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Single particle structure coupled to the second 0+ state in 32Mg

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More than 40 years have passed since the first discovery of the island of inversion [1]. In the shell model point of view the phenomenon is attributed to the change of the effective single particle energy, which gives rise to the quenched N=20 shell gap [2]. On the other hand the single particle structures of 31Mg [3] and 33Mg [4] can be well understood in the Nilsson diagram, which suggests that the quadrupole deformation is important and the magicity loss is the result of the deformation. One cannot disentangle the effect of the quadrupole deformation and the tensor correlation experimentally when single particle structure is coupled to the core of the deformed ground state. The studies of the single particle structure coupled to the spherical core is desired.

Around the island of inversion, in the even-even nuclei the second 0+ state were observed. They are regarded to have different shape of that of the ground state. For example, in the case of 32Mg, the second 0+ state is considered to be spherical [5].

Though it is almost impossible to study the transfer reaction on the second 0+ state because of the short lifetime, there is an alternative way to study the single particle structure coupled to the excited state. In the past, the inelastic channel from the isobaric analog resonance were studied extensively for the single particle structure [6]. The inelastic decay widths can tell us the spectroscopic factor coupled to the excited state.

We would like to propose to measure the inelastic channel of the isobaric analog resonances of 33Mg in particular to the second 0+ state. The isobaric analog resonances will be searched by the proton resonance scattering.The resonance is expected to appear above 3 MeV/u. The energy degraded RI beams will be directed upon the hydrogen target. The two cascade de-excitation gamma rays from the second 0+ states of 32Mg will be measured in the coincident with the recoil energy, which enables us to identify the inelastic chanel. In this talk, we will discuss the details of the experimental setup.

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