

Minds and Machines

Lecture 8

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Pop Quiz

- Put away devices
- Use a blank sheet of paper
- At the top, write your name and your TA's name (Dana Grabelsky, Sydney Harvey, Richard Roth).

Pop Quiz

1. What is the simulation hypothesis?
2. What is skepticism?
3. What does “cogito ergo sum” mean?
4. Name one argument for the existence of God

[optional questions]

5. What's one thing you like about this class?
6. What's one thing you would change about this class?

Previously

- Knowledge and skepticism
- Arguments for the existence of god.

Today

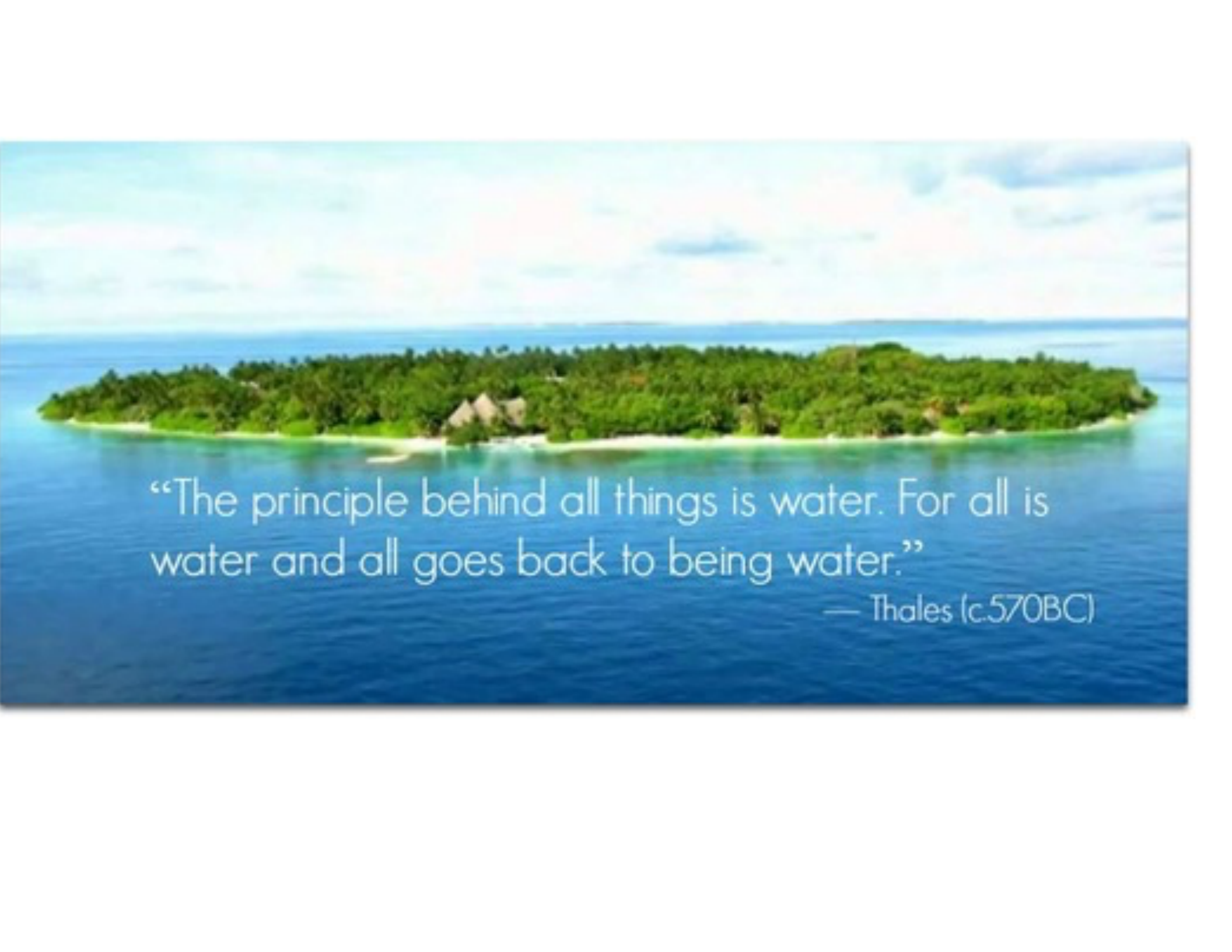
- Metaphysics: the nature of reality
- It-from-bit: The universe is made of information.

Metaphysics

- Metaphysics = the study of the nature of reality.
- Especially: the fundamental nature of reality.
- What is the world made of?

Thales: Water

- Thales (600BC): The world is made of water

An aerial photograph of a small, lush green tropical island in the middle of a clear blue ocean. The island is covered in dense tropical vegetation, including palm trees. A small thatched-roof hut is visible on the left side of the island. The water around the island is a lighter blue, indicating a shallow reef flat or lagoon. The sky is bright blue with some light clouds.

“The principle behind all things is water. For all is water and all goes back to being water.”

— Thales (c.570BC)

What is the **basic material** of the cosmos?

It **must** be...

...something
from which
everything
can be formed.

...**essential**
to life.

...capable
of **motion**.

...capable
of **change**.

