

Leveraging AI

A presentation by Jed Anderson, CEO, EnviroAI

"The future belongs to the curious."

-Anonymous

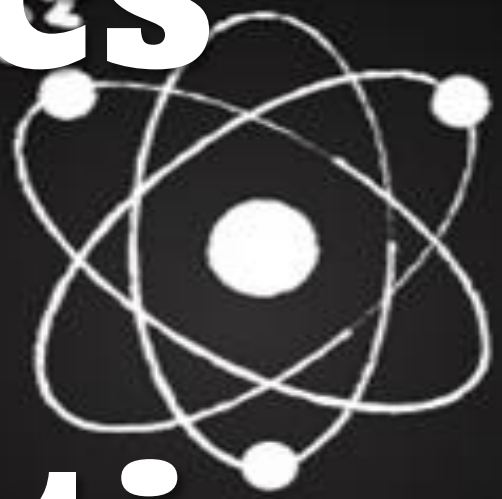




Red or blue?

The bottom of the rabbit hole . . . what is driving AI?

Physics & Information Theory

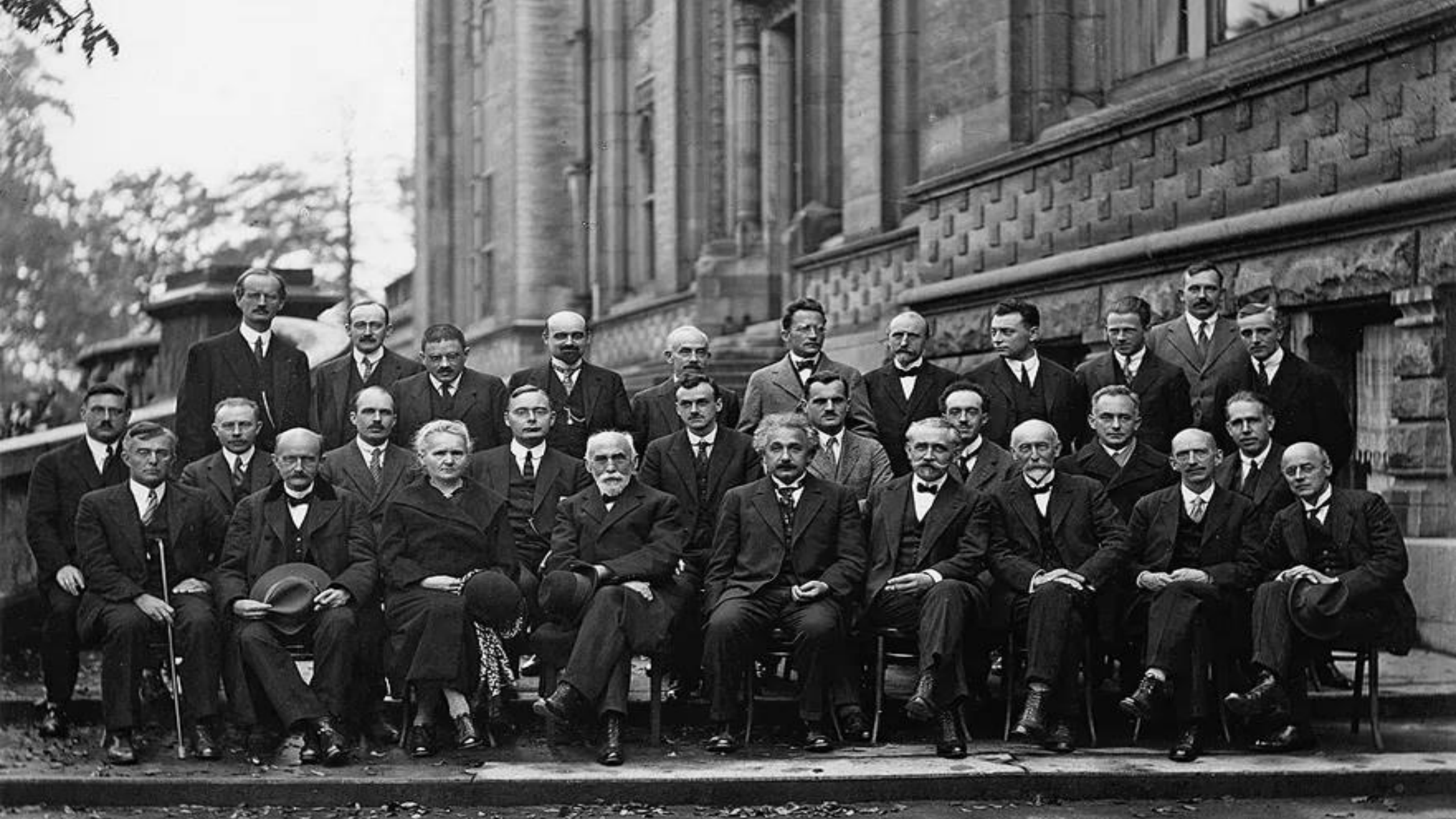


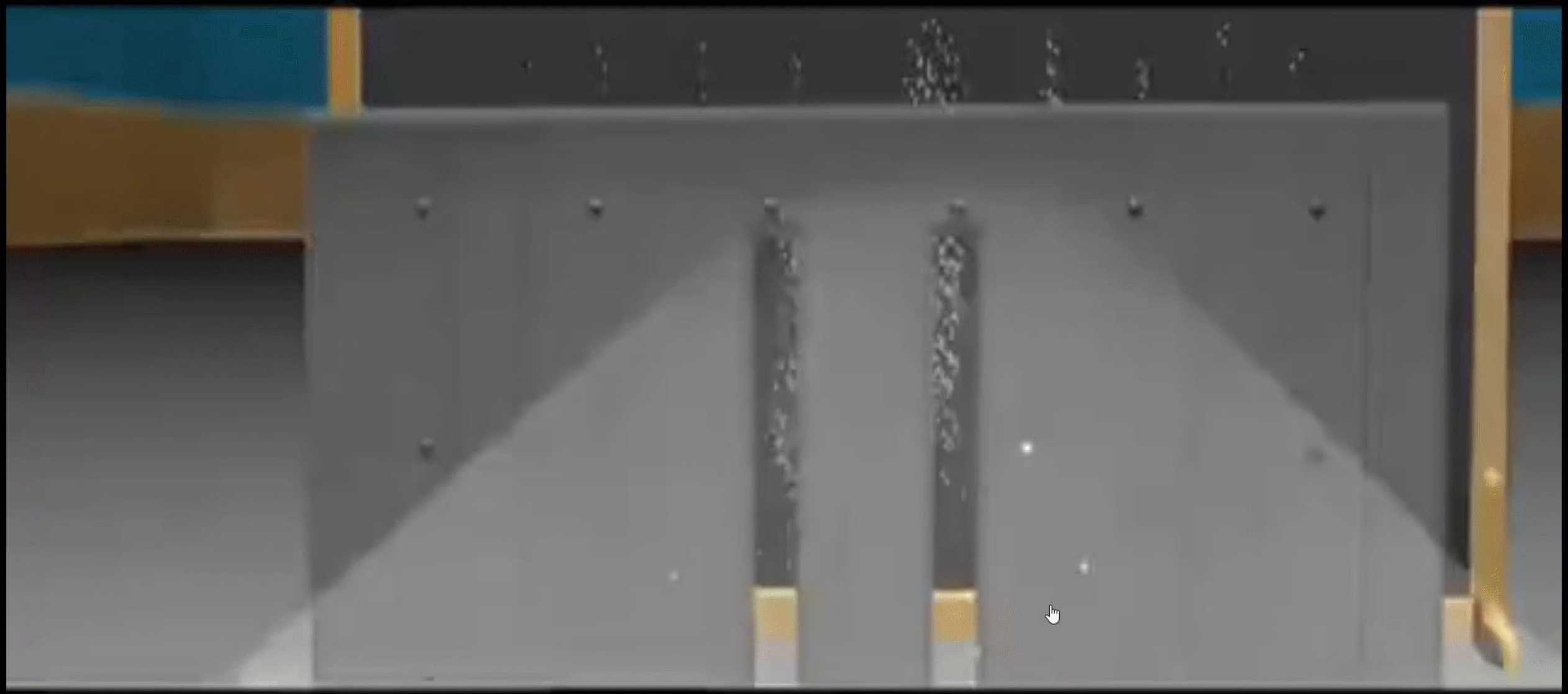
Bits and Entropy

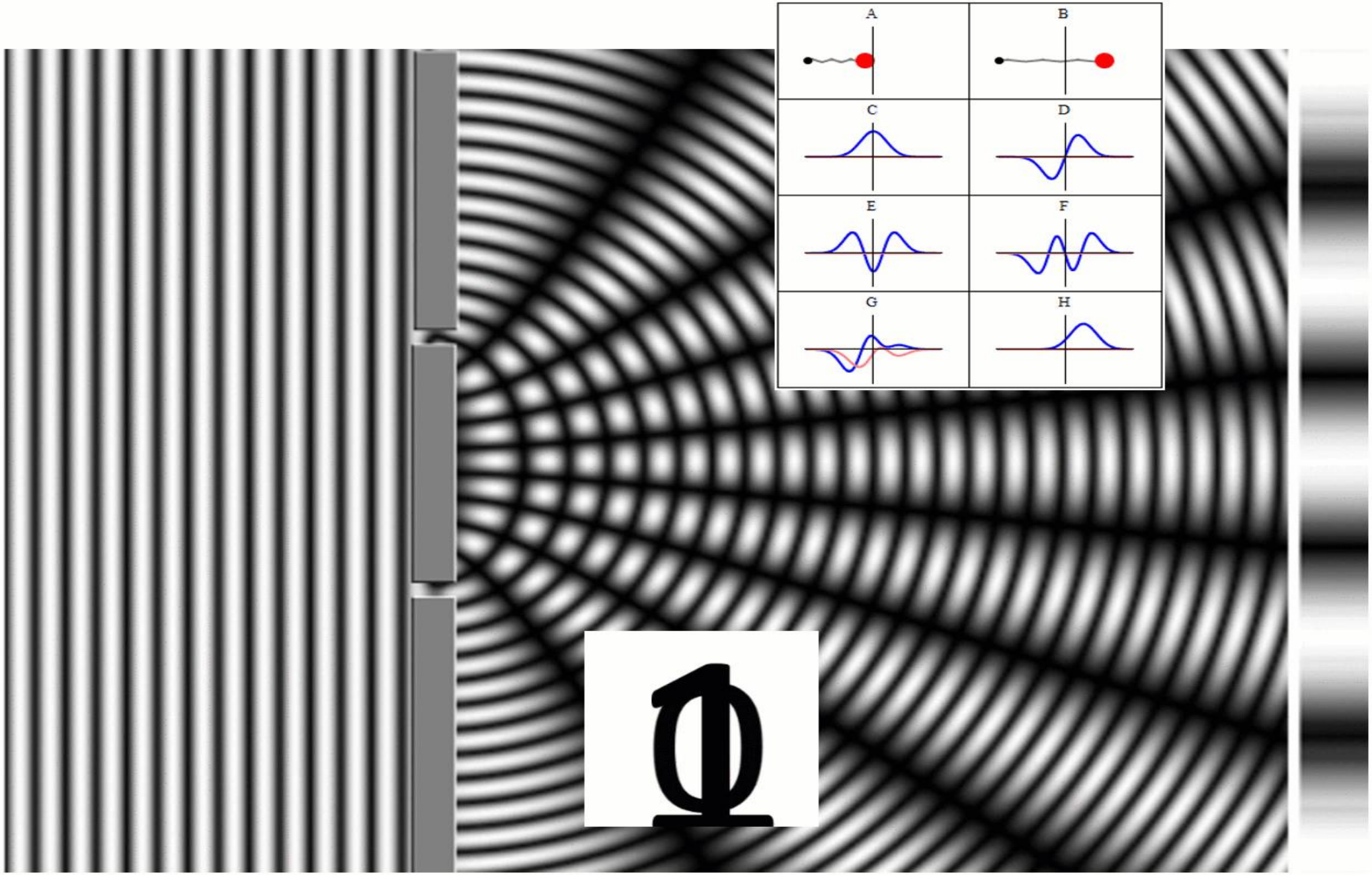
“Everything we call real is made of things that cannot be regarded as real.”

