

ATELIER « INFORMATION QUANTIQUE : CODES, GÉOMETRIE ET STRUCTURES ALÉATOIRES »  
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## A quantum generalisation of Fourier analysis on the boolean cube

Ashley Montanaro \*

am994@cam.ac.uk

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In classical computer science, the theory of Fourier analysis of functions on the boolean cube (the group  $Z_2^n$ ) has developed into an important tool with applications to fields ranging from computational learning to the theory of social choice. In this talk, I will discuss one possible quantum generalisation of these ideas, by replacing functions with Hermitian operators.

Many results in the classical theory can be generalised to this setting. In particular, it turns out to be possible to generalise a famous “hypercontractive” inequality of Bonami, Gross and Beckner which has found many classical applications. The generalisation is a statement about the depolarising channel which allows bounds to be proven on the spectra of  $k$ -local Hamiltonians. However, there are many other classical results for which we do not yet have a proof; these become intriguing open problems.

The talk will largely be based on the paper [arXiv:0810.2435](https://arxiv.org/abs/0810.2435), which is *joint work with Tobias Osborne*.

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\*Centre for Quantum Information and Foundations, DAMTP, University of Cambridge, Wilberforce Road, Cambridge, UNITED KINGDOM.