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Nuclear force is a QCD duplication of QED molecular force

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The prevailing idea about nuclear force is due to meson exchange, either phenomenological one boson exchange model or chiral perturbation effective theory both describe the NN interaction data quite well. However they can not explain a long standing fact, as emphasized by Bohr and Mottelson in their Nuclear structure book, the nuclear force is quite similar to molecular force except the energy and length scale. In addition they are hard to describe the hadron interaction beyond the meson production energy region , i.e, 150 MeV higher than NN threshold. In recent years lattice QCD improve their calculations of NN interaction
directly from quark-gluon structure. However it is also hard for lattice QCD to explain why nuclear force is similar
to molecular force.

We extend the Gell-Mann quark model from hadron spectroscopy to hadron-hadron interaction, where we introduce
the quark delocalization between quarks confined in different hadrons, similar to electrons delocalization between
different atoms. This model describe the vast amount of NN inteaction data as well as the meson exchange model,
describe the nucleon-hyperon interaction as well as the SU(3) extension of the phenomenological one boson exchange
model. It predicts the “inevitable dibaryon d*”, a hadron binding energy scale tight bound six quark system, which had
been discovered by WASA-at-COSY collaboration through comprehensive measurements. Predicting the existence of
nuclear scale binding N-Omega dibaryon, which had been confirmed by Japenese lattice QCD calculation and STAR
collaboration N-Omega scattering data proved attraction between N and Omega. It describes the pJ/psi pentaquark
states well and predicting there must be Jˆp=1/2ˆ- resonance. It also predicts all discovered pJ/psi resonances should
be negative parity ones.

The most important one is up to now it is the only one model which explains why the nuclear force is similar to the molecular
force because it shows the nuclear force is a QCD duplication of QED molecular force.

Abstract Type

Talk

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