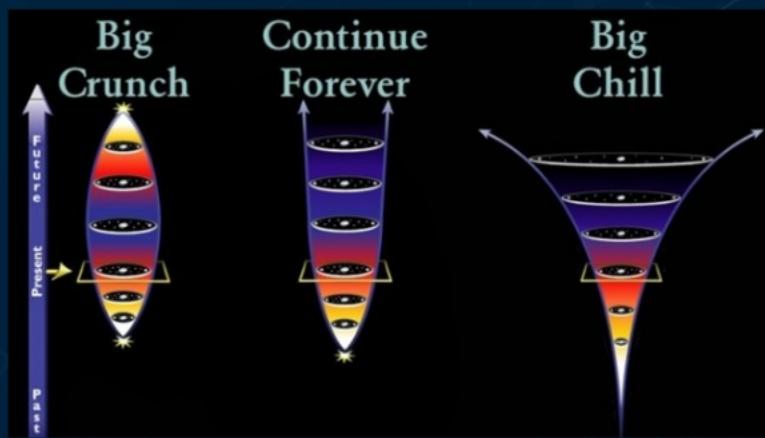


EVOLUTION OF THE UNIVERSE

THE BEGINNING, THE PRESENT AND THE ENDING





What
happened
at the
beginning?

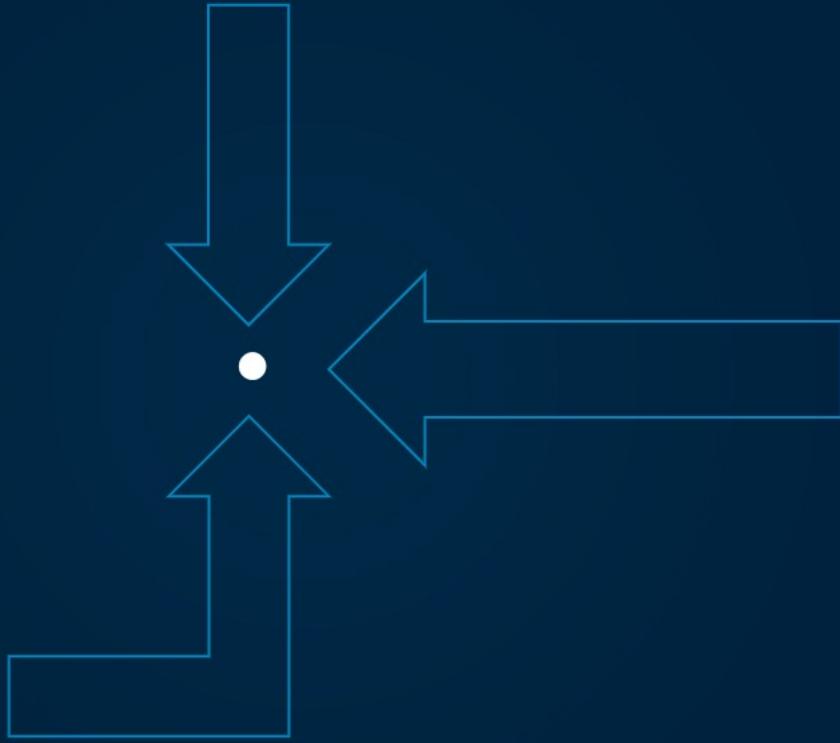
What
happened
after the
beginning?

What made
the universe
look like
how it is
today?

How can
one
destroy
the
universe?

How do
I know
all these
things?

