Quantification of Wigner Negativity Remotely Generated via Einstein-Podolsky-Rosen Steering

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Abstract— Wigner negativity, as a well-known indicator of nonclassicality, plays an essential role in quantum computing and simulation using continuous-variable systems. Recently, it has been proven that Einstein-Podolsky-Rosen steering is a prerequisite to generate Wigner negativity between two remote modes. Motivated by the demand of real-world quantum network, here we investigate the shareability of generated Wigner negativity in the multipartite scenario from a quantitative perspective. By establishing a monogamy relation akin to the generalized Coffman-Kundu-Wootters inequality, we show that the amount ofWigner negativity cannot be freely distributed among different modes. Moreover, for photon subtraction — one of the main experimentally realized non-Gaussian operations — we provide a general method to quantify the remotely generated Wigner negativity. With this method, we find that there is no direct quantitative relation between the Gaussian steerability and the amount of generated Wigner negativity. Our results pave the way for exploiting Wigner negativity as a valuable resource for numerous quantum information protocols based on non-Gaussian scenario.