— **Niels Bohr**







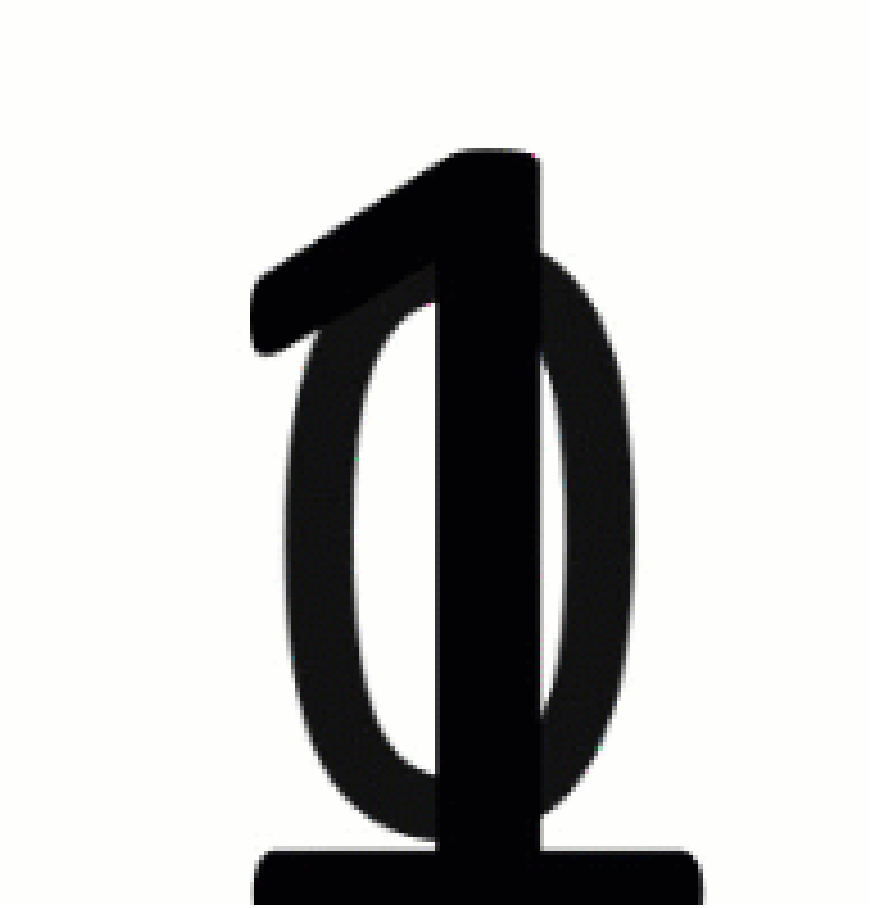

A
B
C
D
E
F
G
H

Classical Digital Computer

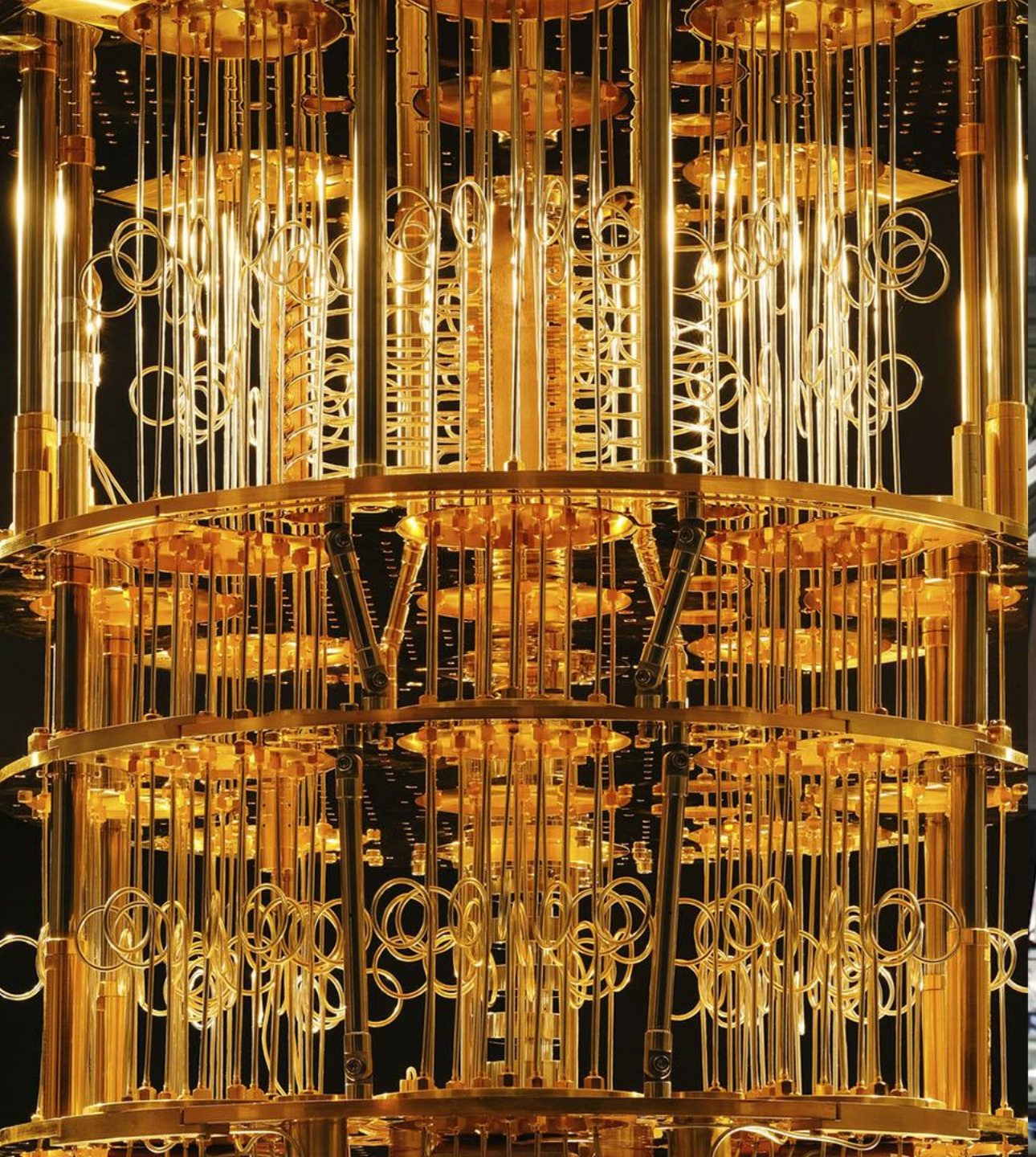
0 or **1**

(no) (yes)

Quantum Computer



(yes/no)




IBM Q

Quantum Data



Classical Data
(binary computer)

01001010010101
10101101110000
10011110000111
10101011111000
01010111100011
01010101010101
11010110101011

Biological Data

ACTGACTGACTTAGG
ATTCGAGATCCATTC
CTTGAGACCTTTTTT
ACCCCTATAGCATCA
TTCCAGGATCTATTAT
CCTATATATAGGGGC
CCATATAAATGGGCT

Human Data

Language data (letters), sensory data (visual images), numeric data (numbers)

All at some level is data.

Bits

TREE

01001101001
01010111011
11011101110
01011101100
01010110111
[etc.]

MUSIC

01001101001
01010111011
11011101110
01011101100
01010110111
[etc.]

HUMAN

01001101001
01010111011
11011101110
01011101100
01010110111
[etc.]

COOKIE

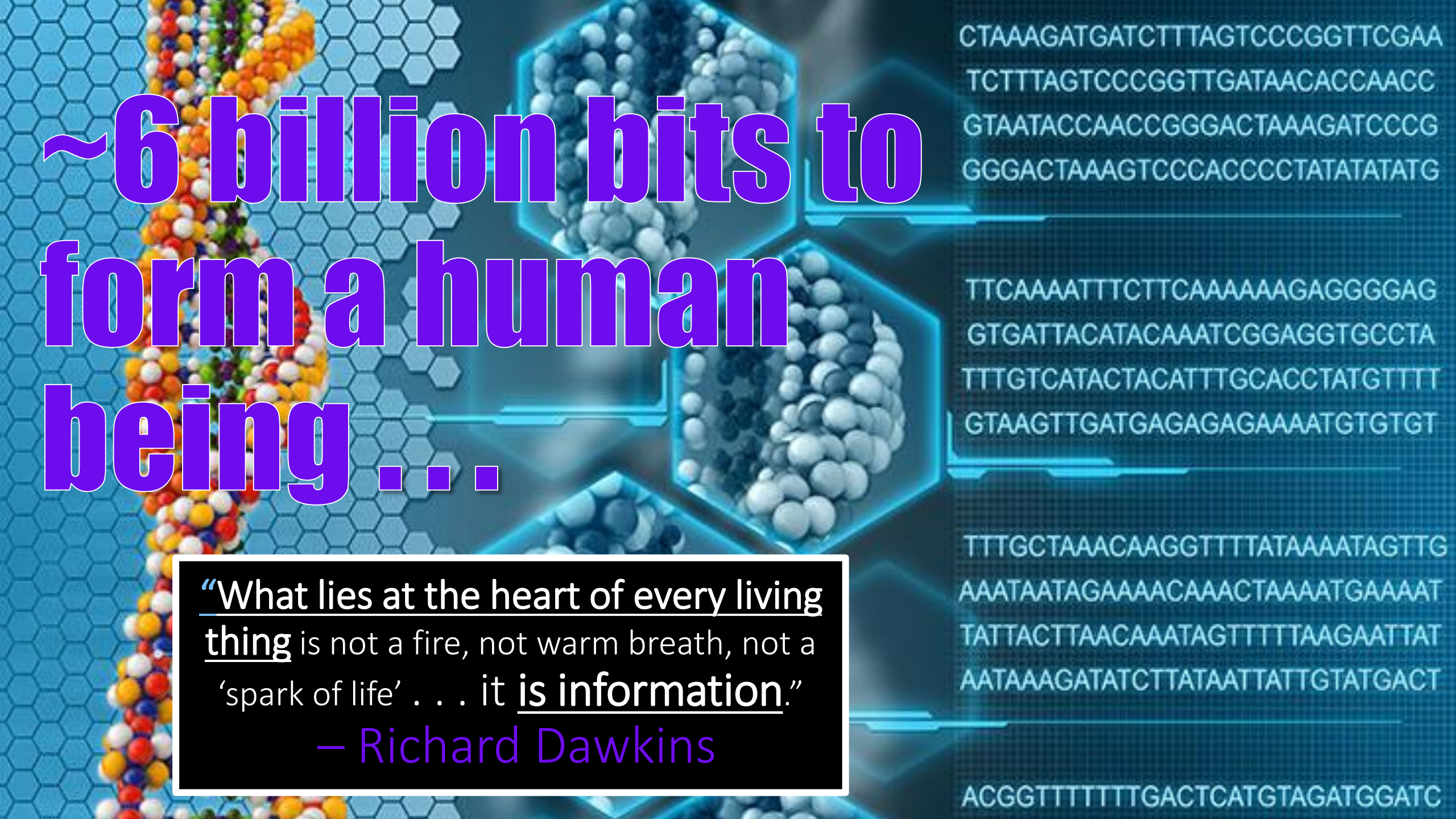
01001101001
01010111011
11011101110
01011101100
01010110111
[etc.]

MATH

01001101001
01010111011
11011101110
01011101100
01010110111
[etc.]

UNIVERSE

01001101001
01010111011
11011101110
01011101100
01010110111
[etc.]