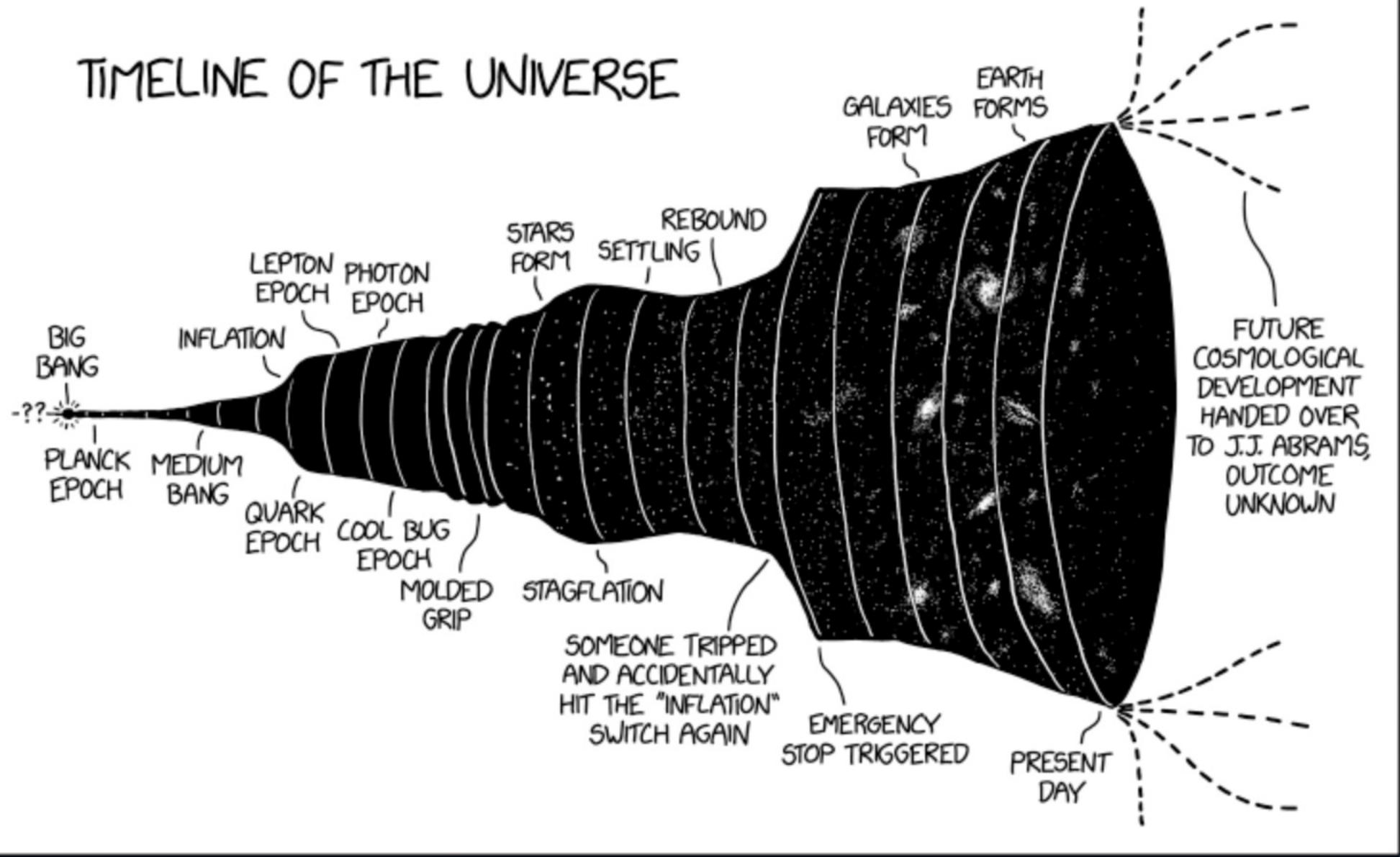
Yeah that single
dot.....



All because of
a single dot.....

Even smaller
than that

TIMELINE OF THE UNIVERSE



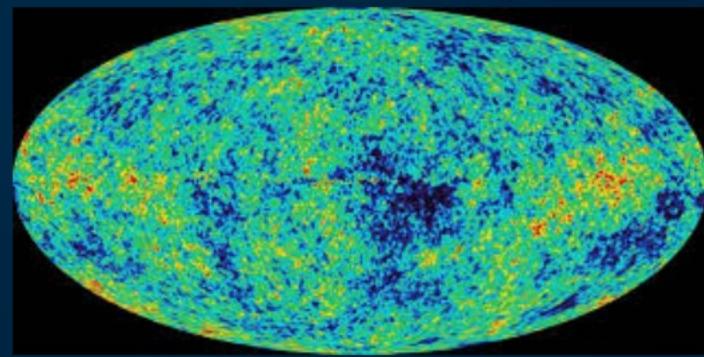
Upto the 20th century most of the scientists thought that the universe as infinite and ageless.



Edwin Hubble discovered that the galaxies are moving apart that concluded that the universe is expanding which supports the idea of Big Bang.



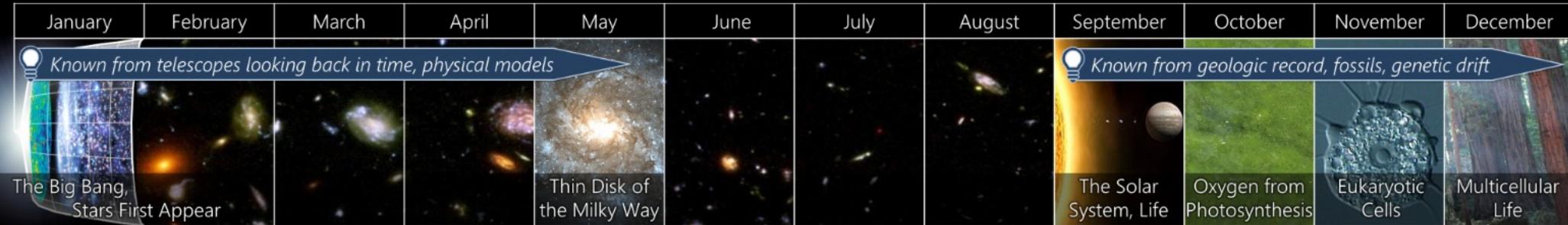
Einstein's theory of relativity gave us better understanding of gravity.