**Everything is
made of water.**

Roddy Meets Thales

C. 585 b.c.





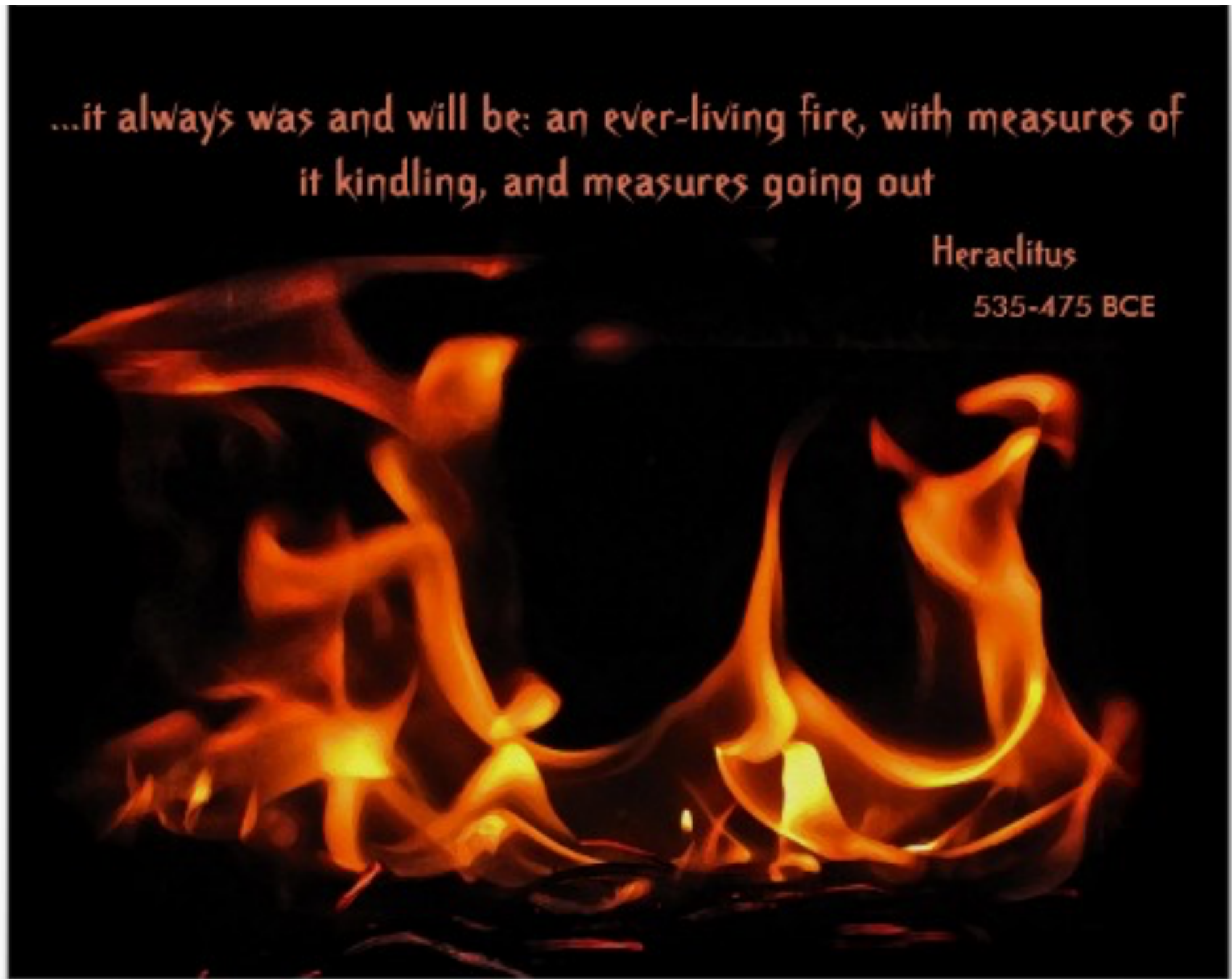
Heraclitus: Fire

- Heraclitus (500 BC): the world is made of fire.

...it always was and will be: an ever-living fire, with measures of
it kindling, and measures going out