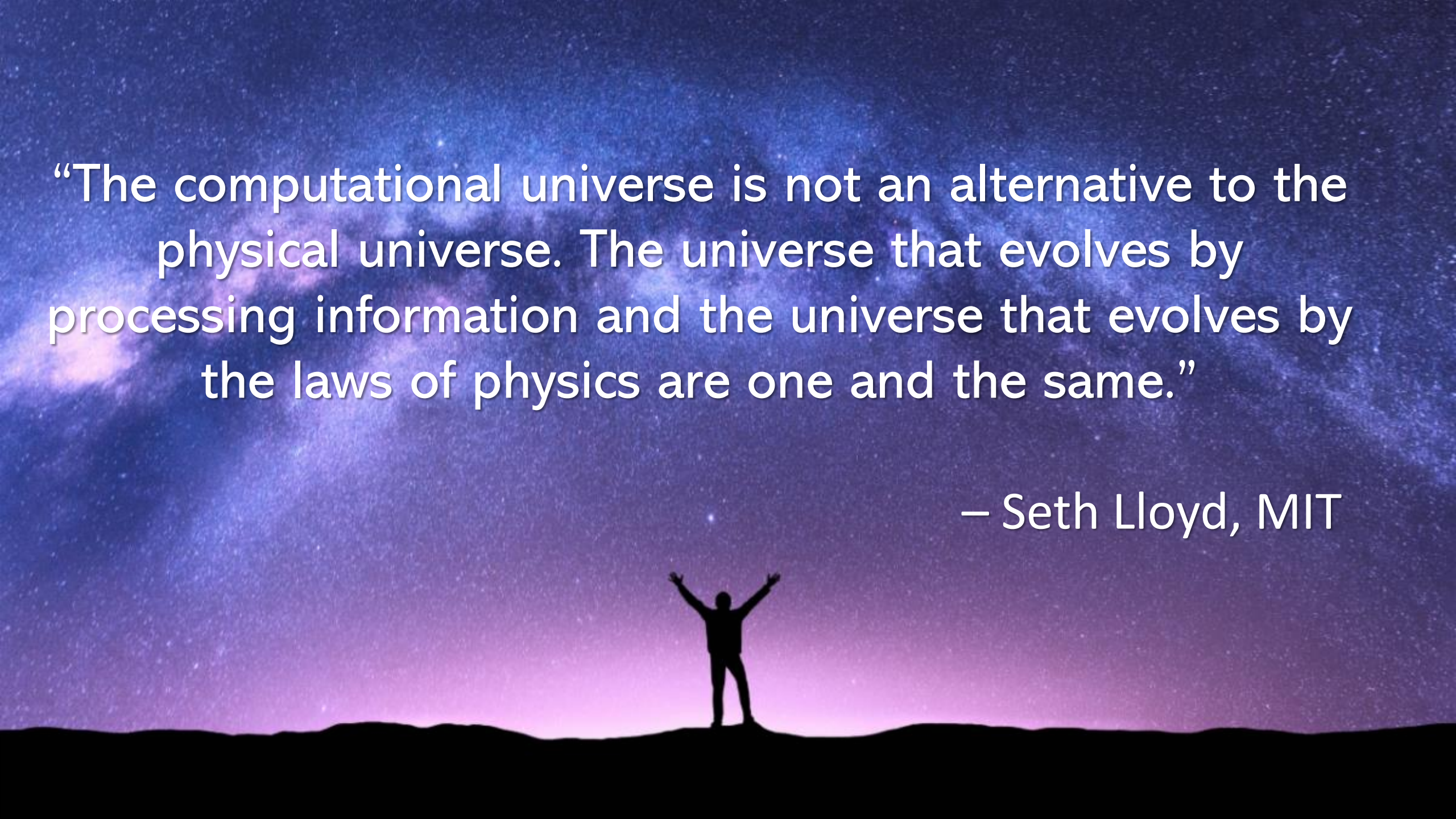
~6 billion bits to form a human being . . .

"What lies at the heart of every living thing is not a fire, not warm breath, not a 'spark of life' . . . it is information."

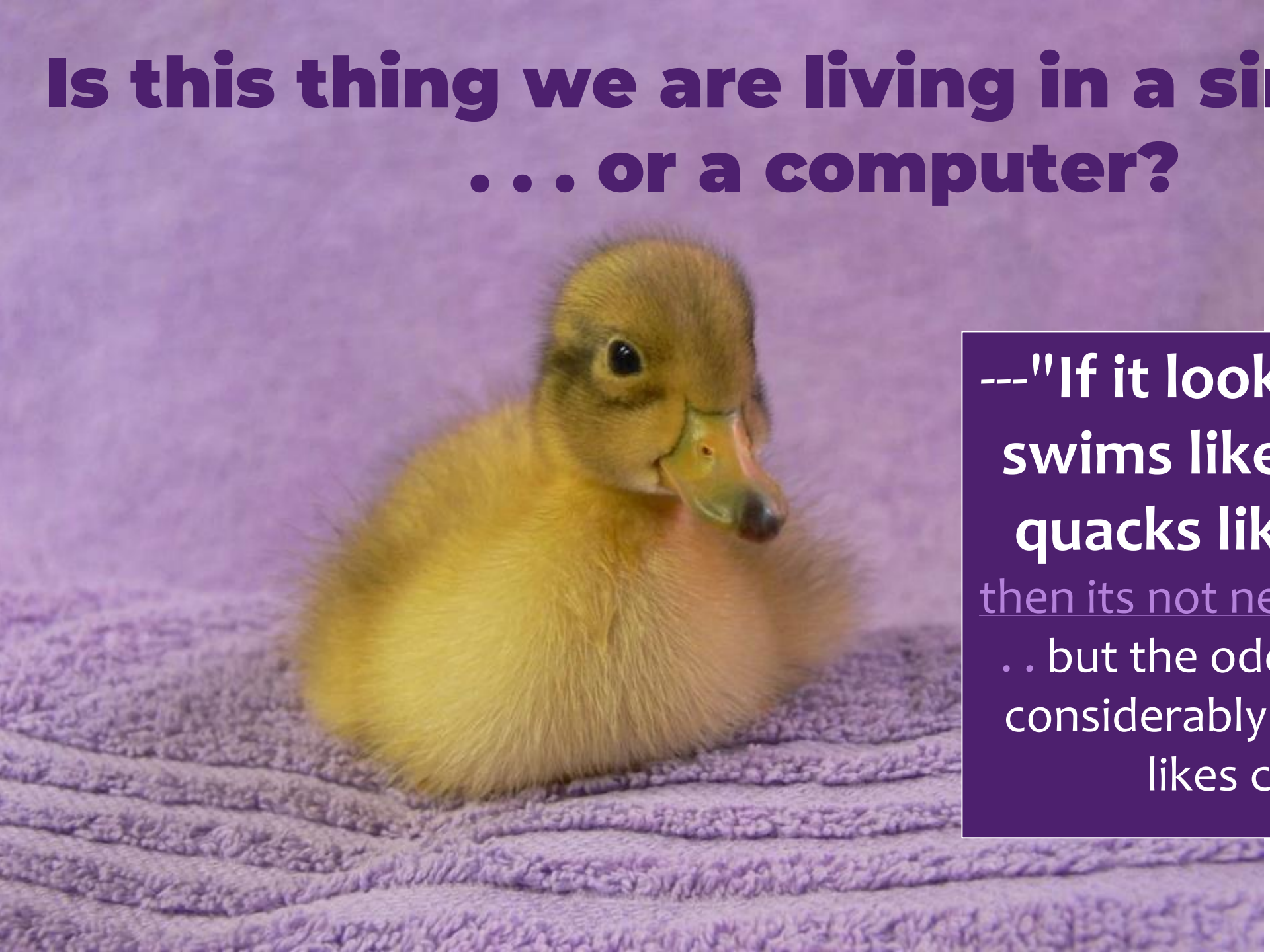
– Richard Dawkins


“It from bit.”
– John Wheeler




“The computational universe is not an alternative to the physical universe. The universe that evolves by processing information and the universe that evolves by the laws of physics are one and the same.”
– Seth Lloyd, MIT

Is this thing we are living in a simulation . . . or a computer?



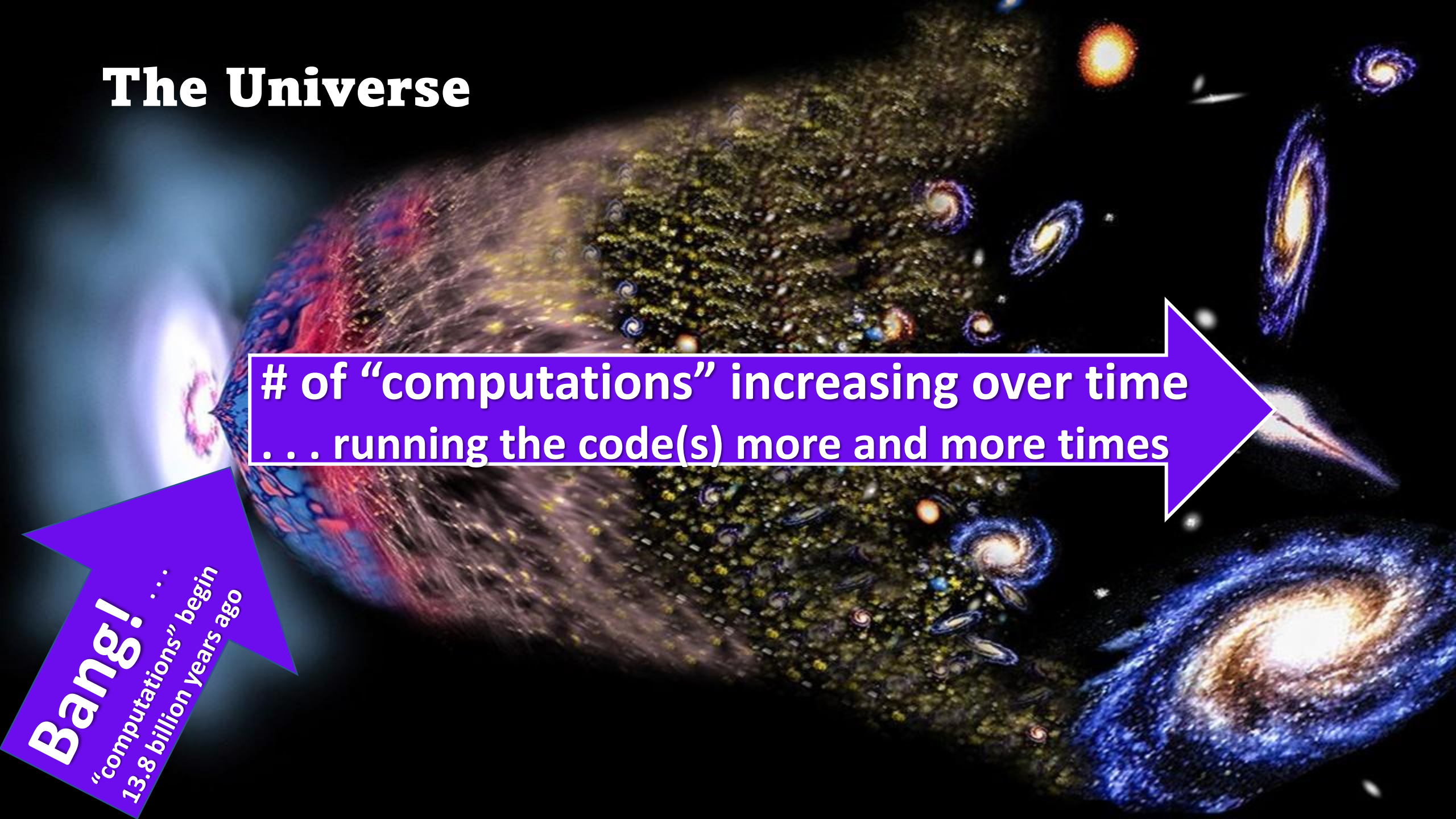
---"If it looks like a duck, swims like a duck, and quacks like a duck . . .

then its not necessarily a duck .

. . but the odds have gone up considerably now that it also likes crackers."

- Jed Anderson

The Universe

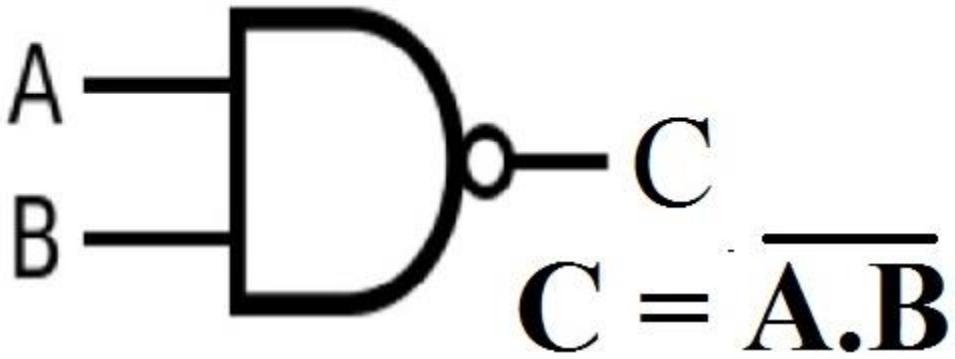


Nature = Simple Equations/Algorithms/Code

$$E=MC^2$$


Yes/No

Universe in some respects is just a bunch of NAND gates . . .



$$C = \overline{A.B}$$



Alan Turing

Truth Table

INPUT		OUTPUT
A	B	A NAND B
0	0	1
0	1	1
1	0	1
1	1	0







A great story . . .