In 1964, by accident, cosmic background radiation was discovered, a relic of the early universe, which together with the observational evidence made the Big Bang Theory the accepted theory in science.

The Cosmic Calendar

The 13.8 billion year history of the universe scaled down to a single year, where the Big Bang is January 1st at midnight, and right now is midnight 1 year later



The Month of December...

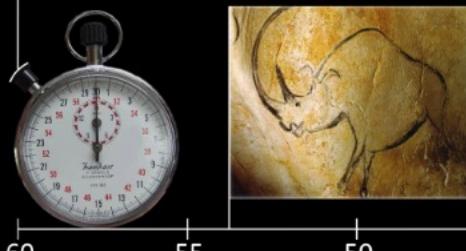
1	2	3	4	5	6	7	8	9	10	11	12	13	14
15 Trace Fossils Only	16			17 Bones and Shells	18 Vertebrates			19 Land Plants		20 Fish with Jaws		21 Insects	
22 Amphibians	23 Reptiles			24 Pangaea Forms	25 Dinosaurs			26 Mammals		27 Birds		28 Flowers	
29 Tyrannosaurids	30 Dinosaurs Extinct, Mammals Take Over on Land and in Sea			31 The Final Day... Dawn: Apes and Monkeys Split	8 PM: Humans and Chimpanzees Split	9:25: Humans First Walk Upright	10:30: Human Brain Size Begins Tripling	11:52: Modern Humans Evolve		11:56 to 11:59: Human Migration			

The Final Minute...

A human life only lasts for the blink of an eye on the Cosmic Calendar: $100 \text{ years} * 365 * 24 * 60 * 60 / 13,800,000,000 = 0.23 \text{ Cosmic Seconds}$

Known from artifacts, radiocarbon dating, DNA extraction from remains

Written records



End of Last Ice Age, Sea Level 400 Feet Lower Than Now

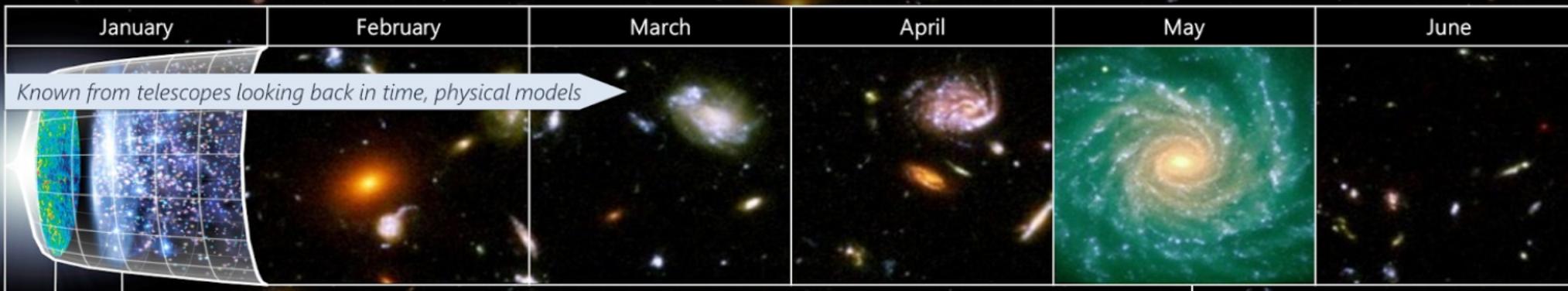


Agriculture Leads to Permanent Settlements



The Cosmic Months

Each Month = 13.8 Billion Years / 12 Months = 1.15 Billion Years



Jan 1, 12 AM 13.8 Billion Years Ago

The Big Bang describes how all the space and matter in the Universe could inflate from a point of energy

Jan 1, 12:15 AM 13.799 BYA

The Cosmic Microwave Background is the furthest back in time telescopes can see, from when plasma cooled into atoms

January 15 13.24 BYA

Stars lit up when gravity clumped enough hydrogen atoms together to begin fusion of heavier elements

Mid May 8.8 BYA

The Thin Disk of the Milky Way, where the solar system is, has stars that are as old as 8.8 billion years



Sept 2 4.6 BYA

The Solar System condensed from exploded stars that had fused the elements needed to form a rocky, watery planet

Mid Sept 3.5 BYA

Life began when a carbon based macromolecule first copied itself, leading to simple single celled life like bacteria

