Describing classicality of states of a finite-dimensional quantum system via Wigner function positivity

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Abstract. In the present report, within the phase-space formulation of quantum theory of $N-$level quantum system, three measures of classicality constructed out of the quasiprobability distributions will be discussed. All considered measures are based on the existence of the "classical states" defined as those whose Wigner function is positive semi-definite over the whole phase space. The variety of classicality measures originates from different ways of quantifying deviations of states from the subset of classical states. Algebraic and geometric descriptions of the set of classical states will be given in terms of the corresponding convex bodies located inside the simplex of density matrices eigenvalues. A few computational aspects of classicality measures will be discussed and exemplified for qubits, qutrits and quatrits.

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