

CU Physics Department Colloquium

Monday, February 20, 2012 4:10 PM 428 Pupin Hall

Exploring the fundamental properties of matter with an electron-ion collider



The proton and neutron, known as nucleon, are the basic building blocks of all nuclear elements that are responsible for our lives and the world of visible matter in the universe, while the proton and neutron themselves are not elementary and are made of quarks and gluons of Quantum Chromodynamics (QCD). One of the most challenging questions in physics for the past several decades and the future is to understand how quarks and gluons form nucleons and nuclei, and to describe their properties in terms of the dynamics of QCD. Like the atom, the elementary bound state of Quantum Electrodynamics, the nucleon is an elementary bound state of QCD. Unlike the atom, whose mass is almost entirely concentrated in a tiny nucleus, the nucleon mass seems to be dominated by energy of gluons zooming around relativistically. In this talk, I will demonstrate that an energetic electron-ion collider with a good luminosity and beam polarization is an ideal machine to scan the internal quark and gluon structure of nucleons and nuclei at a sub femtometer (even at an attometer) scale, and it is a much needed machine to explore the role of gluons in determining the nucleon and nuclear properties.



Jianwei Qiu, Brookhaven National Laboratory