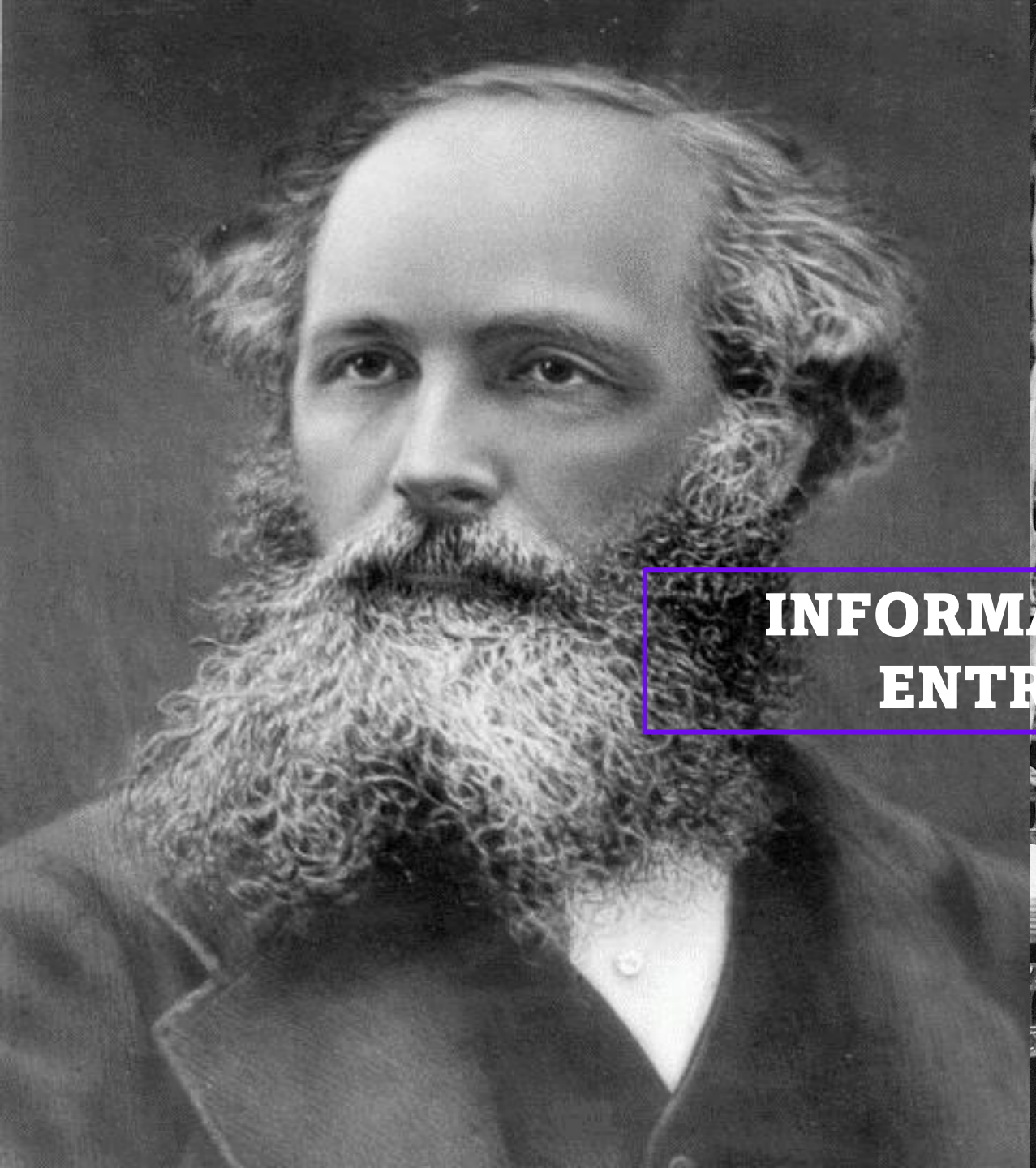
10^{90} Bits of information in the universe

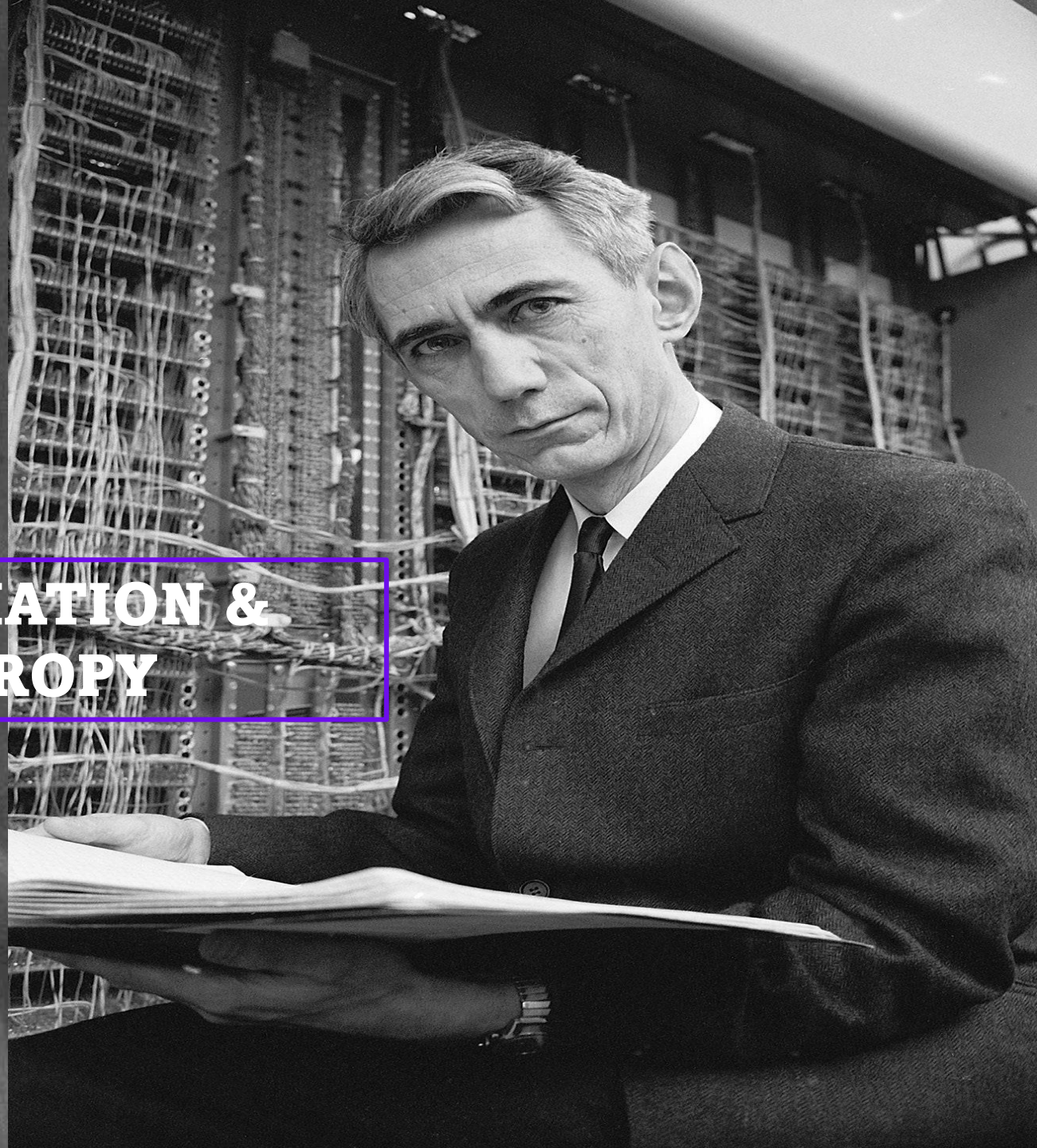
[This includes human-generated information]

