

ASHWIN NAYAK, University of Waterloo, 200 University Ave. W., Waterloo, ON N2L 3G1
A quantum test for group commutativity

We consider the computational problem of testing whether an implicitly specified group is commutative. The group is defined by its k generators, and a procedure that implements group operations. The computational complexity (in terms of k) of this problem was first considered by Pak (2000). We construct a quite optimal quantum algorithm for this problem whose complexity is in $\tilde{O}(k^{2/3})$. The algorithm uses and highlights the power of the quantization method of Szegedy (2004). For the lower bound $\Omega(k^{2/3})$, we introduce a new technique of reduction for quantum query complexity. We also prove an $\Omega(k)$ lower bound for classical algorithms, which shows that the algorithm of Pak is optimal.

This is joint work with Frédéric Magniez (CNRS–LRI, France).