Title: Quantum deformation theory

Abstract: Quantum deformation theory is based on the Quantum Master Equation (QME), also known as the Batalin-Vilkovisky (BV) Master Equation: $d S + h \Delta S + 1/2 \{S,S\} = 0$, inasmuch as classical deformation theory is based on the Classical Master Equation (CME), a.k.a. the Maurer-Cartan Equation: $d S + 1/2 \{S,S\} = 0$. The QME is defined in a space $V [[h]]$ of formal power series with values in a differential graded (dg) BV algebra V , whereas the CME is defined in a dg Lie algebra g.

In classical deformation theory, there are two sides of the story: abstract deformation theory, coming from the works of Deligne, Schlessinger, Stasheff, Goldman, Millson, Kontsevich, and Soibelman, and concrete deformation theories, such as deformations of complex structures (Kodaira-Spencer), associative algebras (Gerstenhaber), and many others. Abstract deformation theory takes the dg Lie algebra g as a primary object and studies the CME, the associated deformation functor, and its moduli space. Concrete deformation theory presents a dg Lie algebra governing the deformation problem and uses the specifics of the concrete situation to understand the local structure of the moduli space, such as smoothness, formality, obstructions, virtual dimension, etc.

In quantum deformation theory, just a tip of the iceberg is beginning to appear. There are a few papers which may be viewed as making first steps in abstract quantum deformation theory: Quantum Backgrounds and QFT by Jae-Suk Park, Terilla, and Tradler; Modular Operads and Batalin-Vilkovisky Geometry by Barannikov; Smoothness Theorem for Differential BV Algebras by Terilla. In the paper on Quantizing Deformation Theory, Terilla puts forward a program of quantizing deformation theory.

There is no general theory of quantum deformations yet, and it is not understood what quantum deformations are in concrete examples. Further steps in quantum deformation theory have been discussed in the talk.