10^{45} Bits of human-generated information

10^{21} Bits of human-generated information GPT-3 was trained on

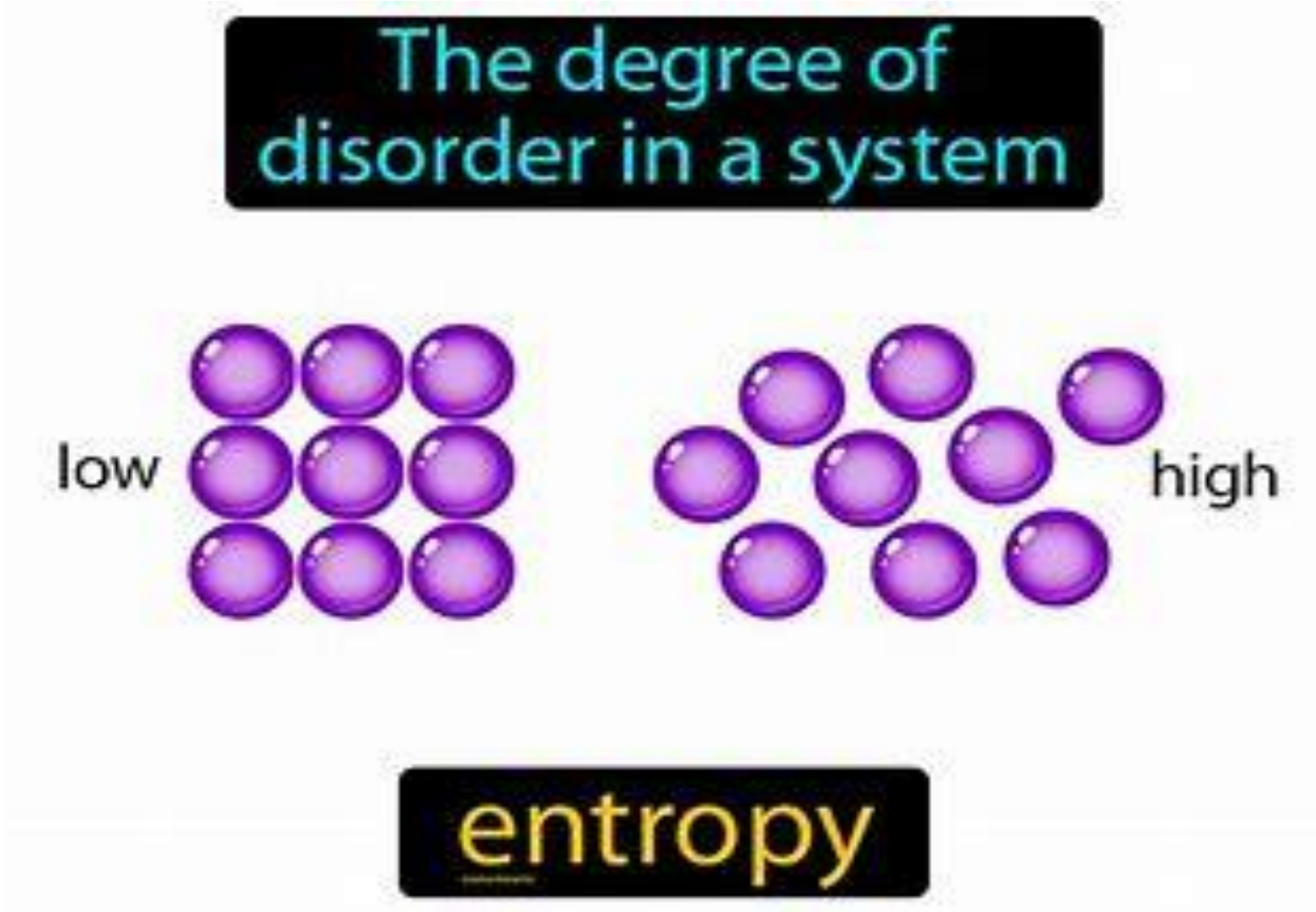
Entropy

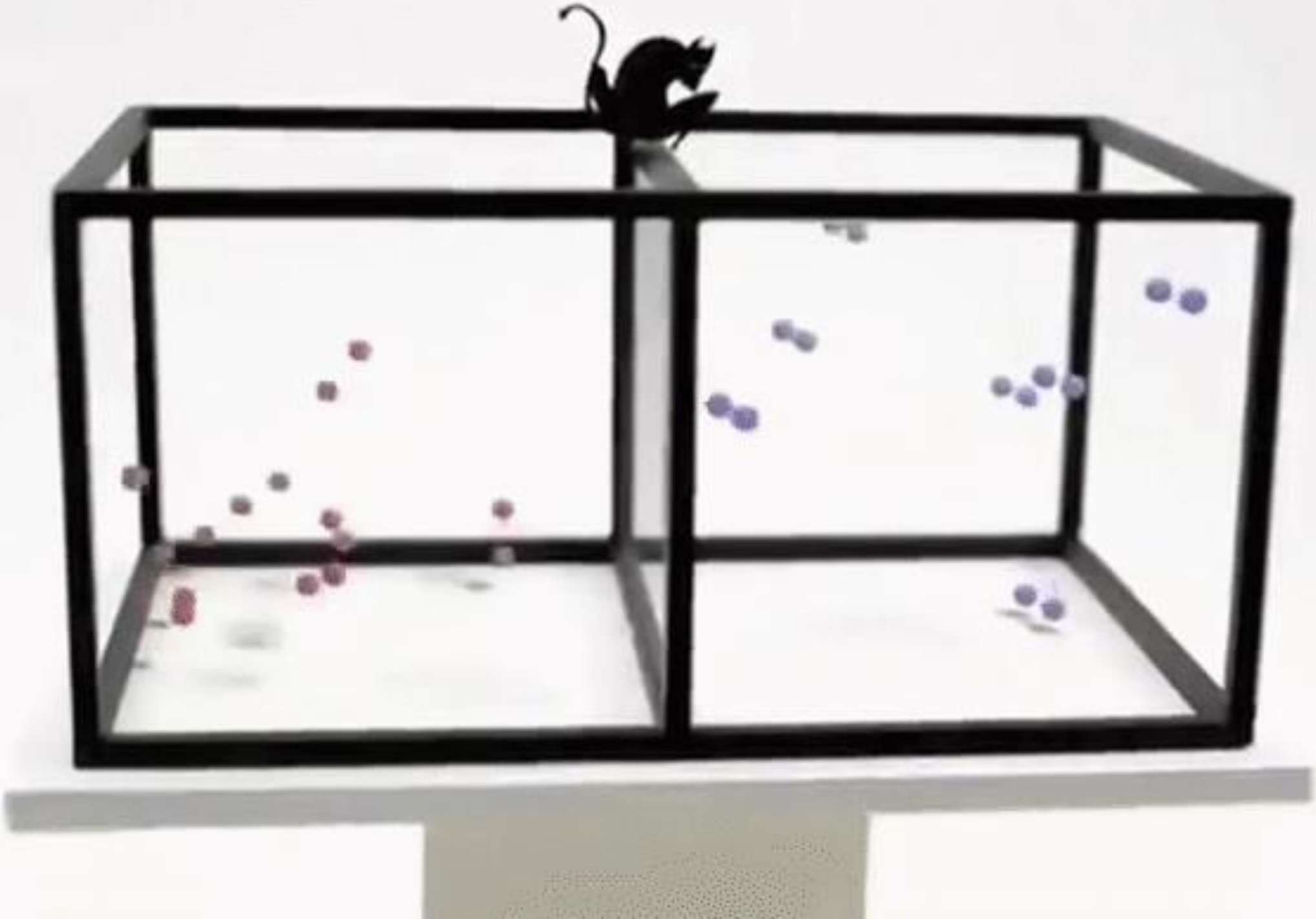




INFORMATION & ENTROPY

2nd law of thermodynamics . . . entropy always increases.





Bit = “a unit for measuring information.”

- Claude Shannon

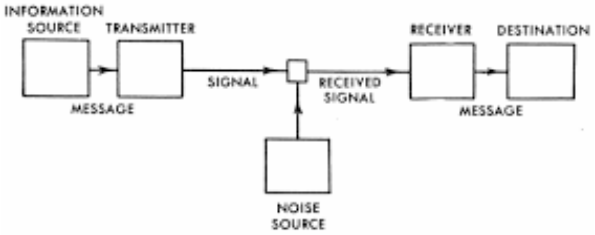
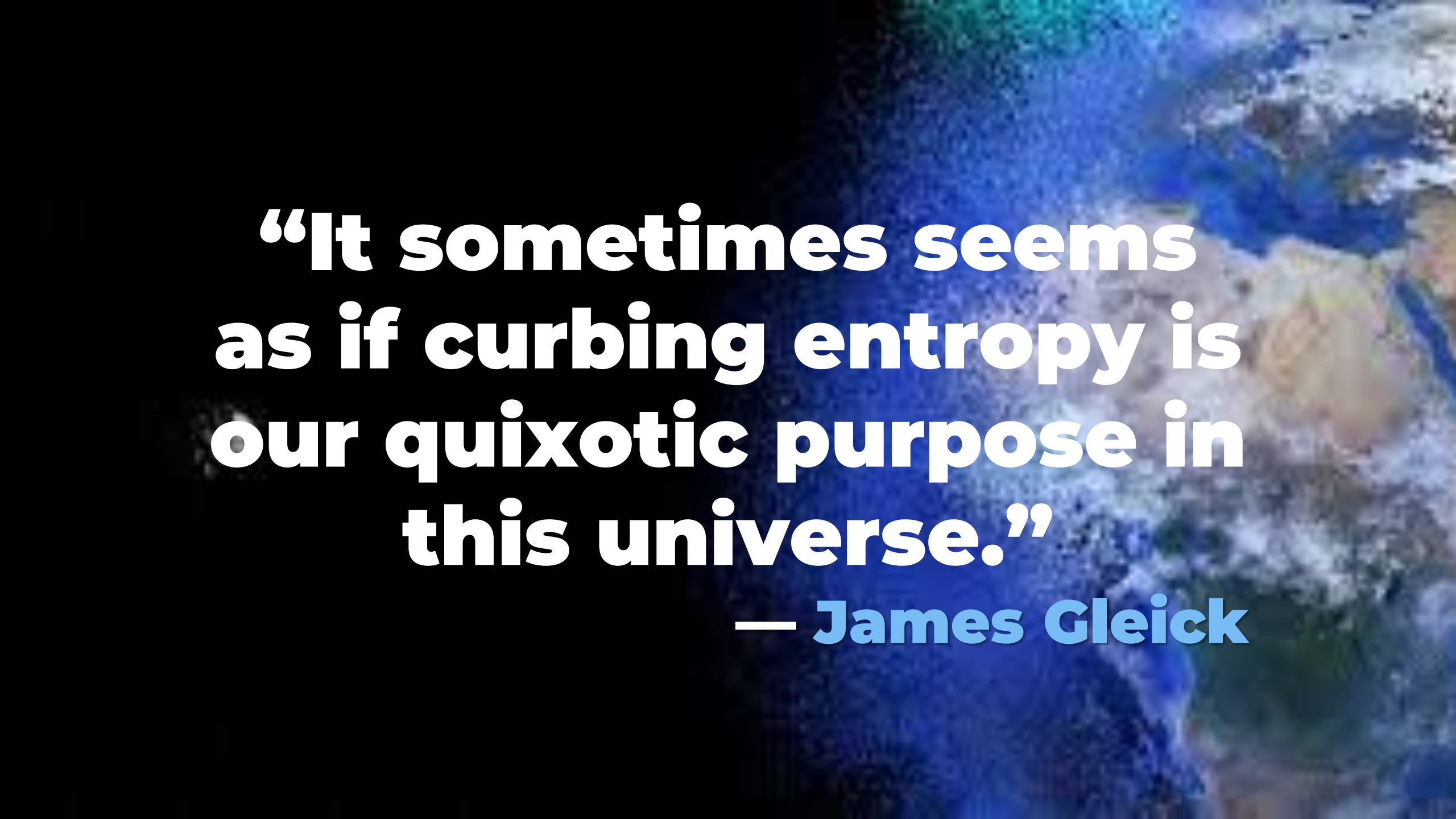
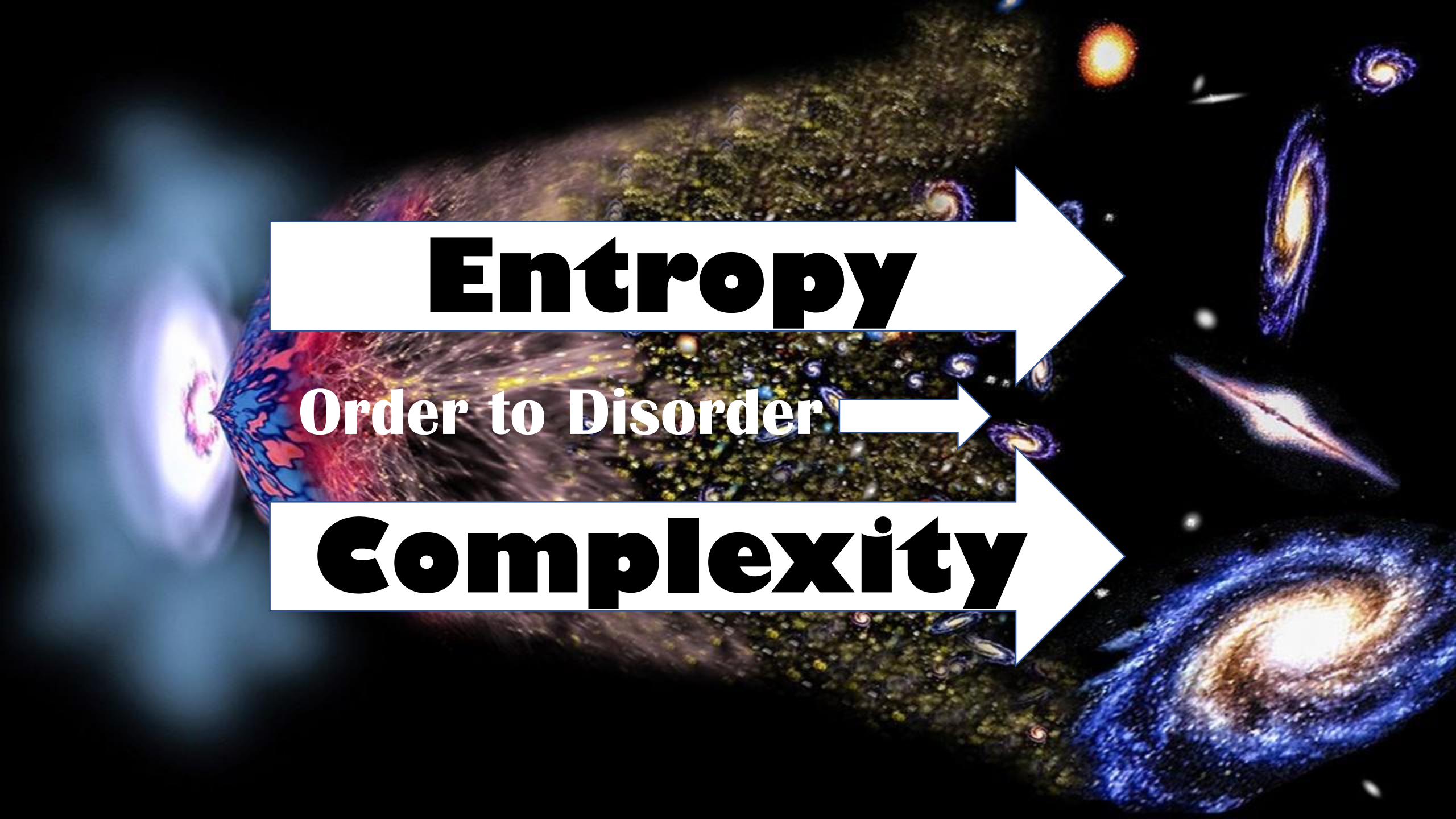


