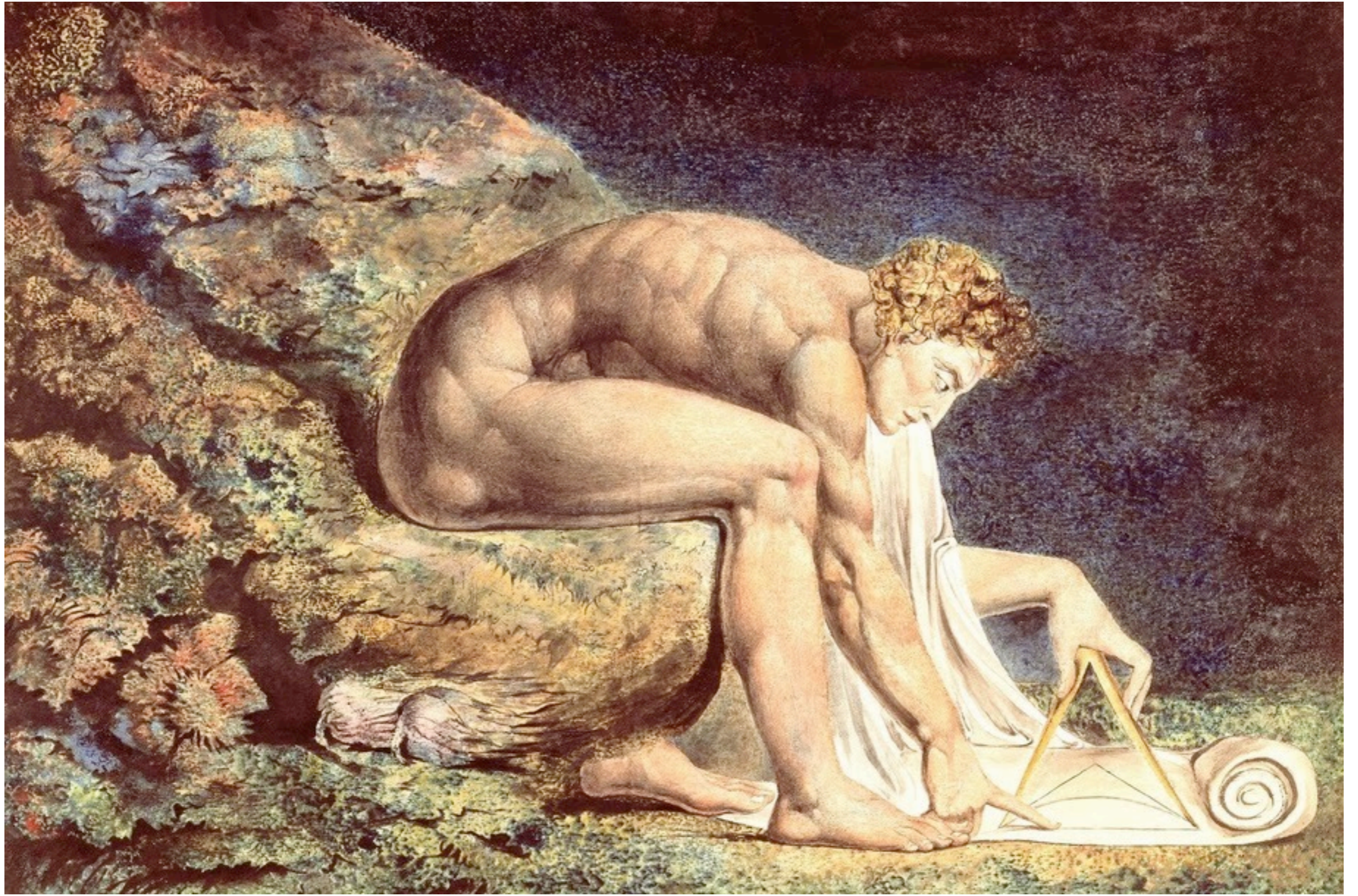


What is Theoretical Physics?

Dark Matter, Take I





BERLIN.

(Prof. Encke and Dr. Galle.)

