Contribution ID: **87** Type: **Poster**

Nuclei in the limits of the drip line: a study of the regions N=20 and N=34

By using a non-relativistic independent particle approach, we have investigated the mechanism promoting $N = 34$ as a new magic number [1]. We carried out Hartree-Fock plus Bardeen-Cooper Schrieffer and Quasi-particle Random Phase Approximation calculations by consistently using the same finite-range interaction in all the the steps of our approach [2]. We used four Gogny-like interactions, with and without tensor terms. We found that the shell closure for $N = 34$ neutrons appear in isotones with proton number smaller than 26. The smaller is the proton number, the more evident is the shell closure at N=34. For this reason, we studied in detail the nucleus ^{48}Si, that appears to be the nucleus with the lowest value of Z for $N = 34$ before the drip line [3]. By using the same techniques, we have investigated also the mechanism producing the extinction of the $N = 20$ neutron shell closure in the nucleus ^{32}Mg [4]. We studied the contribution of the tensor interaction in the emergence of new magic numbers or in the disappearence of the traditionally ones.

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Session Classification: POSTER SESSION