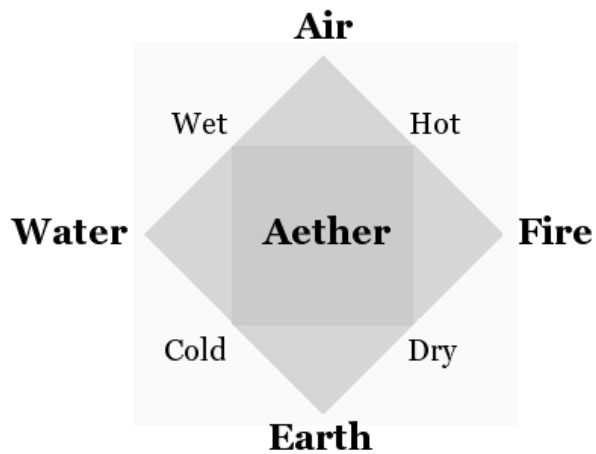
Heraclitus

535-475 BCE

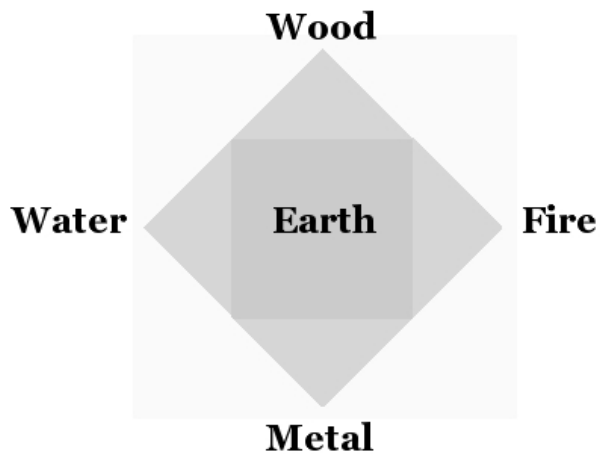


Empedocles

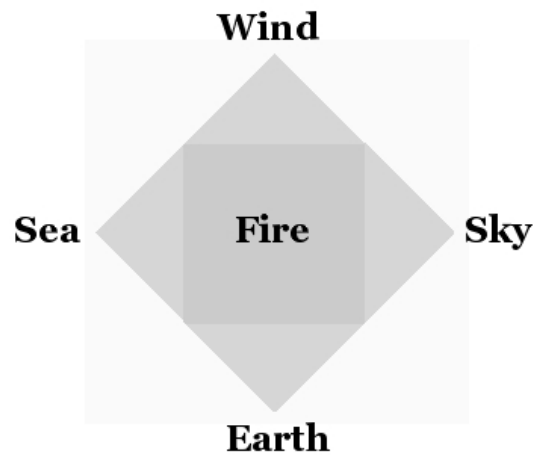
- Empedocles (450 BC): There are four basic elements of reality: earth, air, fire, and water.



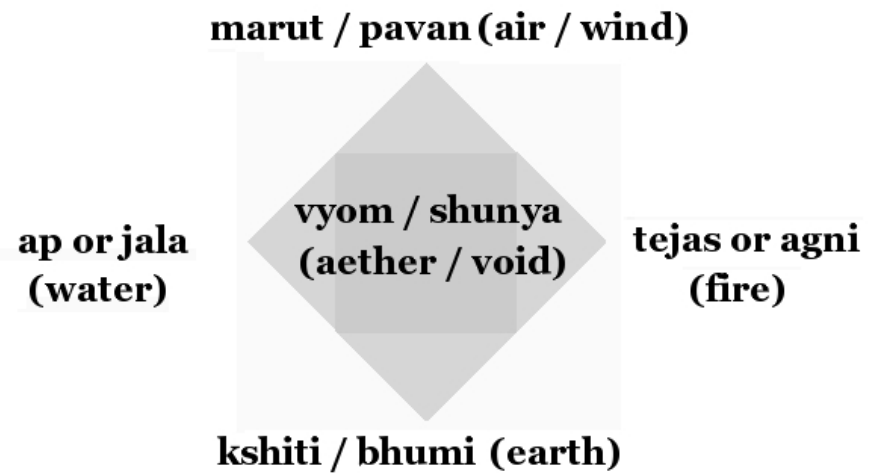
Classical Greece & Medieval Alchemy



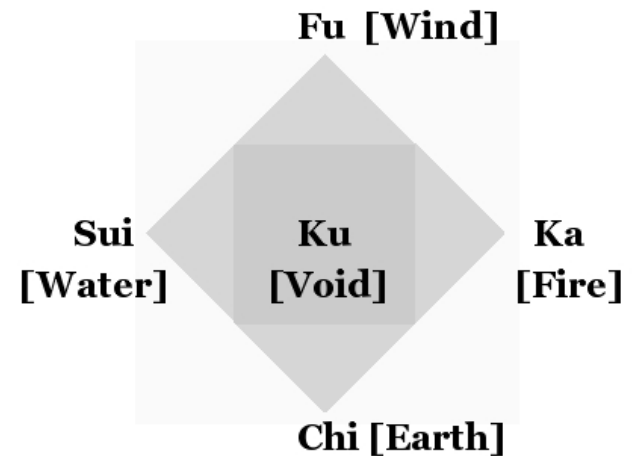
**China; The Wu Xing,
[Five Phases/ Agents/
Movements/ Steps/Stages]**