		Berlin M.T.			R.A.	Dec.
		h	m	s		
1846	Sept. 23	12	0	14.6	328° 19' 16".0	-13° 24' 8".2
	24	8	54	40.9	18 14.3	24 29.7
	25	9	41	45.0	16 59.8	24 55.4
	26	10	11	54.3	15 48.3	25 22.2
	27	8	29	48.9	14 42.8	25 44.6
	28	11	31	28.8	13 25.5	26 11.5
	29	9	14	3.7	12 23.4	26 32.6
	Oct. 2	11	5	35.2	9 7.0	27 41.4
	6	8	0	54.2	5 16.2	29 1.3
	10	8	52	56.3	328 1 42.2	-13 30 14.7

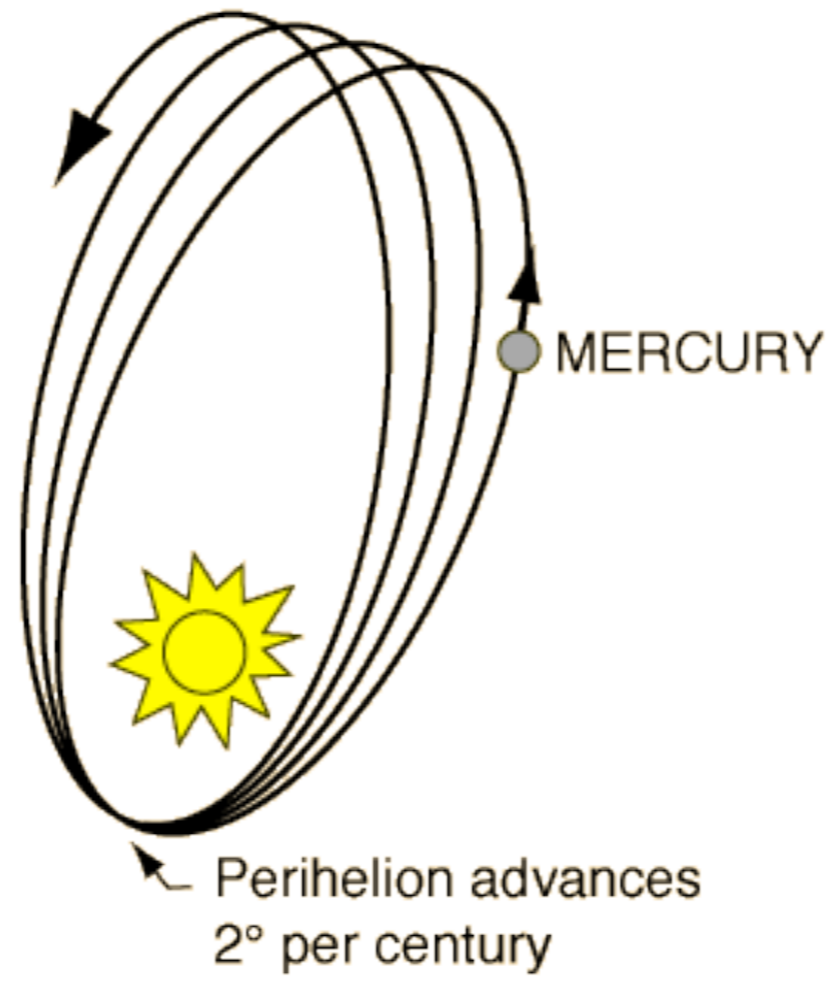
On Sept. 29, the diameter of the planet was found to be 2".79.

The planet is always compared with the same star of the 9th magnitude, the mean position of which is *assumed to be*,

		R.A.	Dec.
1846	Jan. 1	327° 56' 56".4	-13° 26' 9".6



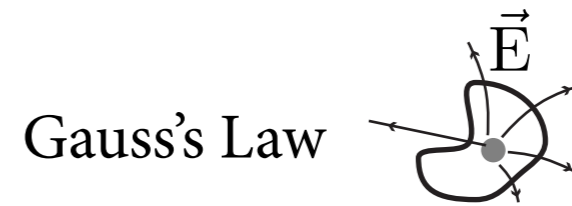
Happy birthday,
Neptune!



