a transition strength of 10^{-4}—10^{-8} of the $E1$ Weisskopf single particle unit (Fig. 1)[1,2]. These transitions cannot be accounted for by any of the known selection rules. It is proposed that other similar transitions in the $2s\,1d$ region should be explored to obtain additional information on the $E1$ transitions. So, e.g. there are $7/2^-$ and $3/2^-$ states in ^{33}S with unknown lifetimes at 2.970 and 3.22 MeV excitation energy, respectively. The ^{32}S(d, p)^{33}S reaction can be used to reach these levels. In ^{33}Cl there is a $3/2^-$ state at 2.98 MeV, which can easily be reached via ^{32}S(p, γ)^{33}Cl reaction. In ^{35}Ar the low energy spectrum is completely unknown, but it can be studied via ^{36}Ar(^3He, α)^{35}Ar reaction.

2. The supposed charge independence of the nuclear forces has been questioned in the last few years[3]. The application of the mass formula $M=a+b\cdot T_z+c\cdot T_z^2$



to isobaric analog states over a wide range of A provides a possibility of testing it[4,5]. The higher members of isobaric multiplets in the $2s\,1d$ shell can be reached using the (double) pick-up or stripping reactions.

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C9 Isobaric Splitting of the Giant Dipole Resonance in Nuclei

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The dipole states in nuclei consist in general of two isotopic spin components, T_0 and T_0+1 (T_0 being the ground state isospin). Exceptions are nuclei with $N=Z$ for which only T_0+1 dipole states are possible. The two groups of giant dipole states with two different isospins are separated by about 1/2 MeV per excess nucleon[1].