**Babylonia
[Enûma Eliš]**



**India; pancha mahabhuta,
[Hinduism]**

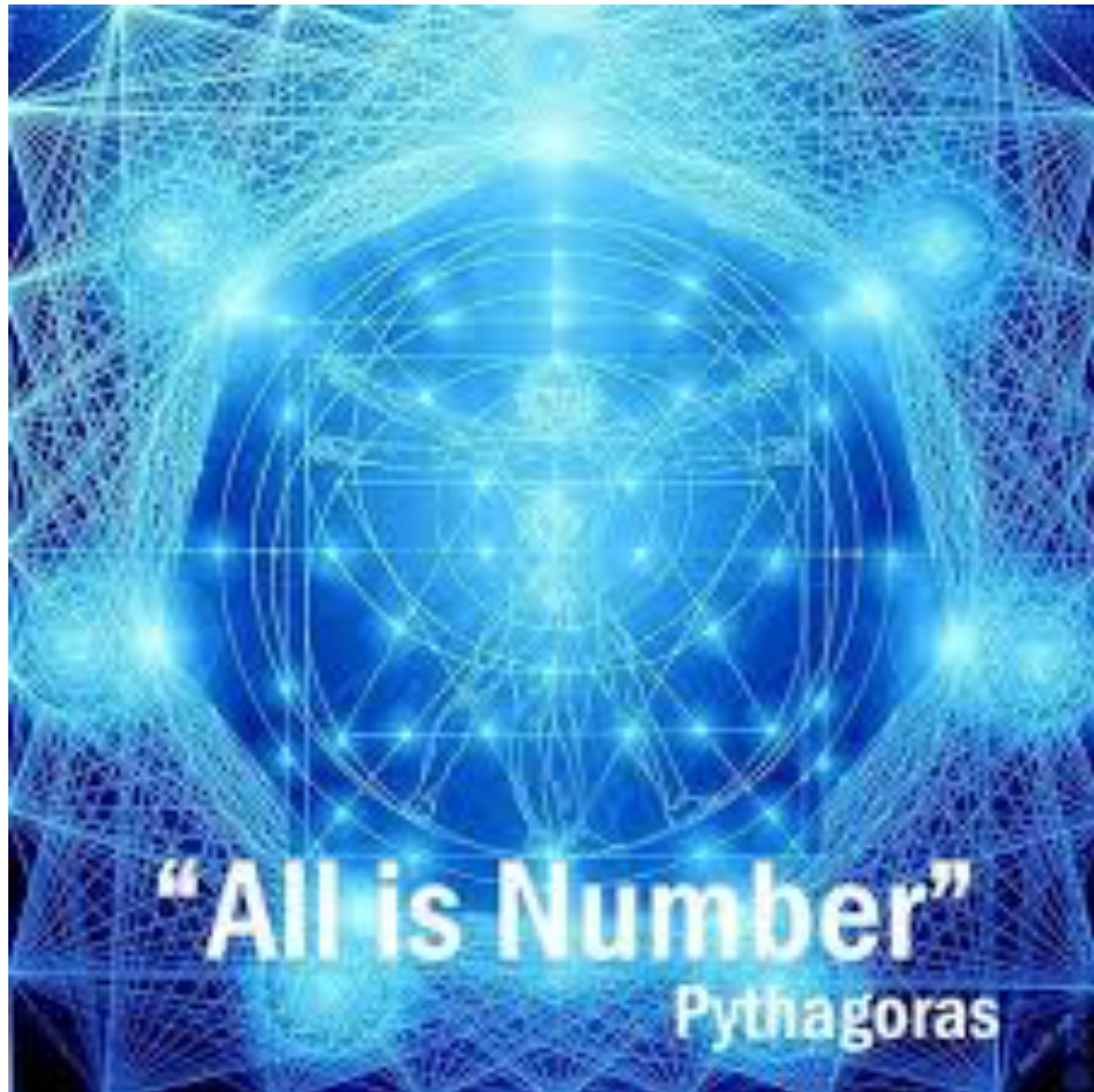


Japan; godai.[Buddhism]