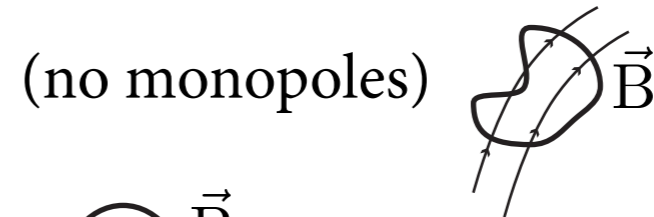
Unification, Take I

Maxwell's Equations

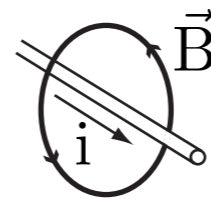
$$\int \vec{E} \cdot d\vec{S} = q$$



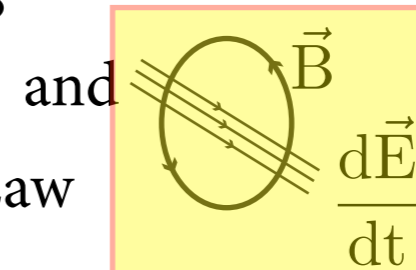
$$\int \vec{B} \cdot d\vec{S} = 0$$



$$\int \vec{B} \cdot d\vec{l} = i + \frac{d}{dt} \Phi_E$$

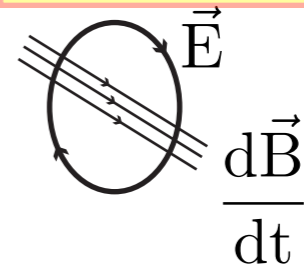


Ampère's Law



