

Title : Discretization of Integrable Quantum Field Theories from 4d Chern-Simons Theory

Abstract : In this talk, I shall first provide a review of various aspects of 4d Chern-Simons theory. I shall then present results based on ongoing work with Jun-ichi Sakamoto and Masahito Yamazaki, where we elucidate the relationship between 2d integrable field theories and 2d integrable lattice models via the discretization of order surface operators to Wilson lines in 4d Chern-Simons theory. This provides a convenient framework to study the quantum integrability of a large class of classically integrable field theories in terms of integrable quantum spin chains. In particular, we show how lattice discretization can be realized, via perturbative 4d Chern-Simons theory, for the Faddeev-Reshetikhin model, the Zakharov-Mikhailov model, the massless Thirring model, sigma models on spheres, as well as the trigonometric and elliptic generalizations of these models. More generally, we discuss how lattice discretization can be realized for a pair of affine vertex operator algebras. Anomalies that prevent the quantization of certain integrable field theories are interpreted as obstructions to converting a discretized surface operator into a collection of Wilson lines.