Simplified four/five elements systems

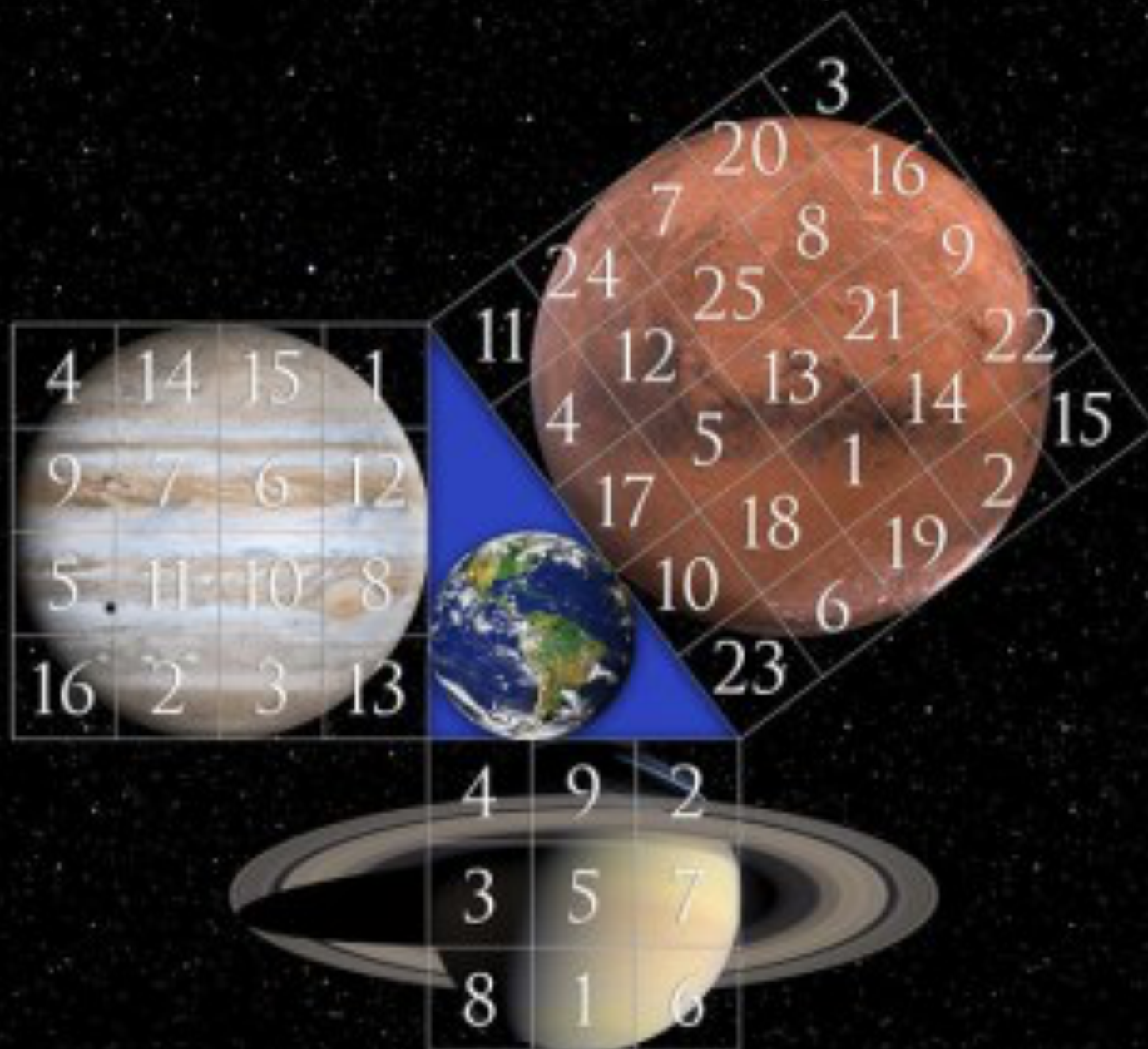
Pythagoras: Numbers

- Pythagoras (550 BC): All is number



“All is Number”

Pythagoras



Democritus: Atomism

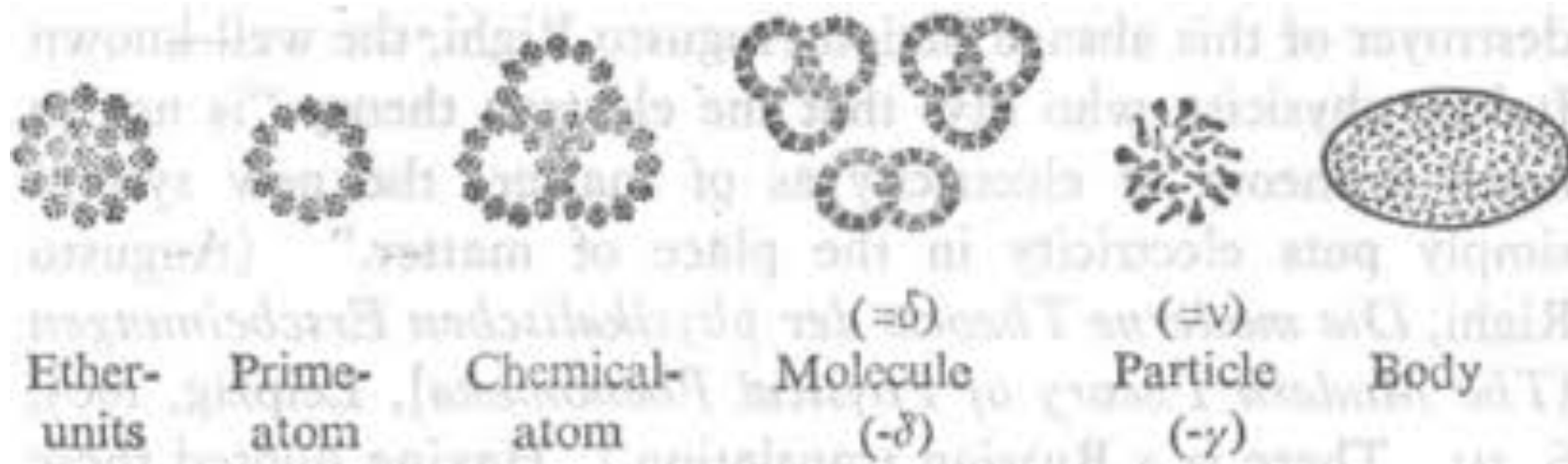
- Democritus (400 BC): Everything is made of atoms.
- Atomism: The basic elements are atoms, which are physically indivisible.



Adventures Inside the Atom

Materialism

- Hobbes (1640) and many others:
Materialism
- The world is made of matter.
- Physicalism: physics describes what is fundamental to reality. Everything else is derivative.

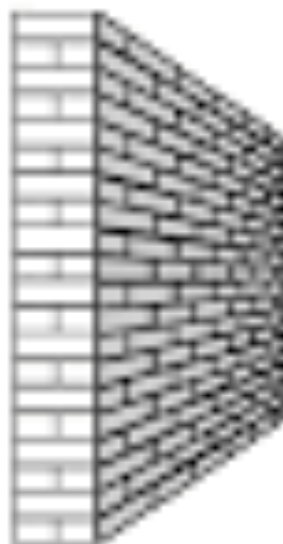


Berkeley: Idealism

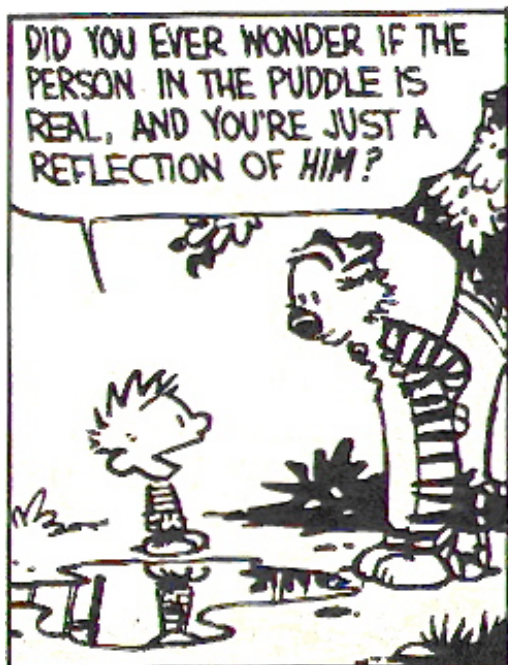
- Berkeley (1700AD): Everything is mind.
- Idealism: everything is ideas.
- The world is fundamentally mental.

