Quantum maps covariant with respect to the group generated by the Weyl operators

Katarzyna Siudzińska

Institute of Physics, Faculty of Physics, Astronomy and Informatics
Nicolaus Copernicus University, Grudziądzka 5/7, 87–100 Toruń, Poland
kasias@doktorant.umk.pl

18 Workshop, Będlewo 2018

Abstract

We construct the linear maps that are covariant with respect to the unitary representations of the finite groups. In particular, we focus on the groups generated by the unitary operator bases; that is, the Weyl operators and their tensor products. Necessary conditions are given for the complete positivity of these maps. Next, we follow the method of constructing the irreducibly covariant quantum channels (completely positive, trace-preserving maps). It turns out that our choices of finite groups lead to the Weyl channels and multipartite Weyl channels. Interestingly, these channels have real eigenvalues if and only if they are also covariant with respect to the transformation matrices that connect the equivalent representations of the group. Introducing even more symmetry constraints results in the generalized Pauli channels, whose construction involves the notion of maximal sets of commuting operators. Finally, we present several examples of the positive but not completely positive irreducibly covariant maps. As their physical application, we use there maps to determine whether or not the open quantum system admits the Markovian evolution.