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Probabilistic protocols in quantum information science: Use and abuse

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Protocols in quantum information science often succeed with less than unit probability, but nonetheless perform useful tasks because success occurs often enough to make tolerable the overhead from having to perform the protocol several times. Any probabilistic protocol must be analyzed from the perspective of the resources required to make the protocol succeed. I present results from analyses of two probabilistic protocols: (i) nondeterministic (or immaculate) linear amplification, in which an input coherent state is amplified some of the time to a larger-amplitude coherent state, and (ii) probabilistic quantum metrology, in which one attempts to improve estimation of a parameter (or parameters) by post-selecting on a particular outcome. The analysis indicates that there is little to be gained from probabilistic protocols in these two situations.