Open Quantum Dynamics

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The subgroup mainly concerned with non-Hermitian dynamics and open systems has focused its attention on the characterization of positive and completely positive maps and their physical interpretation. The obtained results can be summarized as follows.

The subgroup firstly analyzed some features of alternative Hermitian and quasi–Hermitian quantum descriptions of simple, bipartite and multipartite compound systems (in the finite and in the infinite dimensional case). It was shown that alternative descriptions of N interacting subsystems are possible if and only if the metric operator of the compound system can be obtained as a tensor product of positive operators on component spaces [1,2].

Then, a joint research with the subgroup concerned with the *Foundations of Quantum Mechanics* on the *subentity problem* in QM was completed. It was proven that, if one adopts the general formulation of QM on quaternionic Hilbert spaces, proper and improper mixtures can be represented by different kinds of density operators. This representation is compatible with the different evolutions of the two kinds of mixtures in complex QM, hence it allows one to distinguish proper from improper mixtures not only from an interpretative but also from a mathematical point of view, which does not occur in standard QM [3].

Carrying on previous investigations, in a joint research with Manuel Asorey (Zaragoza University, Spain), the subgroup also studied von Neumann entropy preserving maps [4].

Moreover, general properties of dynamical maps preserving Hermiticity and quasi-Hermiticity have been studied, proving that the generator of a dynamical semigroup is always a pseudo-Hermitian operator, and introducing two new Lyapunov functionals for degenerate open systems [5].

Finally the subgroup studied the properties of general linear assignment maps, showing that the positivity axiom can be suitably relaxed, and proposing a new class of dynamical maps (*generalized dynamics*) [6]. In particular, the relation between a given assignment map and system–environment correlations was stressed.

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