

# Department of Mathematics

North Carolina State University

## Lectures on Mathematics in Our Time

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**Massachusetts Institute of Technology**

November 11, 2004, 4 p.m.  
201 Harrelson Hall



**"Vertex algebras and quantum Hamiltonian reduction"**

I will start by reviewing the basic principles of Quantum Field Theory, and then I will derive the notion of a vertex algebra from them. Several equivalent definitions will naturally follow. In the second part of the talk I will explain how the quantum Hamiltonian reduction in the framework of vertex algebras is used in the representation theory of infinite-dimensional Lie (super)algebras.

### **About the speaker**

The theory of Lie groups and Lie algebras is intimately connected with the study of symmetry in Nature. The representation theory of Lie algebras (and in particular that of infinite-dimensional ones) has a wide range of applications in many areas of mathematics and physics, such as number theory, combinatorics, integrable systems, conformal field theory, and string theory. Many of these applications use a kind of infinite-dimensional Lie algebras called Kac-Moody algebras, which were discovered in the late 1960's independently by Drs. Kac and Moody. Over the last forty years, Dr. Kac has made monumental contributions to infinite-dimensional Lie algebras, Lie superalgebras, vertex algebras and conformal field theory. Dr. Kac received his Ph.D. in 1968 from Moscow State University, and has been a Professor of Mathematics at MIT since 1977. He is an honorary member of the Moscow Mathematical Society, and is the recipient of Sloan and Guggenheim Fellowships, the Medal of the Collège de France, and the Wigner Medal in 1994 for "outstanding contributions to the understanding of physics through group theory."