

The Uncertainty Principle Is Wrong (?)

J.M. Renes, M. Berta, M. Christandl, R. Colbeck, R. Renner



TECHNISCHE
UNIVERSITÄT
DARMSTADT

- ▶ Maassen & Uffink:

$$H(X) + H(Z) \geq -2 \log c$$

for $c = \max_{|\psi_x\rangle, |\varphi_z\rangle} |\langle \psi_x | \varphi_z \rangle|$. (eigenvectors of observables)

- ▶ With quantum side information B (and measurements on system A),

$$H(X^A|B) + H(Z^A|B) \geq -2 \log c + H(A|B)$$

- ▶ Proof: conditional min/max entropies, SSA, and *lots* of smoothing!
- ▶ Applications: a decoupling condition, for one:

$$H(X|B), H(Z|B) \leq \epsilon \Rightarrow \|\psi^{AE} - \psi^A \otimes \psi^E\|_1 \leq 2\sqrt{2\epsilon}$$