Hard-core's Physical Origin and Action Mechanism

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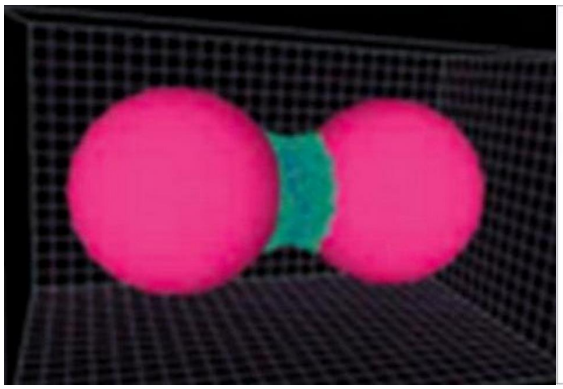
Abstract: giving a new explanation for the physical origin and action mechanism of the nuclear force's 'hard-core' repulsive

Main Viewpoints and Conclusions:



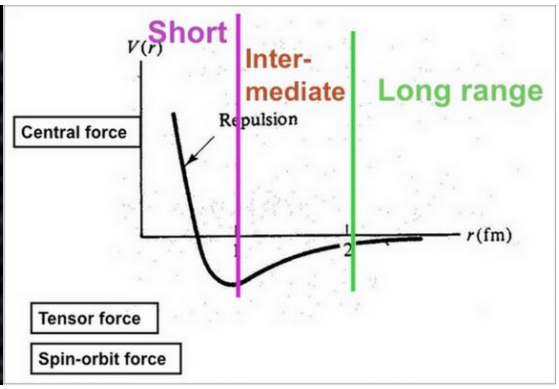


Image 1. shows a Deuteron *Image 2. features of nuclear forces*

These images selecting from the internet, many thanks to the authors of the images and the articles

An atomic nucleus with Z protons and N neutrons is also consists of $A(\geq 2)$ protons and N π-mesons; and the $A(\geq 2)$ protons are glued together by the N π-mesons and then forming into the nucleus; or in another perspective, the $A(\geq 2)$ protons are glued together by one body which consists of N π-mesons that in the form of soft matter with negative charges and then forming into the nucleus. [1][2][3]

For instance, a Deuteron consists of a neutron and a proton; and a neutron consists of a proton and a π-meson; that is the Deuteron consists of two protons and one π-meson, and the two protons (red) are glued together with the π-meson (green) and then forming into the Deuteron by the mutual attraction — the nuclear force, which produced of the positive-negative charges that belongs to each of their own. [1][2][3][4]

Moreover, nuclear forces with a 'hard core' repulsive force at the least distance between their centers of nucleons less than 1.5 fm; also the least distance between of protons' edge less than 0.5 fm (by combined with the experimental results in [1] and [5], and obtained r_p = 0.5 fm; r_n = 2.0 fm; the thickness of neutrons' π-meson outer layer is 1.5 fm). [1][2][5][6]

Then, a conclusion could be obtained by the nuclear force with the 'hard core' repulsive at the least distance between of protons' edge less than 0.5 fm, and the conclusion is that a π-meson has the minimum effective shield thickness to the positive Coulombic force of protons should be not less than 0.5 fm.

Within an atomic nucleus, for instance, a Deuteron — that consists of two protons and one π-meson, if the π-meson's thickness which existing between the two protons less than 0.5 fm, or more accurately, if the least distance between the two protons' edge less than 0.5fm, the thickness of the π-meson that existing between the two protons has also been less than 0.5 fm, and then has been insufficient to shield the two proton's electrical properties appear, at same time, the Coulomb repulsion force between the two protons would take their effects immediately, until the minimum distance between them returned to 0.5 fm above, and reached the net attractive state that the Coulomb repulsion force between the two protons has been effectively shielded.

References

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