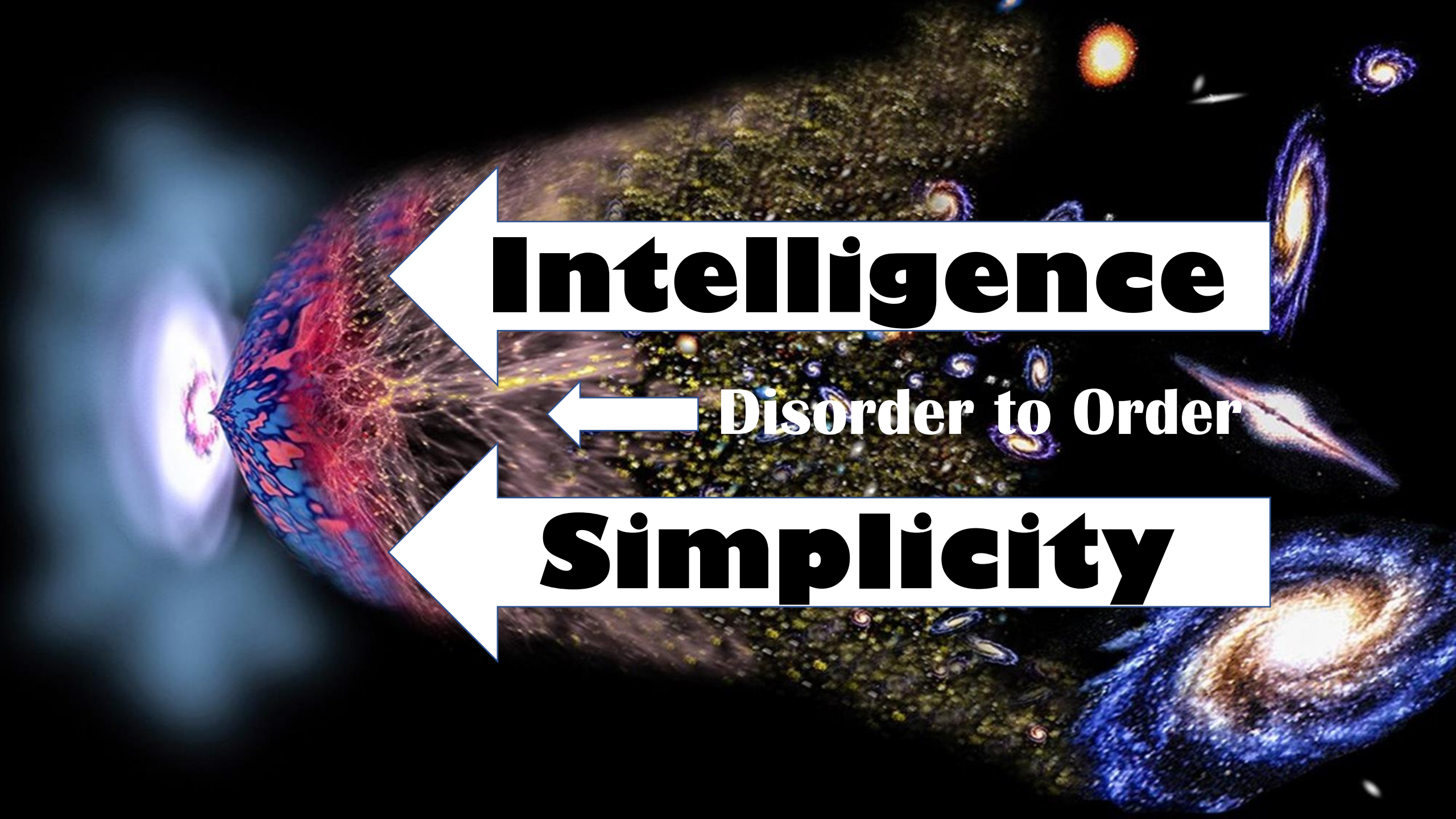
Fig. 1. — Schematic diagram of a general communication system.

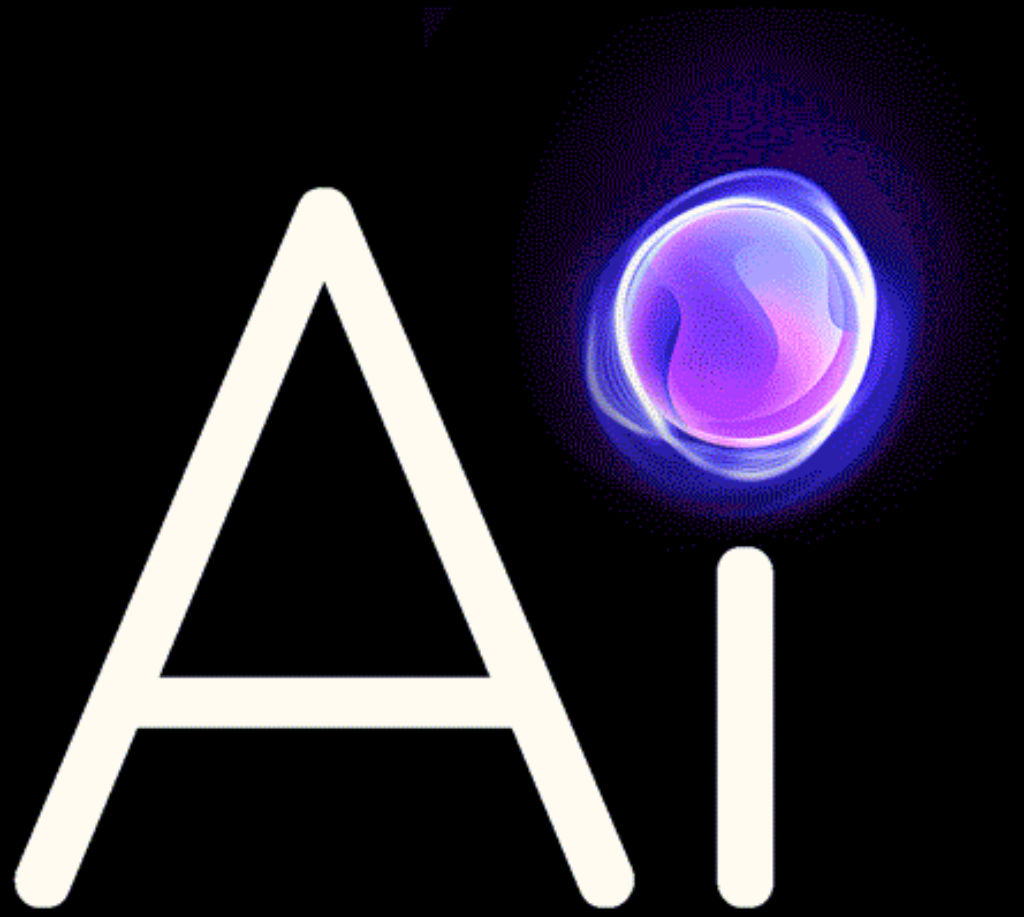
SHANNON ENTROPY

$$H(X) = -\sum_{i=1}^{n} p_i \log_2 p_i$$


“It sometimes seems as if curbing entropy is our quixotic purpose in this universe.”
— James Gleick


Entropy
Order to Disorder
Complexity


Intelligence
Disorder to Order
Simplicity

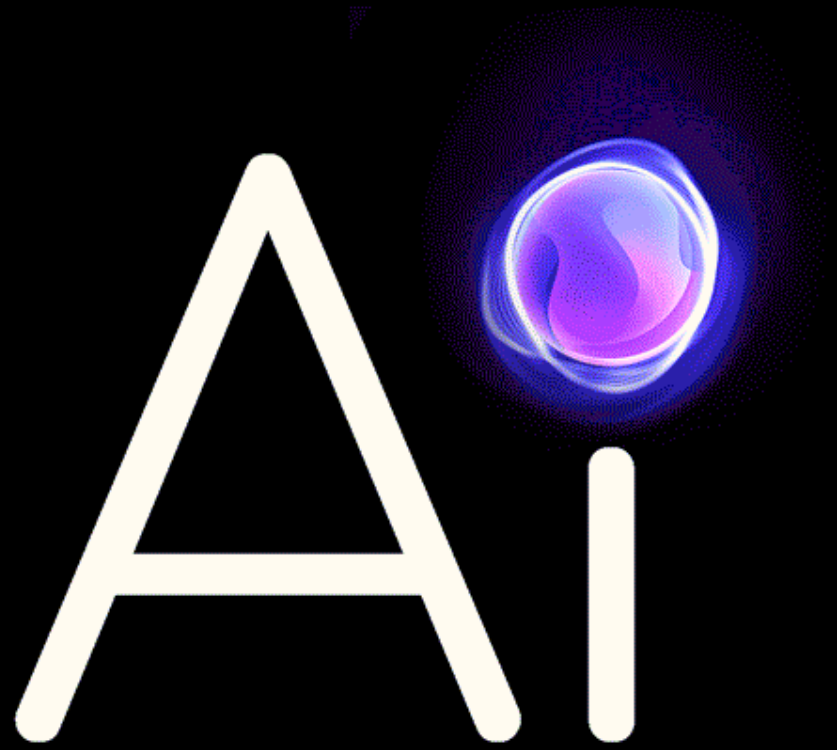


- ✓ This thing can really understand, manipulate, and move around bits
- ✓ Entropy fighter . . . building intelligence and organizing information

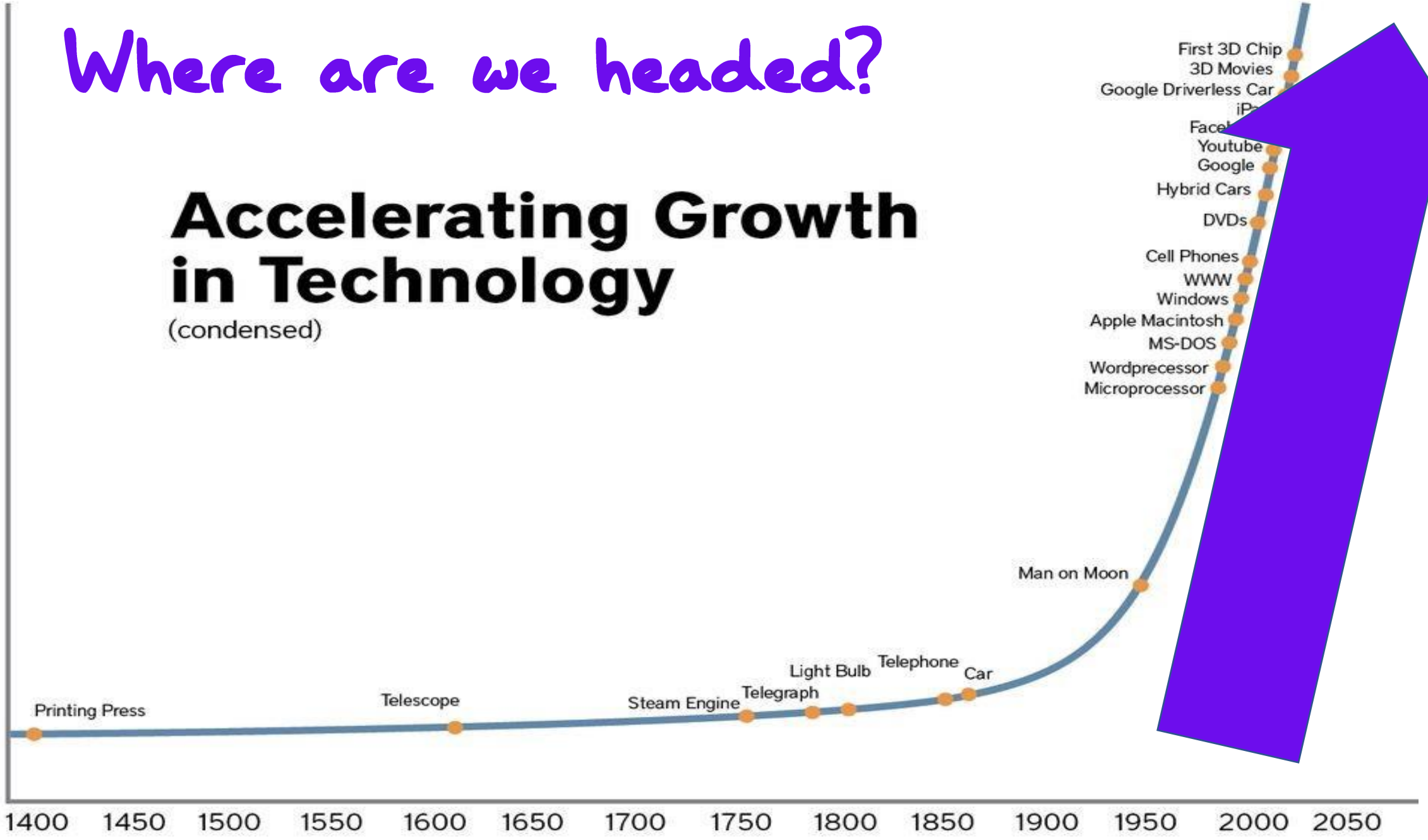

1100

“A.I. is more important than fire or electricity.”

