COHERENT STATES : FROM LASERS TO SPHERICAL WAVELETS

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Canonical coherent states (CS), discovered by Schrödinger in 1926, were popularized by Glauber, Sudarshan and Klauder for the description of lasers, and more generally in quantum optics. Among several equivalent definitions, the group-theoretical one, which links them to the Weyl-Heisenberg group, leads to a considerable extension of the concept of CS. The aim of this talk is to survey the results obtained by this approach. We will treat successively:

1. CS on a locally compact group G, built from a unitary square integrable representation of G.
2. The Gilmore–Perelomov theory, in which CS are indexed by points of the quotient G/H of the group G by the isotropy subgroup H of a given admissible vector.
3. CS on an arbitrary quotient G/H, a generalization due to Ali, Gazeau et the author, which allows to extend the construction to a large class of groups, for instance the relativity groups.
4. Finally, wavelets, which are the CS of the affine groups: the "ax+b " group in one dimension, the similitude group of the plane in dimension 2; the new element here is the central role of dilations. Moreover, the general CS formalism yields a construction of wavelets on several classes of non-Euclidean manifolds, such as the two-sphere or the two-sheeted hyperboloid.