SPECTRAL GAP OF RANDOM QUANTUM CHANNELS

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Abstract. In this talk we show a lower bound on the difference between the first and second singular values of quantum channels induced by random isometries, that is tight in the scaling of the number of Kraus operators. This allows us to give an upper bound on the difference between the first and second largest (in modulus) eigenvalues of random channels with same large input and output dimensions for finite number of Kraus operators $k \geq 169$. The main technical part of the proof is the extension of techniques by Pisier's in order to deal with the correlations of different blocks of random isometries. Moreover, we show that these random quantum channels are quantum expanders, answering a question posed by Hastings. As an application, we prove that ground states of infinite 1D spin chains, which are well-approximated by matrix product states, fulfill a principle of maximum entropy. (Joint work with I. Nechita and M. Junge).