Twitter Thread by Gil Kalai



Gil Kalai
@GilKalai

Where were we: Boaz Barak proposed a “law of nature” that if there is a physical device that can make a certain computation C, then there is a quantum circuit that computes C. 1/11

@boazbaraktcs @quantum_aram @AspectStalence @RosenblumSerge

Aram remarked that Boaz's proposed law is a variant of the strong Church Turing thesis. Correct! 2/11

I proposed a refinement of the general law. There are cases where we can analyse classes of devices (or natural processes) and can conclude that for them there is even a classical circuit that computes what they compute. 3/11

I gave a few examples 1) Computations that take place in Boaz's laptop can be carried out by a classical circuit. 4/11

2) Computations carried out by Boaz's brain can be carried out by a classical circuit. 5/11

Here is another (plausible) example: 3) Protein folding for proteins occurring in nature can be described by classical circuits. 6/11

Boaz responded that “nature” does not have a notion of a “classical device” - nature is quantum. 7/11

This is a nice slogan but it is irrelevant to the fact that *we* can recognize physical devices or fragments of quantum physics that can likely be described by classical circuits. 8/11

In a 2014 paper Kindler and I considered noisy boson sampling. Based on some noise model that we described we concluded that such devices could be described by classical circuits. 9/11

One plausible conclusion that we offered was that it is unlikely that photonic boson sampling devices would exhibit huge quantum computational advantage (HQCA) just like it is unlikely that Boaz's brain or Boaz's laptop will exhibit HQCA. 10/11

My general argument regarding NISQ systems extends this interpretation of our 2014 results. Boson sampling is conceptually and technically simple.
@boazbaraktcs @quantum_aram

11/11