THE UNIVERSITY OF HONG KONG

Institute of Mathematical Research
Department of Mathematics

GEOMETRY SEMINAR

A 2-Introduction to deformation quantization

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Abstract

This is meant to be an introduction to introductions to *deformation quantization*. Physical theories have their domain of applicability. The "Flato deformation philosophy" states that in the passage from one domain to another attached mathematical structures are *deformed* in some category. For instance the Galilean geometrical symmetry group of Newtonian mechanics is deformed to the Poincaré group in the theory of relativity. We shall start with a quick survey of the Gerstenhaber (1964) theory of deformations and its origins, and of the advent of quantization in physics. We concentrate on deformations of the algebra of functions over a symplectic or Poisson manifold, indicate how we arrived to the idea that this can (in fact, should) express quantization, and sketch some developments in the past 35 years. In addition to its developments in physics the idea is seminal in a variety of areas of mathematics, going from e.g. algebraic geometry to index theorems to number theory and representation theory. Quantum groups and noncommutative geometry can be considered as avatars. For some more details see first an extensive review of deformation quantization [2] from about 10 years ago, the "founding papers" [1], e.g. [3,4], and references therein.

References:

[1] F. Bayen, M. Flato, C. Fronsdal, A. Lichnerowicz and D. Sternheimer: *Deformation Theory and Quantization: I. Deformations of Symplectic Structures*, and *II. Physical Applications*, Ann. Phys. **111**, 61--110 and 111--151 (1978).

[2] G. Dito and D. Sternheimer, *Deformation quantization: genesis, developments and metamorphoses*, pp. 9--54 in: *Deformation quantization* (Strasbourg 2001), IRMA Lect. Math. Theor. Phys., **1**, Walter de Gruyter, Berlin 2002 (math.QA/0201168).

[3] D. Sternheimer, *Quantization is deformation*, pp. 331--352 in (J. Fuchs et al. eds.) *Noncommutative Geometry and Representation Theory in Mathematical Physics*, Contemporary Mathematics **391**, Amer. Math. Soc. 2005.

[4] D. Sternheimer, *Quantization: Deformation and/or Functor*?, Lett. Math. Phys. **74** (2005), 293 -- 309.

Date:	February 9, 2012 (Thursday)
Time:	3:30 – 4:30pm
Place:	Room 208, Run Run Shaw Bldg., HKU

All are welcome