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Quantifying the role of interference in quantum information processing DANIEL BRAUN, BERTRAND GEORGEOT, LUDOVIC ARNAUD, University Paul Sabatier Toulouse — We present a quantitative measure of interference, applicable to any quantum mechanical process in a finite dimensional Hilbert space, and use it to examine the role that interference plays in various quantum algorithms and other quantum information theoretical tasks. We present results for the amount of interference in both Grover's search and Shor's factoring algorithms, and on how interference correlates with success probability in the case of disturbances of these algorithms through static or random unitary errors, or decoherence through bit–flips and spin flips [1]. We have also studied the statistics of interference in random quantum algorithms, both using well known random matrix ensembles (CUE, the circular unitary ensemble, and HOE, the Haar orthogonal ensemble), as well as recently introduced random circuit ensembles. We show that the interference distributions in the random circuit ensembles converge rapidly (i.e. exponentially, or even in a Gaussian fashion) towards the universal interference distributions of CUE and HOE, which predict close to maximum interference with very high probability for a randomly picked quantum algorithm [2].

[1] D. Braun and B. Georgeot, Phys. Rev. A **73**, 022314 (2006); and arXiv:0711.1513.
[2] L. Arnaud and D. Braun, Phys. Rev. A **75**, 062314 (2007).

Daniel Braun
University Paul Sabatier Toulouse

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