1. **Yael Fregier** (MIT, USA; Lens, France)

   Title: Moduli spaces of algebraic structures and Maurer-Cartan equations

   Abstract: The aim of this course is to be and introduction to the study of deformation theory and its physical application to quantization.
   We will start by illustrating the deformation theory of quadratic algebraic structures with the example of associative algebras. In particular this can be applied to formalize quantization as a deformation, the so called "star product".
   We revisit the example of associative algebras with the language of DGLA and Maurer-Cartan equation. We then motivate the introduction of the notion of L_∞ algebra by its use to describe moduli spaces of non-quadratic algebraic structures. We use L_∞ algebras to formulate the formality theorem, ensuring the existence of star products on any given Poisson manifold.
   If time permits, we will conclude with a crash course on operads with a black box called Koszul duality enabling to build L_∞ algebras governing deformations of arbitrary type of "quadratic" algebraic structure.

2. **Harald Grosse** (Vienna, Austria)

   Title: Noncommutative Quantum Field Theory
   Joint work with Raimar Wulkenhaar, Universität Münster

   Abstract: We first mention requirements of local quantum field theory and the problems of summing up the renormalized perturbation expansion in 4 space-time dimensions. Phrased differently, the Landau ghost problem shows up. No nontrivial model has been constructed up to now.
   In order to get an improvement it was suggested to add "gravity" effects, respectively to deform space-time.
   The resulting models, in general, suffer from the Infrared Ultraviolet mixing. For Euclidean deformed space-time this can be cured and leads to a special model, which needs 4 (instead of 3) relevant/marginal operators in the defining Lagrangian. This model is renormalizable up to all orders in perturbation theory. In addition a new fixed point appears. The beta function vanishes at the fixed point to all orders in perturbation theory. This way, we were able to tame the Landau ghost. The renormalization group flow is bounded.
   We discuss Ward identities and Schwinger-Dyson equations. We derive integral equations for the renormalized N-point functions.
   We perform a limit for the resulting matrix model, which leads to solvable correlation functions using singular integral equations.
   A different limit leads to a local, Euclidean invariant quantum field theory, which is solvable as well.

[1] V. Rivasseau, "Non-commutative renormalization" In: *Quantum Spaces (Séminaire Poincaré X)*, eds. B. Duplantier and V. Rivasseau, Birkhäuser Verlag Basel (2007) 19–109 [arXiv:0705.0705 [hep-th]].

[2] H. Grosse and R. Wulkenhaar, "Self-dual noncommutative ϕ^4-theory in four dimensions is a non-perturbatively solvable and non-trivial quantum field theory," arXiv:1205.0465 [Commun. Math. Phys. accepted].

3. **Alexander Kuznetsov** (Steklov Math. Inst. Moscow, Russia)

   Title: Derived categories of coherent sheaves and moduli spaces

   Abstract: In my talks I will try to show how one can use an information about the structure of the derived category of coherent sheaves on an algebraic variety X to get a description of moduli spaces of natural geometric objects on X, such as vector bundles or subvarieties. We will discuss some classical examples, such as moduli spaces of bundles on the projective plane and space, and more recent results on moduli spaces of bundles and curves on some Fano threefolds and cubic fourfolds.

4. **Yoshihiro Ohnita** (Osaka City, Japan)

   Title: Hamiltonian stability problem of Lagrangian submanifolds in Kähler manifolds

5. **Vincent Rivasseau** (Paris, France)

   Title: Random Tensors

6. **Katrin Wendland** (Freiburg, Germany)

   Title: K3 surfaces: Geometry, conformal field theory and number theory