Cartesian Dualism

Mind



Matter



IF THAT WAS TRUE, YOU'D DISAPPEAR AS SOON AS THE PERSON IN THE PUDDLE MOVED AWAY FROM THE PUDDLE, RIGHT?



Descartes' Dualism

- Descartes: There are two fundamental components to reality: matter and mind.
- This is *dualism*.

DUALISM vs MONISM

Cartesian Duality:
MATTER-MIND



KEY:

Physical and **M**ental substance
is either fundamental or derivative.
(solid line) (dashed line)

Physicalism:
MATTER > Mind



Idealism:
Matter < MIND



Neutral Monism:
3rd SUBSTANCE
> Matter & Mind



Three Metaphysical Views

- Materialism: everything is matter
- Idealism: everything is mind
- Dualism: everything is matter or mind

Metaphysics of Simulation

- Question: if the simulation hypothesis is correct (we're living in a computer simulation), what is the correct metaphysical view of our reality?

It-From-Bit Hypothesis

- It-From-Bit Hypothesis: The world is made from information.

It-From-Bit Hypothesis

- It-From-Bit Hypothesis: The world is made from information.
- https://www.youtube.com/watch?v=5T6VKwaR_vc

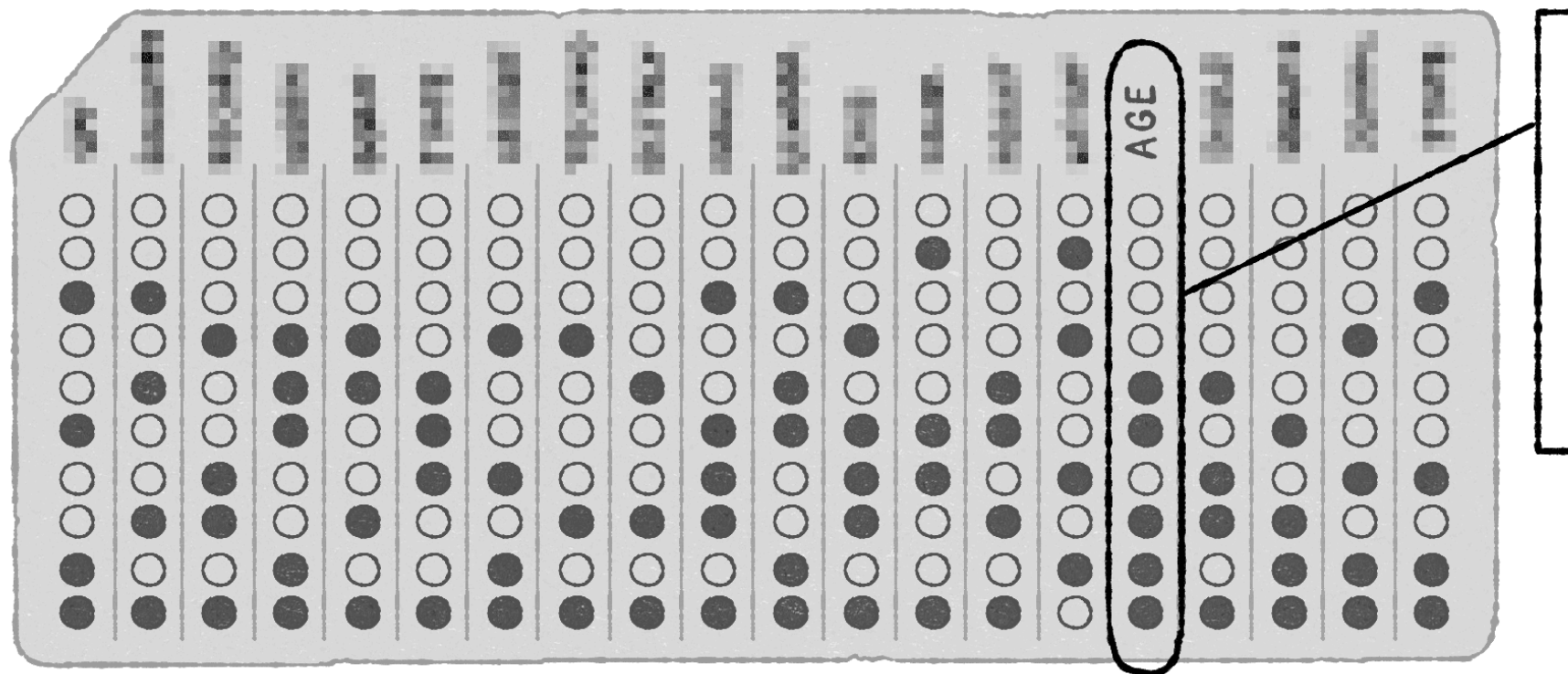
Wheeler on It-From-Bit

- "Every physical quantity, every it, derives its ultimate significance from bits, binary yes-or-no indications, a conclusion which we epitomize in the phrase, *it from bit*."

