School Geoquant 2017

The focus on the **2017 Geoquant school** will be on the quantization of moduli spaces of bundles and metrics, Higgs bundles, Hitchin systems, WKB analysis, BV quantization, topological recursion, mirror symmetry, and integrable systems.

Those topics are clearly in the center of the current interest in the field. We are happy that we could find leading experts in the field which are willing to deliver introductory lectures. The following lectures are foreseen:

- Jørgen Ellegaard Andersen (CGM, Aarhus University, Denmark), *Geometric Quantisation of Moduli Spaces*

  This mini course we will cover the basics of quantization of moduli spaces of bundles over Riemann Surfaces. This will include both moduli spaces for compact Lie groups and also for non compact ones, which can also be though of a moduli spaces of Higgs bundles. In particular we will discuss quantisation with respect to both complex and real polarisations,the old and new Verlinde formulae and construct Hitchin-Witten connections so as to obtain quantum representation of mapping class groups.

- Kohei Iwaki (Nagoya University, Japan), *Exact WKB analysis and related topics.*

  Exact WKB analysis, developed by Voros et.al., is an effective method for global study of (singularly perturbed) ordinary differential equations defined on a complex domain. After recalling several fundamental facts about exact WKB analysis, I will explain the relationships to other research topics, such as cluster algebras, topological recursion, integrable systems of Painleve type and many more things.

- Si Li (Tsinghua University, China), *BV quantization and geometric applications*

  In this lecture, we discuss the homological method of BV quantization in quantum field theory, with emphasis on geometric applications. We introduce the basics of infinite dimensional techniques of renormalization method in QFT, and discuss the geometry of BV quantization in low dimensional examples. As applications, we explain its relation with index theorems in 1d, integrable hierarchies in 2d, and quantum B-model on Calabi-Yau geometry.

- Alexander Veselov (Loughborough University, UK), *Algebra and geometry of quantum Calogero-Moser systems*

  Quantum Calogero-Moser systems play a very special role in the modern theory of integrable systems and were the subject of active investigations over the last few decades. Mathematically they can be considered as far-going generalisations of the radial parts of Laplace-Beltrami operators on the symmetric spaces and thus are naturally related to representation theory and new classes of special functions (Jack, Macdonald). The discovery of Dunkl operators provided a simple proof of their integrability and led to the new important class of algebras (Cherednik).

  The aim of the course is to introduce the main ideas and techniques behind integrability of the quantum Calogero-Moser systems and their deformed versions, including relations with the theory of symmetric functions and Lie superalgebras.

Each of these courses are planned for 4-5 sessions each lasting one hour. In addition to them we will allow short presentations (e.g. posters, talks by the participants). As they have been proven very effective in former schools organized in the frame of the GEOQUANT activity, regular discussion sessions are foreseen. There students can ask the lecturers additional questions in a less formal way, demand for more background information or even present by themselves certain aspects.

18.1.2017