$$\int \vec{E} \cdot d\vec{l} = -\frac{d}{dt} \Phi_B$$

Faraday's Law



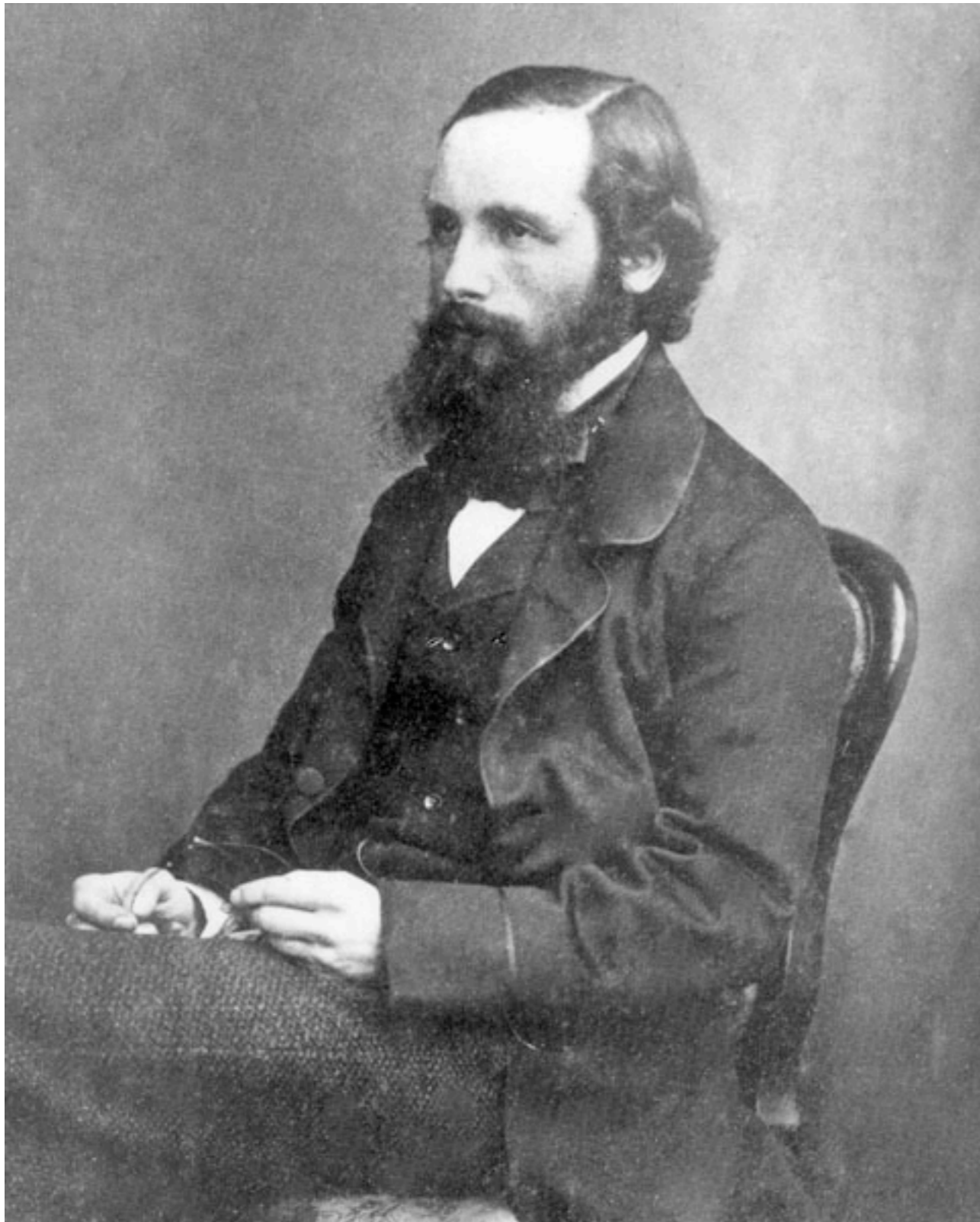
$$\vec{\nabla} \cdot \vec{E} = \rho$$

$$\vec{\nabla} \times \vec{B} = \vec{J} + \frac{\partial \vec{E}}{\partial t}$$

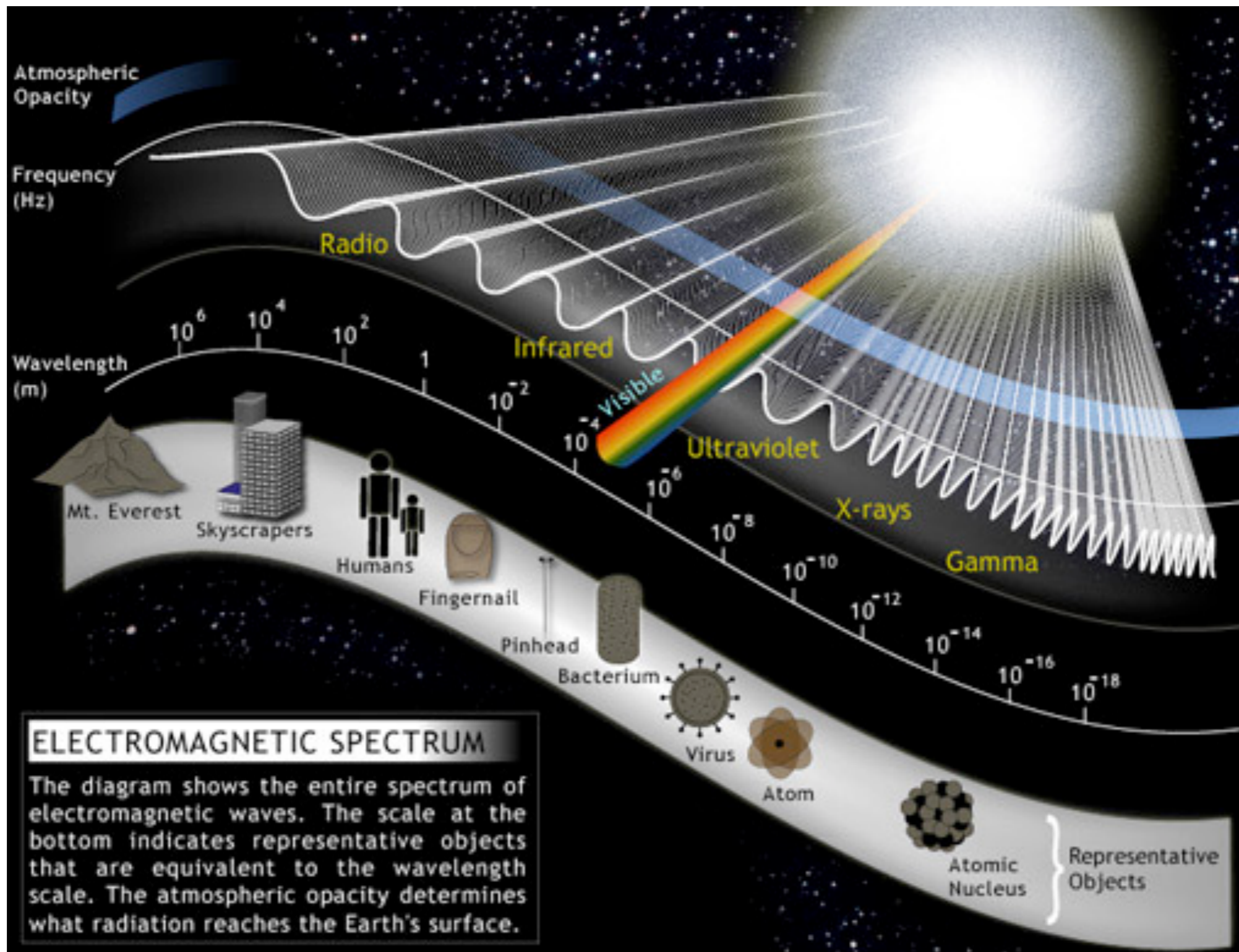
$$\vec{\nabla} \cdot \vec{B} = 0$$

$$\vec{\nabla} \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$$

(Differential Forms)