—John Wheeler, 1989

Varieties of Information

- Structural information: Bits, e.g. 011100110 encoded in a computer.
- Semantic information: Facts, e.g. *Trump is the 45th US president*
- Symbolic information: Bits encoding facts: e.g. 1011100010011 representing *Trump is the 45th US president*.



STRUCTURAL
INFORMATION:
0000110111

ENCODES

SEMANTIC
INFORMATION:

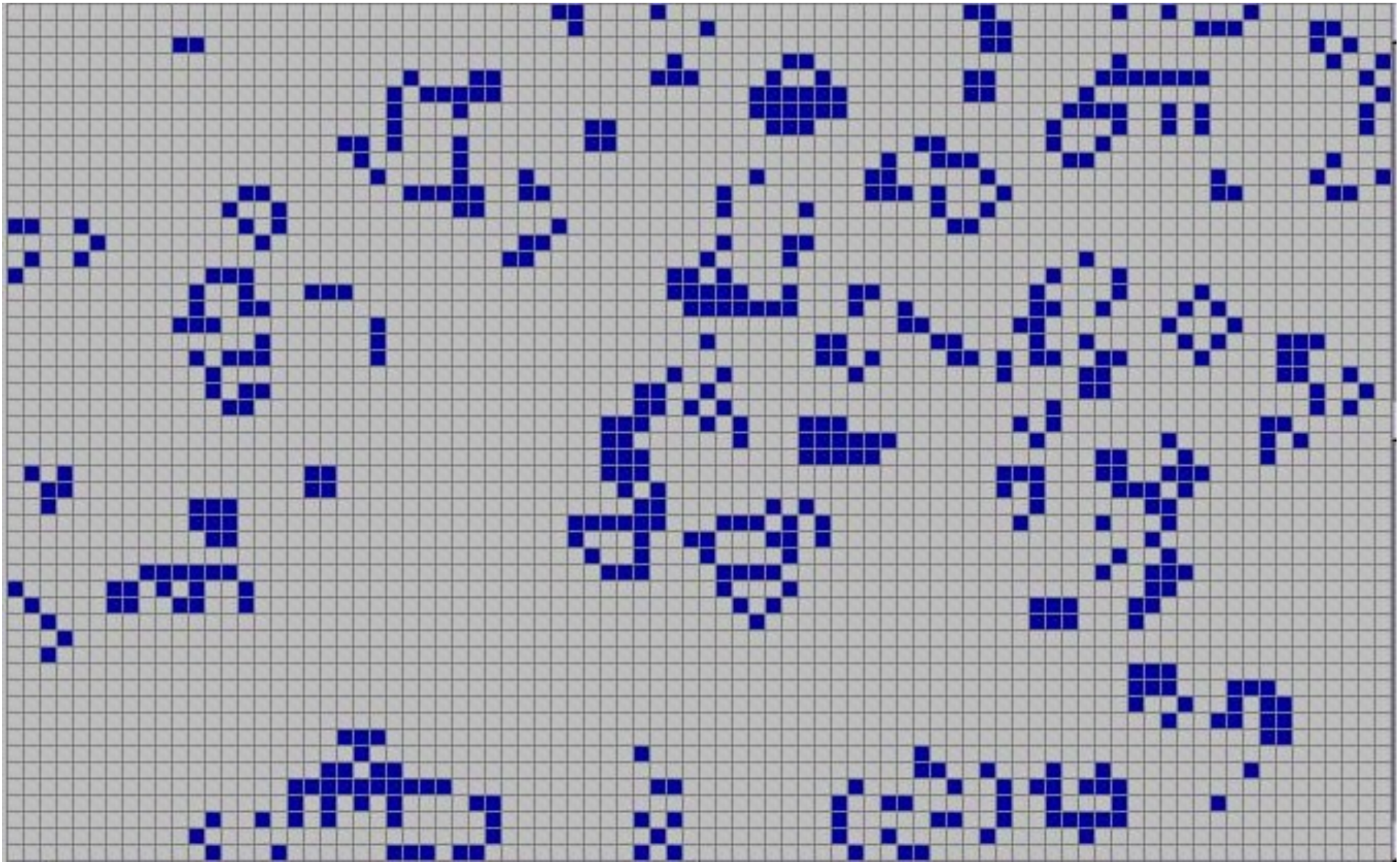
AGE = 55

Structural Information

- What matters for the it-from-bit hypothesis is structural information.
- The idea is that patterns of bits underlie physics.

Computation Under Physics

- Physical processes are made up of underlying computational processes.
- Underneath biology is chemistry
- Underneath chemistry is physics.
- Underneath physics is computation.



<https://bitstorm.org/gameoflife/>



.....
Atoms
.....

110101101011
011010000111

It-From-Bit in Science

- The it-from-bit hypothesis is taken seriously by some scientists.
 - E.g. Stephen Wolfram, *A New Kind of Science*
- Some think there is physical evidence for the hypothesis (but this is controversial).

