

# 1st Annual Hampton/MIT Summer Program

for

## Undergraduate Research with an Electron Ion Collider

Application deadline: **March 15, 2007**

Inside protons and neutrons, or nucleons, quarks and gluons move around at nearly light-speed, and extra gluons and quark/anti-quark pairs pop into existence one moment only to disappear the next. It is this activity that generates nearly all the mass of nucleons and ultimately of all visible matter. Peering inside the nucleon with a moderate-resolution microscope, one witnesses a few ever-present quarks and a sea of activity. How are the quarks, anti-quarks and gluons spatially distributed in nucleons, how do they move, and how do they contribute to the nucleon's spin? We have partial answers to these questions from years of measurements with high-energy probes, yet their precise roles remain to be determined and mapped out. Improving the resolution even further reveals a flood of gluons that overwhelm the quarks, with gluons packed so densely that they start annihilating each other. Are these gluons affected by nuclear properties, and can one directly study the properties of these gluons in bulk?

A novel Electron Ion Collider has been proposed that will allow us to look in detail into the sea of quarks and gluons, to create and study gluons, and to discover how energy transforms into matter. It will address compelling key physics questions essential for our understanding of the fundamental structure of matter:

- Precision imaging of the sea-quarks and gluons to determine the spin, flavor and spatial structure of the nucleons
- Definitive study of the universal nature of strong gluon fields manifest in nuclei.

The Massachusetts Institute of Technology and Hampton University Physics groups are key players in the development of this Electron Ion Collider, and in particular co-lead the physics simulation and the detector research and design efforts. We offer a Summer research opportunity to undergraduate students to participate in these studies. During this 1st Summer Program, we foresee the students to predominantly reside near the Thomas Jefferson National Accelerator Facility and work with Hampton University faculty, with a visit to the Massachusetts Institute of Technology included. Travel, housing and a per diem will be paid for successful applicants. Participants will also be encouraged to continue this program for a second Summer period, when their activities will predominantly take place at the Massachusetts Institute of Technology.

### To apply, email:

Prof. Richard G. Milner, [milner@mit.edu](mailto:milner@mit.edu)

or

Prof. Rolf Ent, [ent@jlab.org](mailto:ent@jlab.org)

*Include a succinct paragraph stating your interest and academic background.*