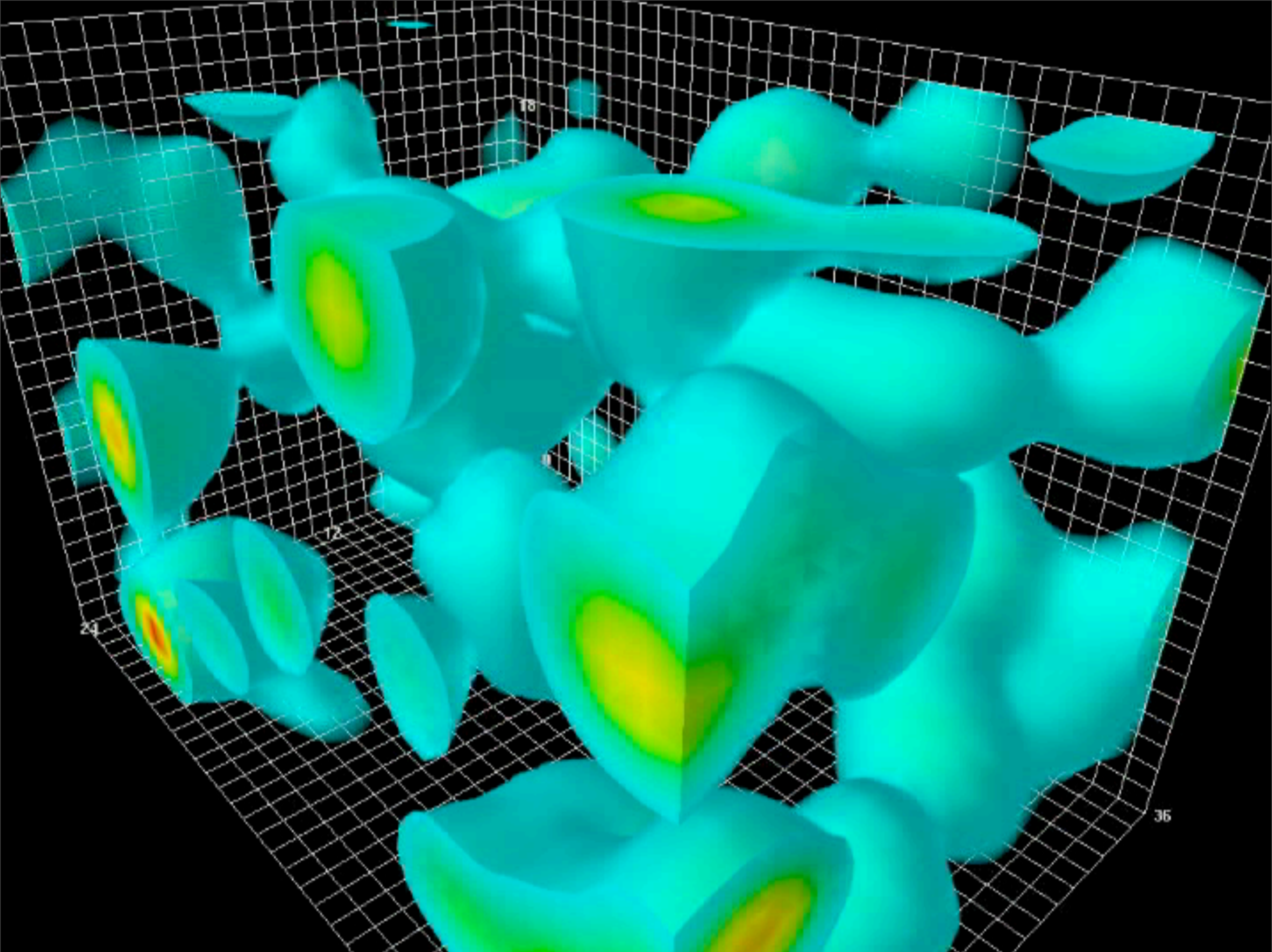
“We can scarcely avoid the inference that light consists in the transverse undulations of the same medium which is the cause of electric and magnetic phenomena.”





“One cannot escape the feeling that these mathematical formulae have an independent existence and an intelligence of their own, that they are wiser than we are, wiser even than their discoverers, that we get more out of them than was originally put into them.”

