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# Prof. Chi-Jen David Lin/ Institute of Physics

## Non-perturbative Quantum Field Theory, Higgs Physics and the Electroweak Symmetry Breaking, Lattice Quantum Chromodynamics

We are the "Lattice Field Theory Group" (Figure 1) at Institute of Physics, National Chiao-Tung University. We study non-perturbative strongly-interacting quantum field theories in high-energy physics by investigating these theories on a space-time lattice in a finite box (Fig. 1). This formulation of quantum field theories is closely connected to the theory of phase transitions and critical phenomena. It enables us to carry out large-scale numerical computations using supercomputers. Our primary research interests on this subject include the following two major parts: **(a) Higgs Physics and the Electroweak Symmetry Breaking:** The recent discovery of the Higgs boson at CERN (Fig. 2) results in several open questions in particle physics. These questions are at the core of the validity of the Standard Model (SM) as a theory that can be valid at high energy scales which may be reached by future experiments. In addition to studying the Higgs-Yukawa sector of the SM thoroughly, we are researching on the possible alternative scenario of treating the Higgs boson as the bound state of new particles that still to be discovered. **(b) Lattice Quantum Chromodynamics (QCD):** We are working on new methods to apply this most beautiful and successful theory in particle physics in a thorough understanding of the structure of protons and other hadrons (Fig. 1).

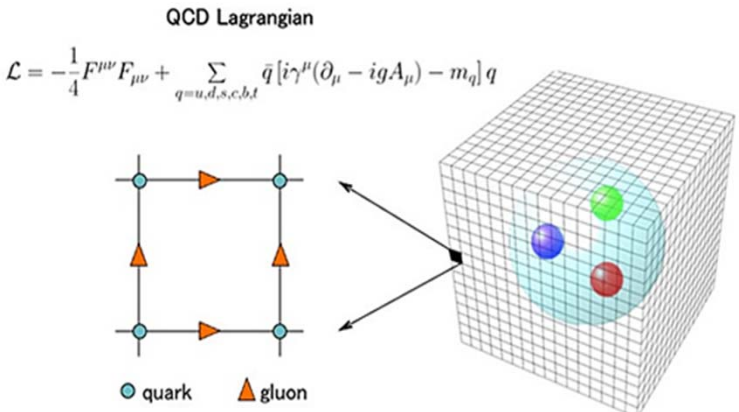


Figure 1

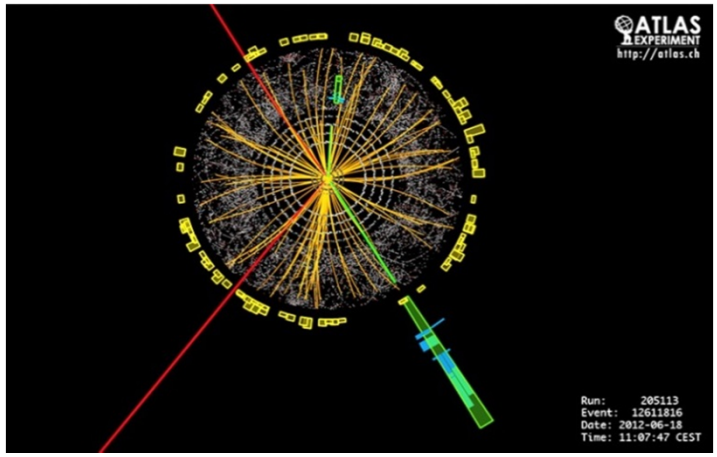


Figure 2

**Key Facilities:** Our brains, assisted by high-performance computing facilities at NCTU and National Centre for High-performance Computing. Active discussions with particle physics phenomenologists and string theorists around the world.