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Deformation theory and group actions

This will be a short introduction to deformation quantization as a general method to pass from a classical mechanical system (represented by a Poisson manifold) to the corresponding quantum system. The emphasis in this approach is put on the algebra of observables (functions on the Poisson manifold), quantization appearing as a deformation of the algebra structure.

Given a classical symmetry, given by the action of a Lie group or of a Lie algebra on the manifold, preserving the Poisson structure, one is interested in building a quantization such that the Lie group acts by automorphisms of it (or the Lie algebra by derivations). A classical action is particularly interesting when it comes from a momentum map and one looks in this case for a corresponding momentum map in the corresponding quantum setting. A classical construction using a momentum map is the Marsden-Weinstein reduction which allows to reduce the number of variables and one looks for quantum analogues of reduction in the quantum framework.

The course will concentrate on formal deformation quantization, stating results concerning those points. Some comments will be made about the necessity for a convergent setting, and the use of group actions to build examples in that setting.