Space as a Material



Like Fish Discovering Water



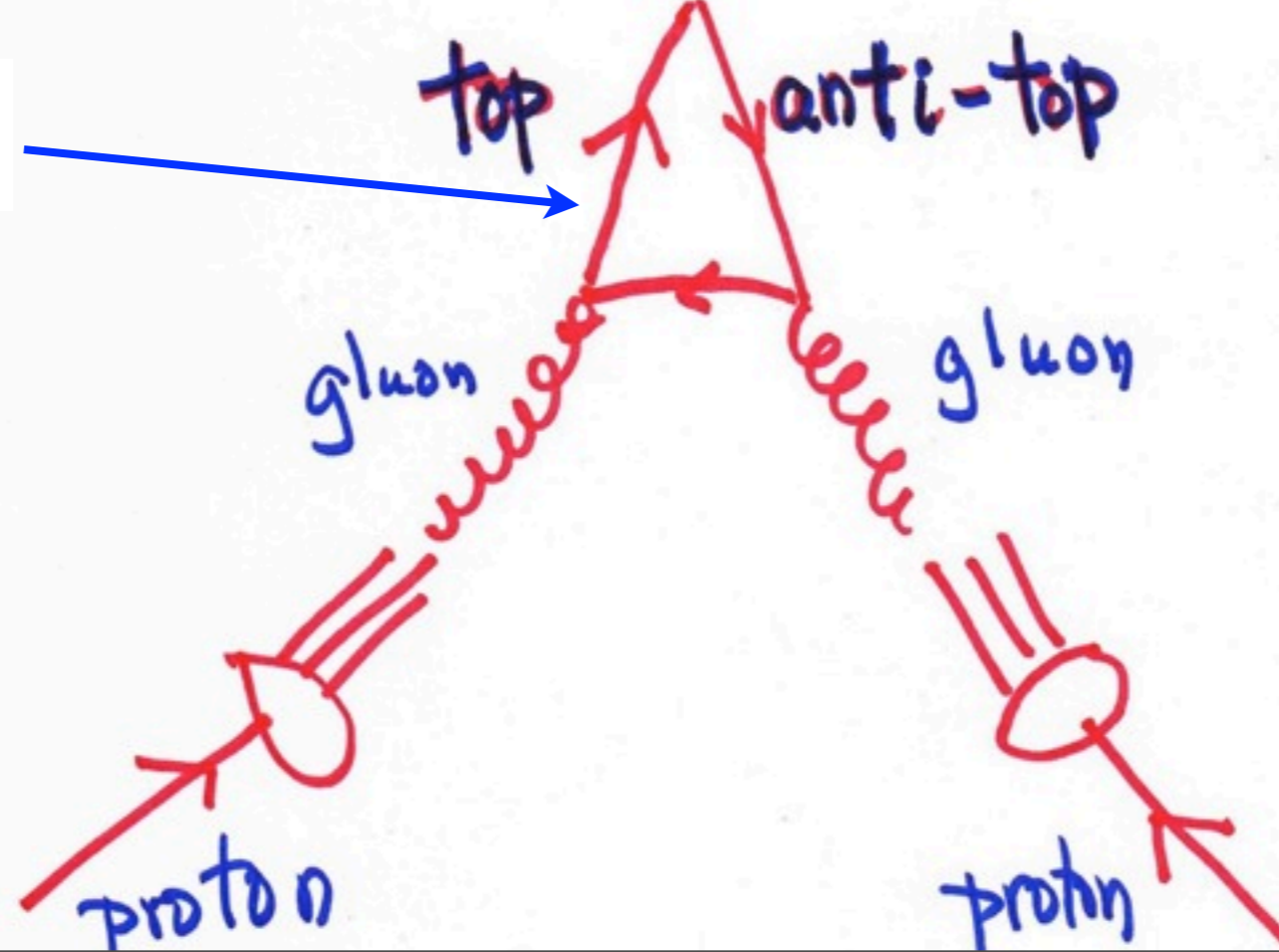
We Live in Cosmic “Universal Ocean”

$t\bar{t} + W^+W^- + ?Y?$



decay

$t\bar{t} + ?X?$



production

philosophical implications

For fundamental physics:

Could *all* the apparent distinctions among elementary particles arise from their interaction with cosmic fields?

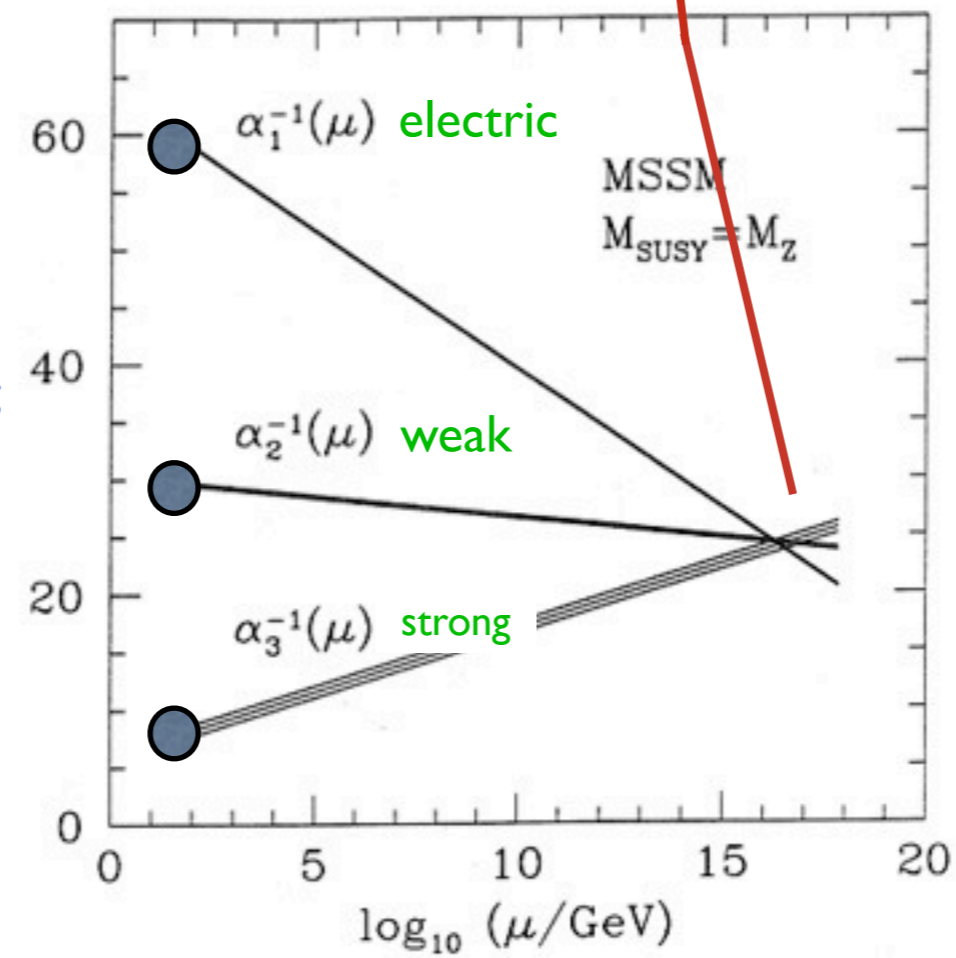
Detailed investigation shows: Very possibly!

