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Title: **Quadrupole collectivity in neutron-rich light nuclei.**

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Nowadays, many experimental and theoretical studies are focusing on the understanding of how quadrupole collectivity develops in neutron-rich light nuclei. The main reason being that, for those nuclei, the $N = 20$ and $N = 28$ shell closures seem to be weakened opening up the possibility of quadrupole deformed ground states. The best example, up to know, of the erosion of the $N = 20$ shell closure corresponds to the first excited 2^+ state in ^{32}Mg [1]. Both its excitation energy and its $B(E2)$ transition probability indicate [2] that this state is the member of a strongly deformed rotational band. From a theoretical point of view, this nucleus has been studied with the shell model (SM) and with the mean field method. In the later method the key ingredient to obtain a deformed ground state in ^{32}Mg is the rotational energy correction [3] which is usually disregarded in mean field calculations for heavier nuclei. In order to study the properties of the neutron rich nuclei around $N = 20$ and $N = 28$ we have used the Gogny interaction (D1S parameterization) to perform, as an initial step, HFB calculations constrained in their quadrupole moment for several nuclei. To evaluate the effect of the restoration of the rotational symmetry we have computed [4] the angular momentum projected (AMP) energy curves for the quadrupole constrained HFB intrinsic states. The main conclusion of those calculations is that the AMP dramatically changes the HFB energy landscape. For instance, the ground state of the nucleus ^{32}Mg is spherical in the HFB calculation but it becomes deformed in the AMP one. We have also found that in many cases two coexisting minima appear after the AMP has been carried out. Therefore, for a proper description of the ground and excited states of the nuclei considered we have performed configuration mixing calculations (GCM) with the angular momentum projected wave functions (AMP-GCM).

In my talk I will present the results of such AMP-GCM calculations for several neutron rich and light nuclei. To be more precise, I will discuss the isotopes $^{30-34}Mg$ [5], $^{32-36}$Si and $^{28-32}$Ne to illustrate the erosion of the $N = 20$ core and the isotonic chain $^{40}Mg -^{48}Ca$ [6] to illustrate the erosion of the $N = 28$ core. The theoretical results for two neutron and two proton separation energies, excitation energies and $B(E2)$ transition probabilities agree well with both experimental results and the calculations carried out with other interactions and/or methods.

References

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Invited talk.