When different entanglement witnesses detect entangled states simultaneously
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Abstract
The question under what conditions different witnesses may detect some entangled states simultaneously is answered for both finite- and infinite-dimensional bipartite systems. Finite many different witnesses can detect some entangled states simultaneously if and only if their convex combinations are still witnesses; they can not detect any entangled state simultaneously if and only if the set of their convex combinations contains a positive operator. For two witnesses $W_1$ and $W_2$, some more can be said: (1) $W_1$ and $W_2$ can detect the same set of entangled states if and only if they are linearly dependent; (2) $W_2$ can detect more entangled states than that $W_1$ can if and only if $W_1$ is a linear combination of $W_2$ and a positive operator. As an application, some characterizations of the optimal witnesses are given and some structure properties of the decomposable optimal witnesses are presented.

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