In this way, Einstein's dream of unification has evolved from mystic faith to quantitative science.

Unification, Take 2

Why I ♥ SUSY

↑
inverse coupling
strength



large energy, short distance →

Gravity fits too!
(roughly)

For cosmology:

If space is - or, more flexibly, if space is filled with - a material, could that material

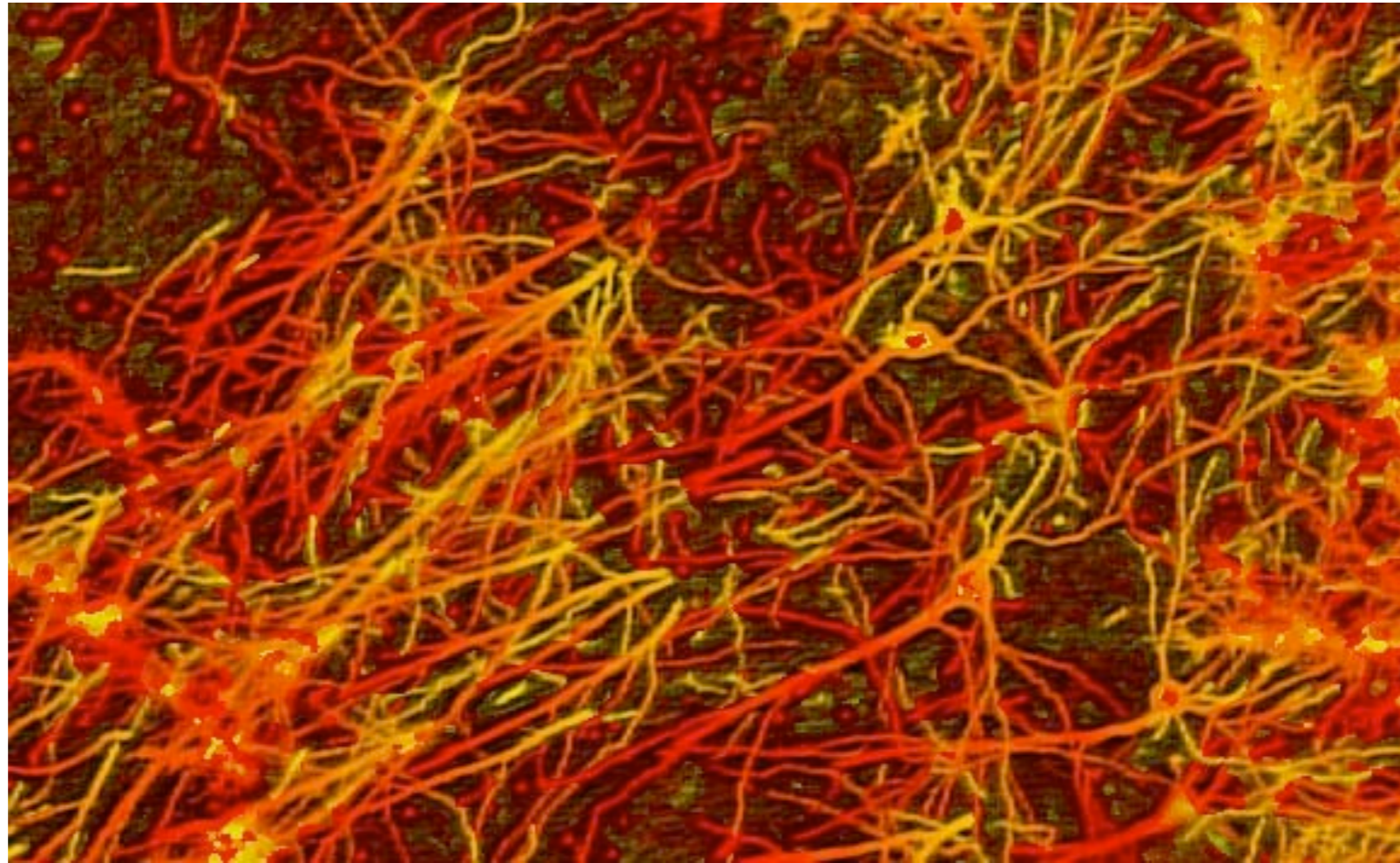
change with time? (Specifically, could it boil away in the hot Big Bang?) **inflation**