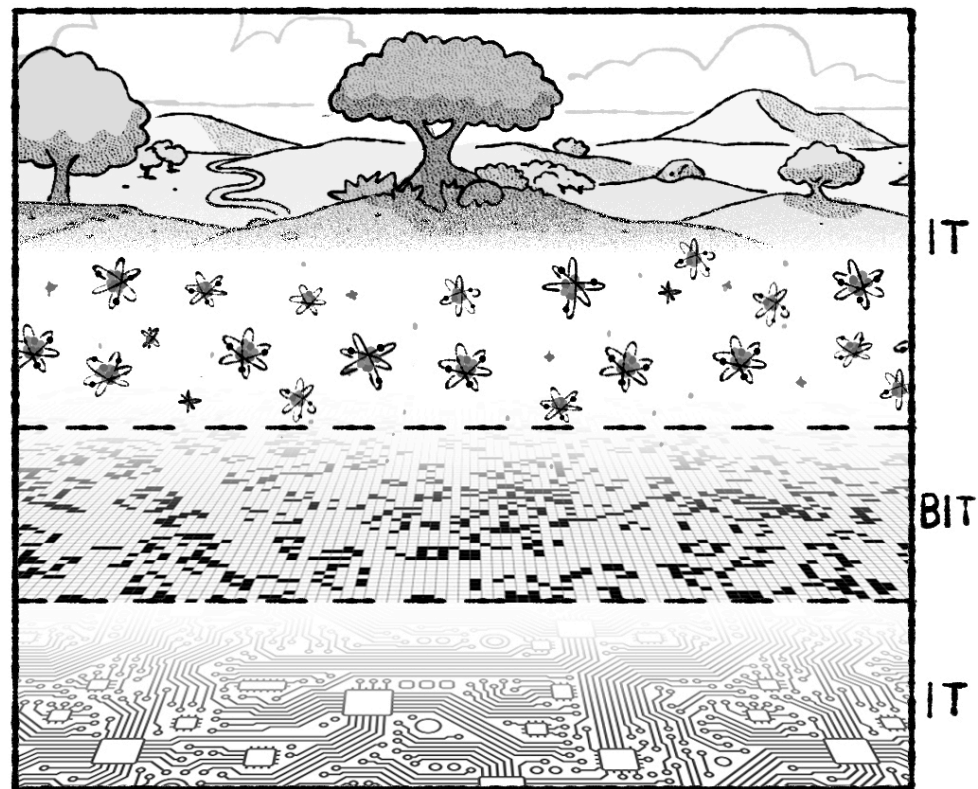
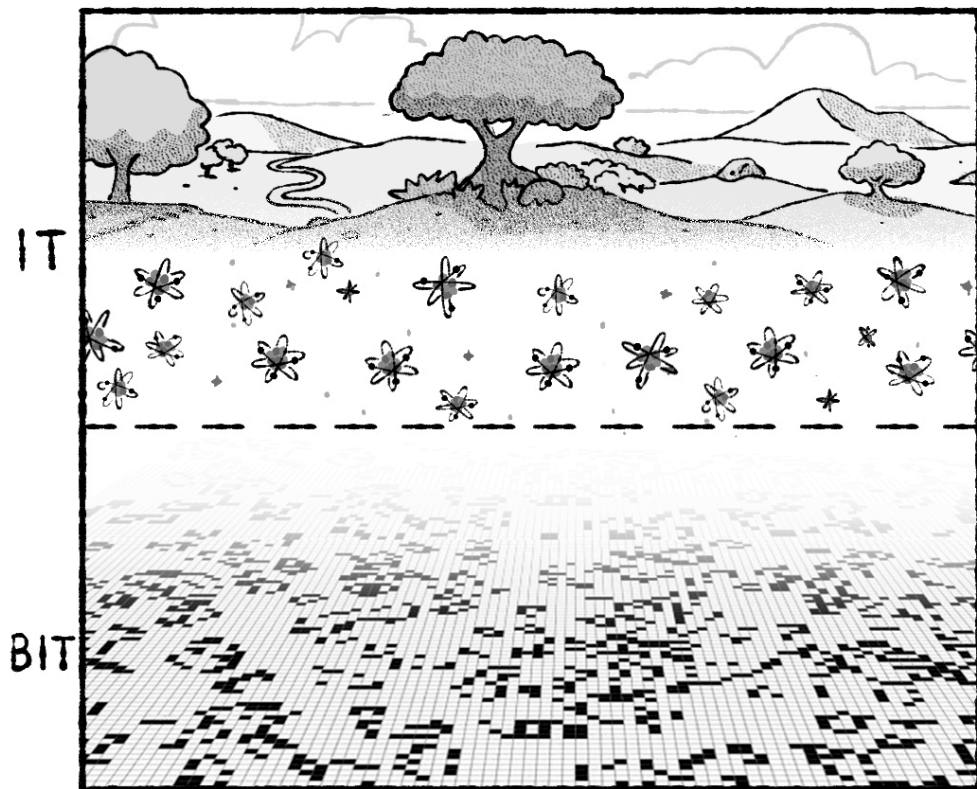
Pure It-From-Bit

- Pure It-From-Bit: The world is *fundamentally* made of bits.
- Strong version of it-from-bit hypothesis
- The ultimate level of reality is information, or computation.



It-From-Bit-From-It

- The It-From-Bit-From-It Hypothesis.
 - Weak version of it-from-bit hypothesis
 - Computation underlies physics, and something else underlies the computation.
 - Atoms made from bits made from something deeper still.



It-From-Bit

- My view: The Simulation Hypothesis and the It-From-Bit Hypothesis are closely related.
- If the Simulation Hypothesis, a version of the It-From-Bit Hypothesis is true.
- The objects in our worlds are made of computational processes running on a computer in the next world up.

Next Meetings

- The Reality Question:
 - What is reality?
 - Is virtual reality genuine reality?