Non–uniqueness of quantization, complex time evolution and generalized coherent state transforms

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From the rather messy quantization ambiguity of a phase space M with a real polarization (= maximal set of independent local preferred observables in involution) one gets a very nice, infinite dimensional, symmetric space of Kähler quantizations. This is done, in geometric quantization, by allowing the preferred local observables (defining a polarization) to be complex–valued. If the associated polarization is Kähler than there is no problem of reality conditions.

Also, it becomes easier to study the quantization ambiguity as different Kähler quantizations can be linked with a geodesic (with respect to the natural Mabuchi metric on the space of Kähler quantizations) or a imaginary time canonical transformation. By appropriately lifting these geodesics to the quantum bundle one gets integral transforms relating different quantizations, the generalized coherent state transforms transforms. The usual (Hall) coherent state transforms correspond to $M = T^*G$, where G is a Lie group of compact type, and to geodesics starting from the real vertical (or Schrödinger) polarization (which can be considered a point in the boundary of the space of Kähler polarizations) to the standard, bi-invariant, Kähler polarization.

We will describe a natural way of finding the geodesics on the space of Kähler quantizations and discuss examples of geodesics and of the related coherent state transforms.