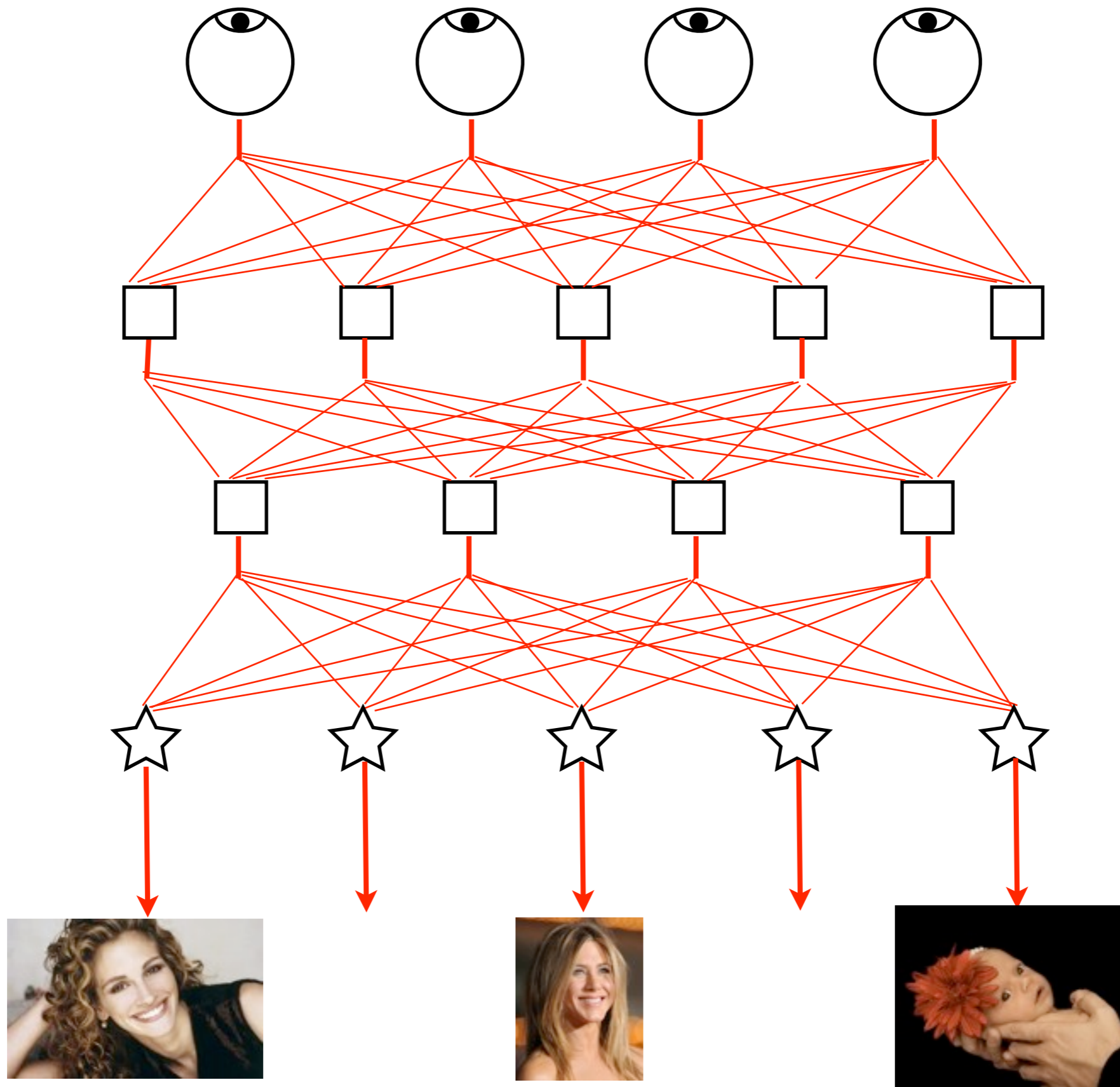
be radically different elsewhere? **multiverse**

Theory and Technology









cruder,
denser,
cheaper,
reproductive?