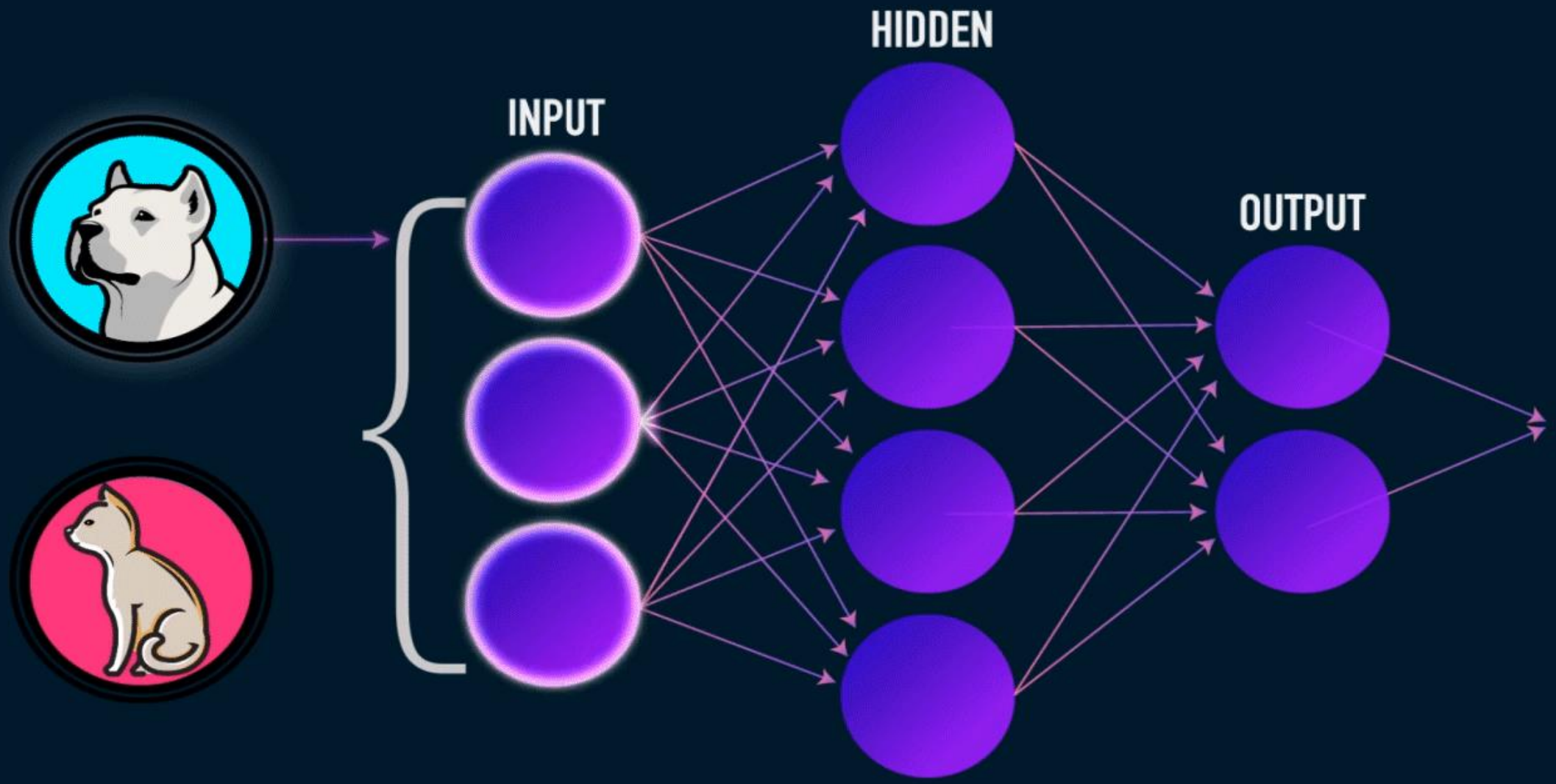
–Google CEO, Sundar Pichai

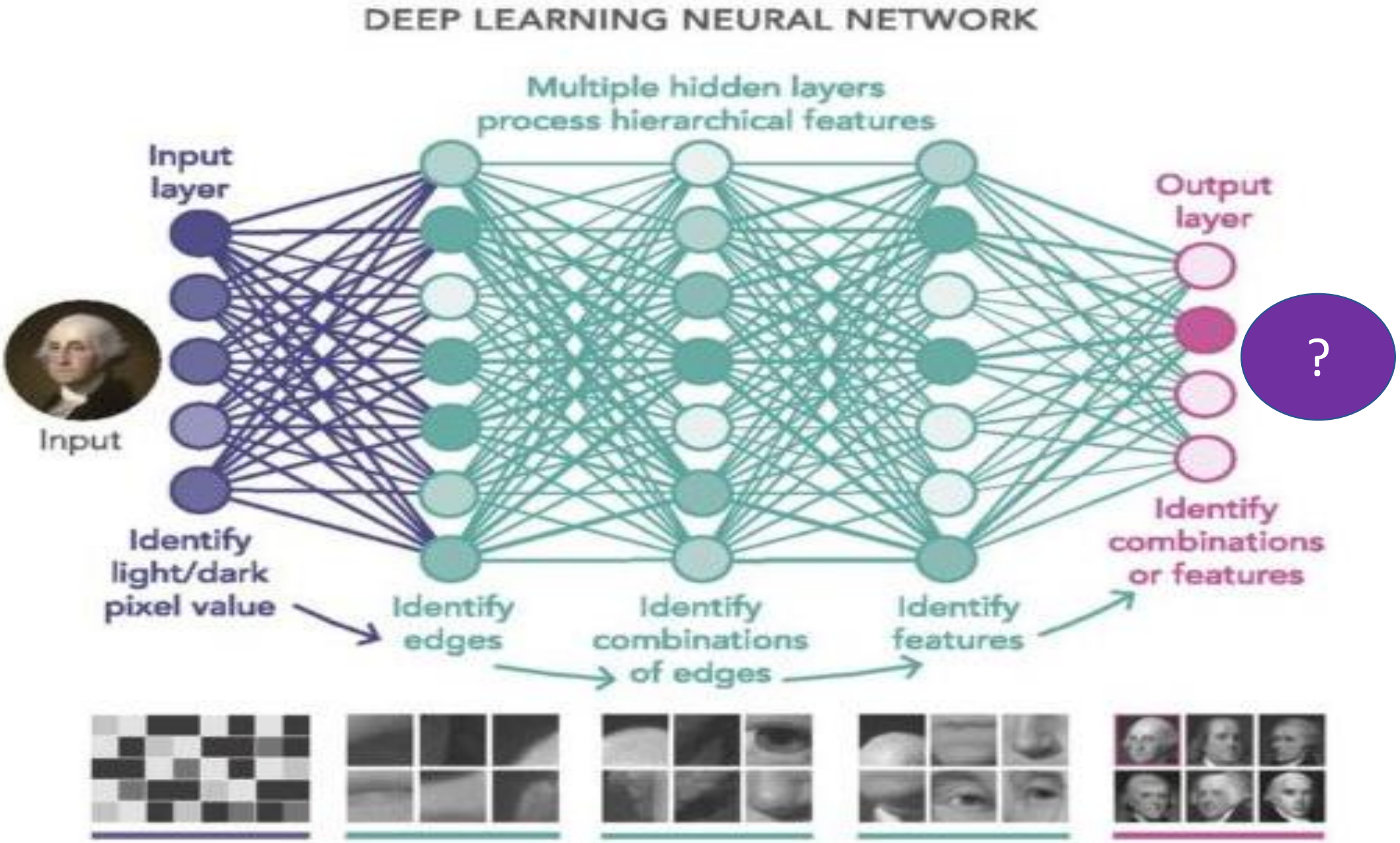


Where are we headed?

