What is Quantum Computing?
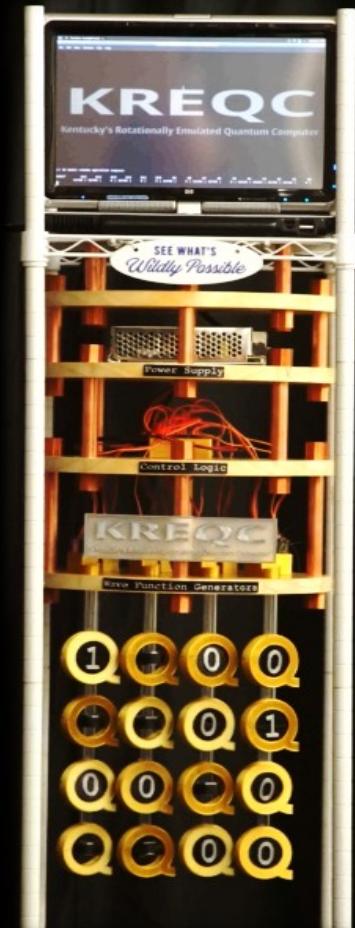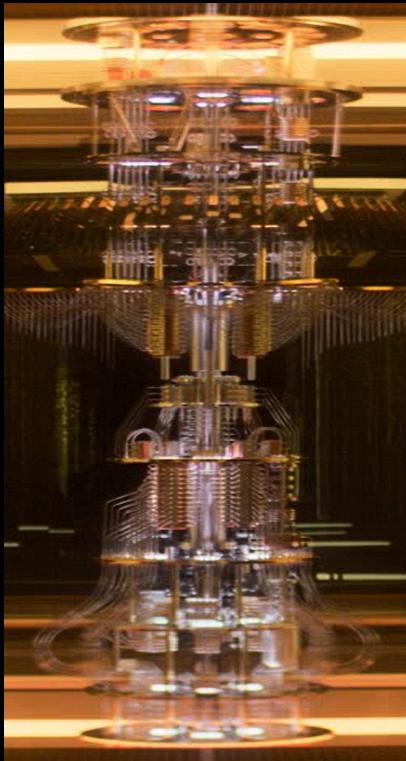
E-Day, February 25, 2023

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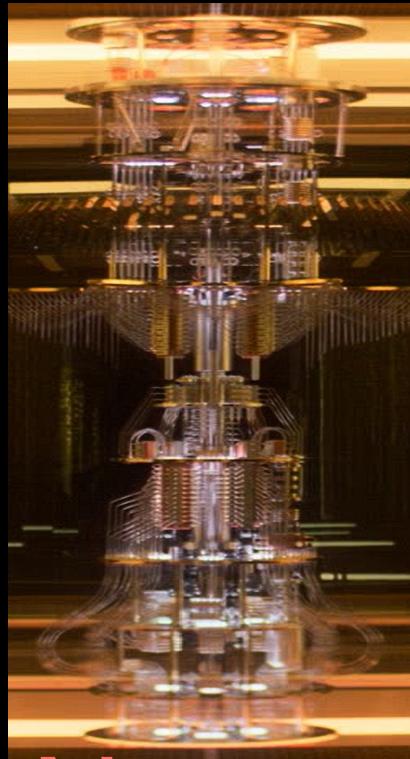
Quantum Computers?

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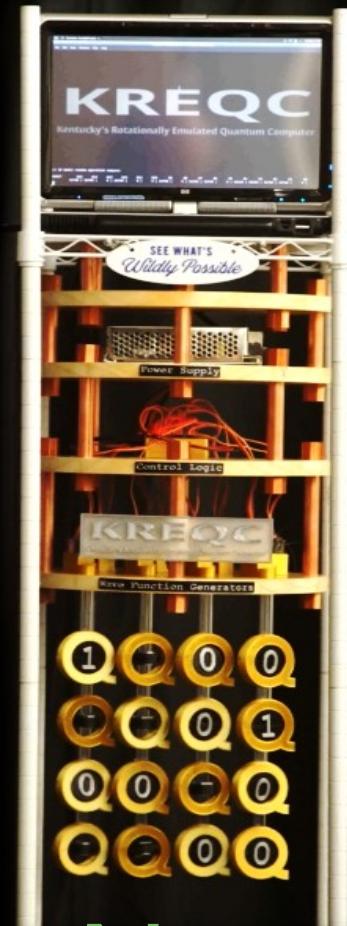
Yes No Yes No

Parallel Processing

- Get computations done faster by working on more than one at a time

- This is why modern computers are faster; more circuitry enables more parallel processing, but that takes more energy

Quantum Processing

- Uses Qubits instead of bits:
  - A Qubit can be 0, 1, or Superposed
  - Superposed holds probabilities of each value

- K-way Entangled Qubits superpose 2^K values

- Each gate operation can operate on 2^K values:
  parallel processing without parallel hardware!

What we're doing

- Can't build useful quantum computers
  - Decoherence causes garbage results
  - Not enough entanglement nor enough Qubits

- **Parallel Bit Pattern computing** efficiently implements entangled superposition *using conventional computer logic gates*

What our PBP does

- Much lower power/computation by dramatically reducing number of gate-level operations

Table 4. Active gate counts for 32-bit word operations vs. proposed PBP model.

$nproc$	Chunk bits	Gates (Words)	Gates (PBP)	Ratio
65536	256	12279113318	3209523	3826:1
262144	256	55522282700	3141452	17674:1
262144	512	55520002048	6563379	8459:1
1048576	256	252845228032	3135360	80643:1
1048576	1024	252876370739	13902438	18189:1
4194304	2048	1154496017203	29179904	39565:1
16777216	4096	5277432676352	61104947	86366:1
67108864	8192	24153849174425	128459571	188027:1