Theoretical study of particle phenomenology and dynamics of quantum gauge theories

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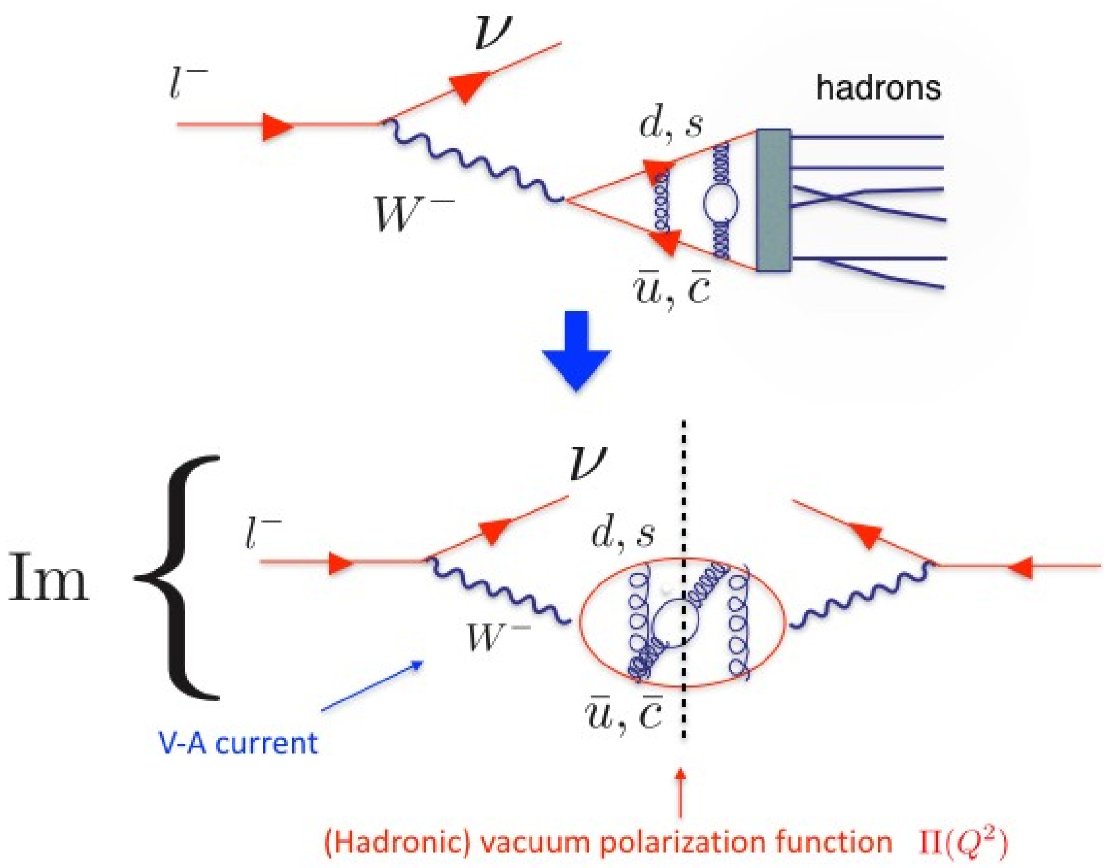

Diagram for weak decay of the charged leptons (top). Using the optical theorem, the width of inclusive hadronic decay is related to the hadronic vacuum polarization functions measured on lattice (bottom).

The standard model of particle physics has succeeded in explaining the present high energy experiments. However, there exists several theoretical problems: absence of the dark matter candidate, the mystery of the origin of matter. Inadequacies of the standard model may require new physics beyond the standard model. This is our key motivation to research particle phenomenology of various new physics models. Since an experimental observation of the deviation from the standard model is an important clue for new physics, precise determinations of the standard model parameters are important. Among them, quantum- chromodynamics quantities that relate the dark matter or universe's matter dominance have not been precisely calculated from a first principle. We calculate these quantities by using numerical simulations of the first principle lattice gauge theories, and study phenomenological applications to new physics models such as supersymmetric standard models or composite particle models. We are also investigating non-perturbative dynamics of the quantum gauge theories.

Keywords : Particle phenomenology, Lattice gauge Theory, Numerical Simulation of Lattice Quantum Chromo Dynamics, Dark matter, String Phenomenology