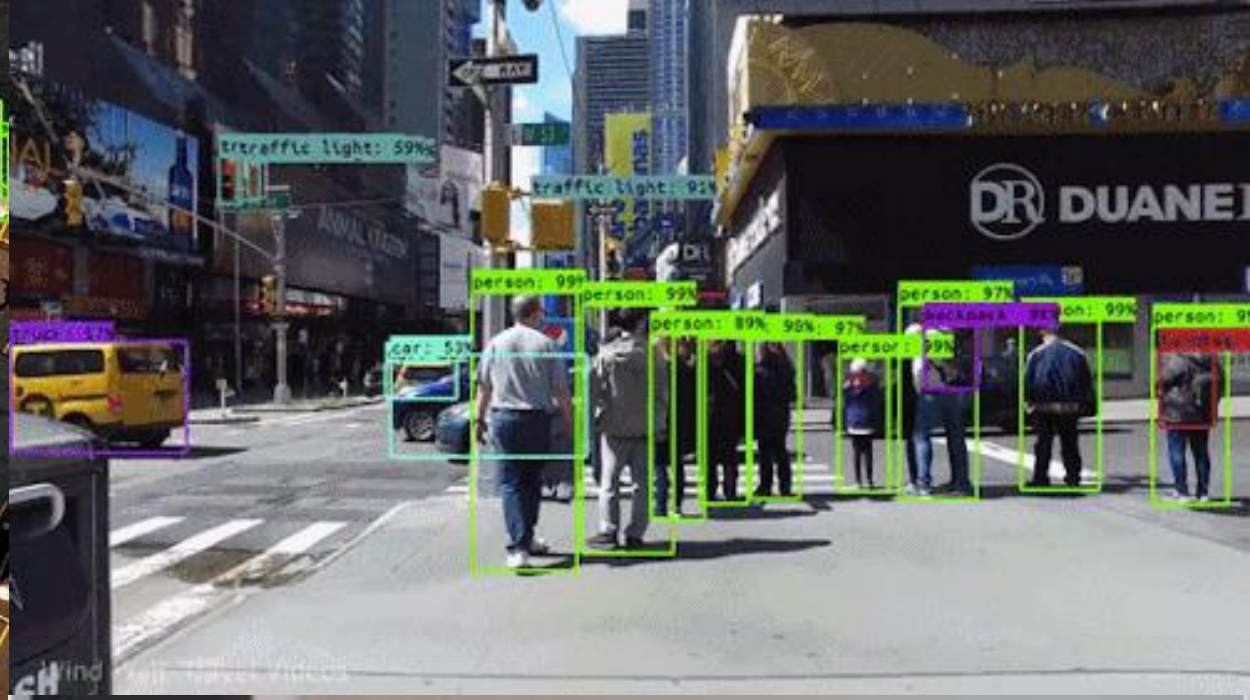


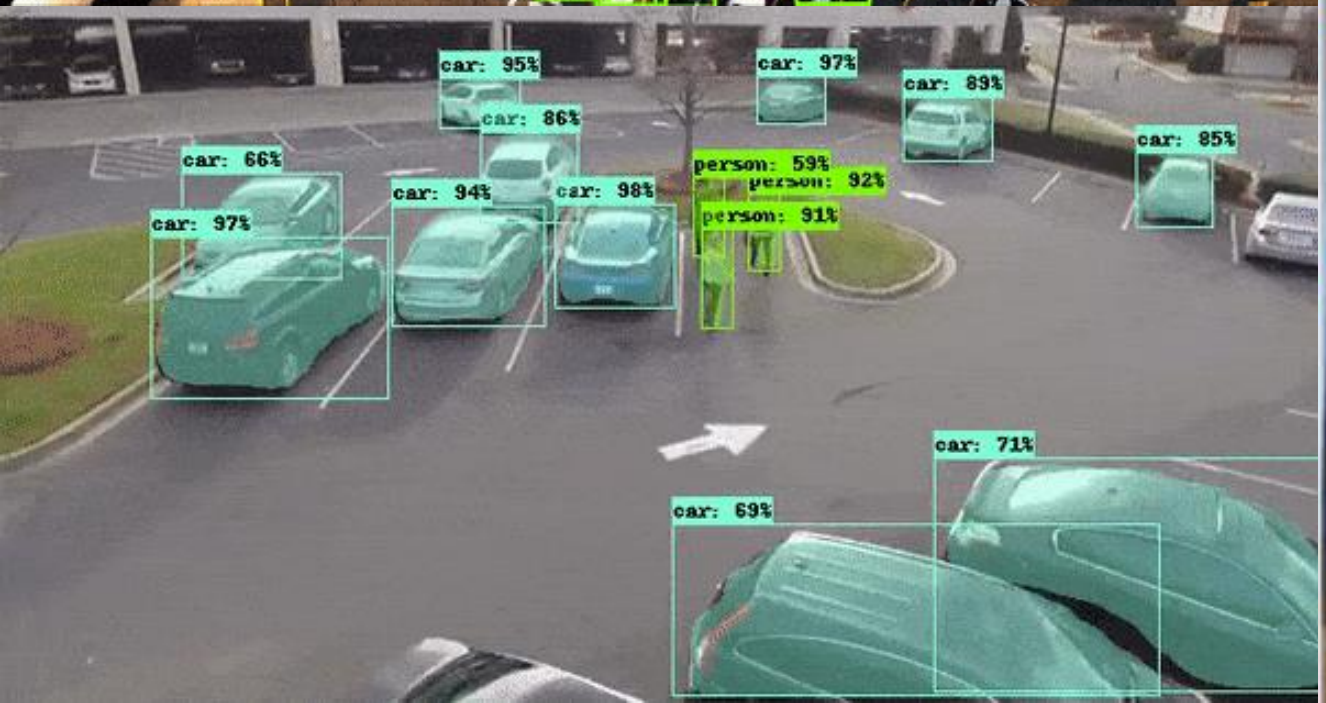

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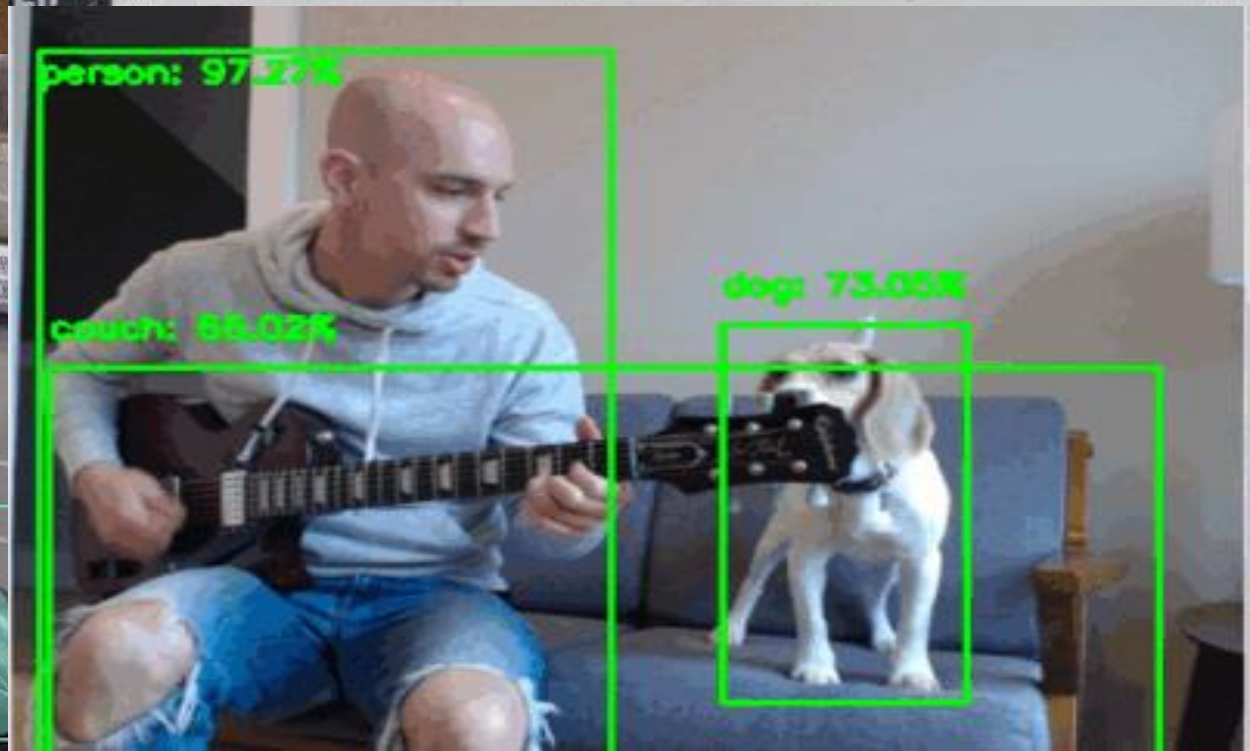

HIDDEN
INPUT
OUTPUT


DEEP LEARNING NEURAL NETWORK
Multiple hidden layers
process hierarchical features
Input
layer
Output
layer
Input
?
Identify
light/dark
pixel value
Identify
edges
Identify
combinations
of edges
Identify
features
Identify
combinations
or features


STOP

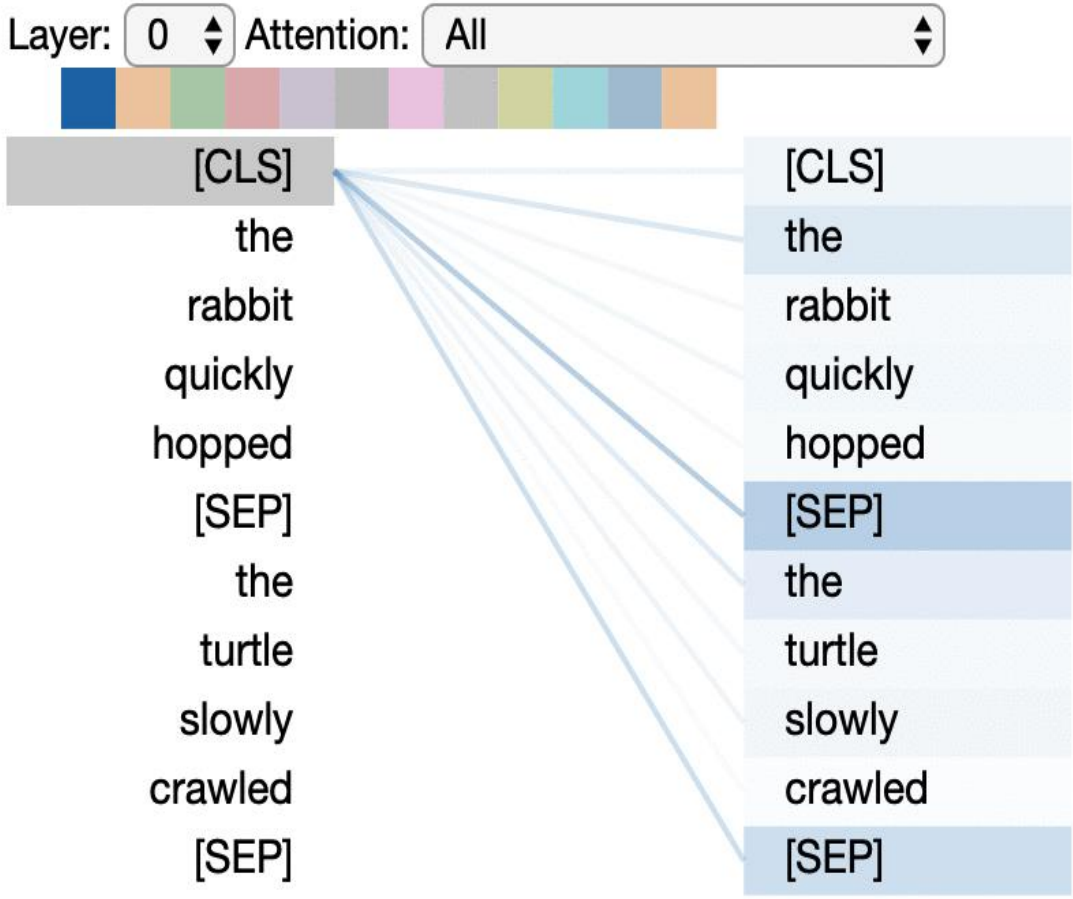

traffic light: 59%
person: 99%
person: 99%
person: 89%
person: 97%
car: 53%


car: 95%
car: 86%
car: 97%
car: 89%
car: 66%
car: 85%
person: 59%
person: 92%
car: 94%
car: 98%
person: 91%
car: 97%
car: 71%
car: 69%


person: 97%
couch: 88.02%
dog: 75.05%


Lane Change: RIGHT
Ego Speed: 14.60 MPH
Time: 28659.6552s48000
CAL: P 1.35 / 0.10 R 0.00 deg
Vision fps: 0.00 Draw fps: 16.46 Display fps: 18.68
NL(0.00), E(1.00), F(0.00), TF(0.00), S(0.00)
NRW: FLP(0.00), FRP(0.00)
+0.0000 AUTO_HIGH_BEAM
+0.0000 BLINDED
+0.0000 RAINING
+0.0000 TIRE_SPRAY
+0.0001 WET_ROAD
0.7872 RESTRICTED
0.0000 CONTROLLED_ACCESS
L:1 R:0 F:1 ON:1
W:7.3 AP:0.3 R:1
VS: 25.0 MPH St: 1
merge: 1.0 1 74.3 L
STOP
MAIN

Words are just data.



The Future?

Environmental Compliance & Protection

5 Primary Technologies Taking Shape

#1 Artificial Intelligence/Machine-Learning

#2 Digital-Twin/Quantum-Twin Tech

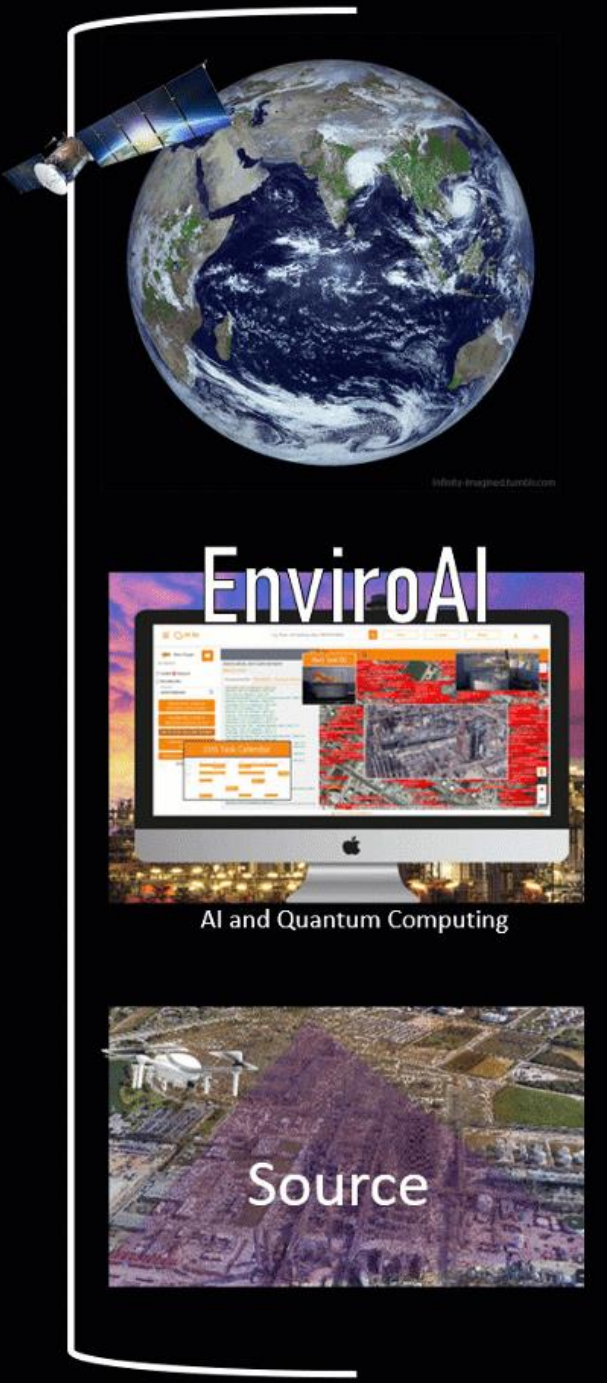
- Real-time simulation and modeling

#3 Digital/Quantum Computing

#4 Digital/Quantum Sensing

#5 Digital/Quantum Connectivity and Communication

AI




“It from bit.”
– John Wheeler