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The kink effect of the nuclear charge radii in some isotopic chains and the nucleon-nucleon tensor force within nonlinear relativistic models in the Hartree-Fock approximation.

The marked change in trend of the evolution of the charge radii of some isotopic families of nuclei versus the mass number A is known as kink effect. This is a consequence of the shell structure of nuclei and, obviously, cannot be explained by the droplet model. The fact that the density-dependent Hartree-Fock model with standard Skyrme functionals [1] or Gogny forces [2] were not able to reproduce this effect for the lead isotopic chain, for example, whereas the relativistic models in the simple mean-field approach did reasonably well [3,4], has increased the interest in understanding the mechanism responsible for the kink effect [5-12]. However, it seems that the full theoretical understanding has not been reached yet.

The aim of this communication is to use relativistic nonlinear models based on the Hartree-Fock approximation, including the sigma, omega, pi and rho mesons, to explore the influence of the nucleon-nucleon tensor force on the behaviour of the nuclear charge radii of some isotopic chains.

It is found that most of the effect of the tensor force on the nuclear charge radii is channeled, indirectly, through the effect of this force on the spin-orbit splittings. We conclude that the formation of the kink effect in the lead isotopic chain is produced, essentially, by the combination of the binding energy of the 1i11/2 neutron orbital and its geometrical properties, which cannot be reduced to the magnitude of the overlap of its wave function with those of the proton orbitals.

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