A possible explanation of asymptotic freedom and quark confinement

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Abstract
In strong interaction, asymptotic freedom and quark confinement are still two unsolved puzzles. Here I propose that color charge field is like magnetic field to have zero divergence. Thus, no single colored charge can be isolated just like we cannot isolate magnetic monopole. In addition, the closer the two or three quarks, there won't be more interaction force like electric force or gravity. Thus, this can explain the two phenomena: asymptotic freedom and quark confinement.

Main text

In QCD, there are two puzzling phenomena: quark confinement and asymptotic freedom. Only white color can be made in strong interaction including red quark, blue quark, and green quark. Or, a green quark and an anti-green anti-quark to make a white color. No single colored quark can be isolated. This is called quark confinement. In addition, when two or three quarks become closer, the interaction between them won't be stronger. This is not like electric force or gravity interaction that the force increases with closer distance. This phenomenon in strong force is called asymptotic freedom.

Here, I will propose a mechanism to solve the two puzzles. I propose the color charge field divergence is equal to zero. This is mimicking magnetic field. There is no magnetic monopole. When there is magnetic north pole, there is always magnetic south pole. That is the same with strong interaction. There should be existing red, green, blue color for each quark or colored with anti-colored quark to make a white color in strong interaction. This solves quark confinement. We cannot isolate magnetic monopole. And, we cannot isolate single color quark.

This can also solve asymptotic freedom. Because the divergence of electric field and gravity field is not zero, the closer the objects, the stronger the interaction force. However, if the field of colored charge divergence is zero, then the interaction won't be stronger if the two color charged quarks become closer to each other. This solves the asymptotic freedom in strong interaction. Strong interaction is just like magnetic force. Because its divergence is zero, we should expect its curl is not zero. Thus, field of glueballs with quarks and gluons should have curl. We can use three dimensional rotations to solve this problem. For example: +X is red, -X is anti-red, +Y is blue, -Y is anti-blue, +Z is green, and -Z is anti-green. This might also solve proton spin crisis.

Another thought of free neutron decay is below. Beta decay will release W- boson which can finally become electron and neutrino. W- boson can also decay into quark anti-quark pair such as anti-up quark and down-quark pair that is equal to a pion-. Pion- mediates attractive force between nucleons. Thus, we can view there is a pion- hidden in neutron that mediate the force between proton and neutron inside the atomic nucleus. This is a SU(2) quantum hadrodynamics. We know neutron has magnetic moment which can be also explained by the hidden pion-, and there is magnetic attraction between neutron and proton. Because magnetic field has no divergence, this is the reason for SU(2) asymptotic freedom.

There is no magnetic monopole because of zero divergence of magnetic field. Thus, there is no color charge in QCD due to the zero divergence of gluon fields. Each gluon composes of one positive color and one anti-color, so it is like a dipole magnet. This explains the quark confinement in QCD. In addition, asymptotic freedom can also be explained. For example: a pion composed of anti-blue quark, blue ant-quark, and a blue-anti-blue gluon. The anti-blue quark links to the pole of blue color of the gluon, and the blue anti-quark links to the pole of anti-blue color of the gluon. When the two quarks come closer, the ant-blue quark will experience the repulsive force from the pole of anti-blue color of the gluon. In addition, the blue anti-quark will experience the repulsive force from the pole of blue color of the gluon. Thus, the attractive force mediated by gluon will be attenuated. This is the reason of asymptotic freedom. In my theory, free blue-anti-blue gluon and green-anti-green gluon could exist. Because of zero divergence of gluon field, we can view the gluon filed described by a curl like magnetic field. Besides, all fundamental particles rotate in constant lightspeed, so we can still use Yukawa potential to describe gluon field.

Back to the hidden pion theory, we can view the neutron as a composite particle. It can be viewed as a proton plus a minus pion. This view can also help to explain why neutron has magnetic moment. Proton is made of UUD, and minus pion is made of $\underline{U}$D. The two combined is equal to a neutron UDD. Thus, if a neutron links a proton in the nucleus, we can see it as two protons link together via a minus pion. Actually, by release or absorb pion, neutron and proton can change each other. Thus, pion is actually mediating nuclear force. This can be formulated by Yukawa potential, and this force is always attractive because pion has an even spin zero. Unlike gluon or photon, it has an odd spin one and it can cause attractive or repulsive force. Gluon force and electromagnetism can also be formulated by Yukawa potential. However, photon has no mass and gluon or pion has mass. Thus, photon mediated force is long ranged and gluon/pion mediated force is short ranged inside atomic nucleus.

Finally, I will talk about beta decay. Beta decay is thought to be a release of W- boson from neutron to form a proton, an electron, and a neutrino. We can also view this as a minus pion release from the neutron. Neutron can decay into proton because neutron has larger mass. W- boson is much heavy, although particles can borrow energy from vacuum due to uncertainty principle. It is more reasonable that a light minus pion released from the neuron for beta decay. A neutron in the atomic nucleus won't decay because there is a proton-pion-proton binding which is described above. Only free neutron without such binding decays. One a minus pion was released from the neutron, the proton can be formed. The minus pion can then borrow energy to form a W- boson. Beta decay happens. A minus pion can decay into muon and an anti-muon neutrino. The decay continues, the muon will decay into an electron, a muon neutrino, and an anti-neutrino (i.e. neutrino itself). The muon neutrino and anti-muon neutrino cancel each other. Thus, the final product of neutron beta decay is a proton, an electron, and a neutrino.

Thus, SU(3) strong force can form quarks and gluons to make neutrons and protons. SU(2) weak force can bind neutron and proton via the minus pion to form atomic nucleus. The SU(2) weak interaction also can produce electron. The U(1) electromagnetism also help proton and neutron to bind together, and it also help electron to orbit around the atomic nucleus to form an atom.