Oct 28 2.45 BYA

Photosynthesis Freed Oxygen, slowly changing Earth's chemistry until there was enough for animals to breathe

Mid Nov 2.1 BYA

Eukaryotic cells, the building blocks for multicellular life, are large cells with organelles like a nucleus and mitochondria

By Dec 1st 1.15 BYA

Animal cells diverged from fungi cells to finish forming all six Kingdoms of Life as single celled organisms

The Days of December

Each Day = $13.8 \text{ Billion} / 365 \text{ Days} = 38 \text{ Million Years}$

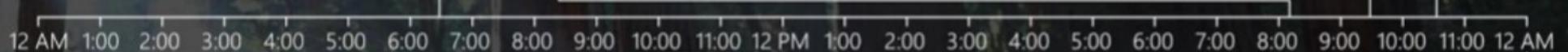
Known from geologic record, genetic drift, and fossils

4	5	6	7	December 1 st	2	3
11 Continental drift split apart the supercontinent Rodinia	12 	13 Earth thawed after having mostly frozen Cryogenian period (Snowball Earth)	14 Sponges and other soft bodied animals appear 	15 Trace fossils are all that remain of these animals 	16 	17 Arthropods that fossilize appear, some like this horseshoe crab 
18 Vertebrates like this lamprey first appear in the fossil record 	19 Land Plants like these liverworts are first to colonize the continents 	20 Fish with jaws and four limbs like this lungfish appear, launching the tetrapod body plan 	21 Insects are the first creatures to move on land and in air 	22 Amphibians were the first tetrapods to live mostly on land, although their young need water 	23 Reptiles were the first animals to live completely on land 	24 Pangaea formed when continental drift again grouped the continents together 
25 The Great Permian Extinction event killed 95% of species on Earth, allowing dinosaurs and pterosaurs to take over top ecological niches 	26 Mammals evolved hair, warm blood, and milk for nursing, all while living as nocturnal foragers beneath dinosaurs 	27 Birds evolved from dinosaurs as Pangaea began to split up into the familiar continents we know today 	28 Flowers evolved to help plants advertise their pollen to birds and insects 	29 Tyrannosaurids took over as the top dinosaur on land and birds beat out pterosaurs in the skies 	30 The K/T Extinction killed off dinosaurs at 6:04 AM on Dec 30 th (66 million years ago) allowing mammals to grow in size and diversify 	31 The Final Day began with mammals dominant but with human ancestors only resembling creatures like this squirrel monkey 

December 31st

Each Hour = 13.8 Billion / 365 / 24 Hours = 1.6 Million Years

6:30 AM 	27.5 Million Years Ago	8:10 PM 	6 Million Years Ago	9:25 PM 	4.1 Million Years Ago	10:30 PM 	2.35 Million Years Ago
Apes and monkeys like this baboon split from their last common ancestor	Human and Chimpanzee evolution split, with the species sharing social skills, tool use, and 98% of their DNA	Walking upright evolved in Australopithecus, perhaps to traverse grasslands that replaced forests	Human brain size began tripling as hominids got into an intelligence arms race, making advanced tools				



Known from the geologic record, genetic drift, fossils, and artifacts left by hominids

The final 15 minutes are also known from DNA extraction from remains



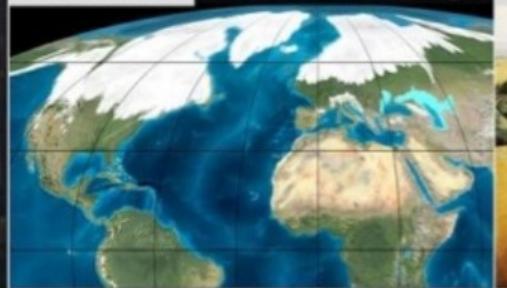
11:45 PM 	400,000 Years Ago	11:52 PM 	200,000 Years Ago	11:56 PM 	100,000 Years Ago	11:58 PM 	40,000 Years Ago
Human control of fire allowed migration by providing warmth, protection, and cooked food	The oldest modern human remains have been found in Ethiopia, about one million human generations ago	Modern human migration began out of Africa into the Middle East, then spread worldwide	Neanderthals were driven extinct along with other large species, like this European Woolly Rhinoceros				

The Last Cosmic Minute

Each Second = 13.8 Billion / 365 / 24 / 60 Minutes / 60 Seconds = 438 Years

-54 Seconds

20,000 Years Ago



The last ice age ended with sea level 400 feet lower than today and modern humans living nomadic lives

-23 Seconds

10,000 Years Ago



Agriculture began along rivers in the Middle East, allowing human population to multiply by over 1,000

-12 Seconds

5,200 Years Ago



Written language began with picture stories like this one on a Sumerian clay tablet, with letter sounds coming later

-6 Seconds

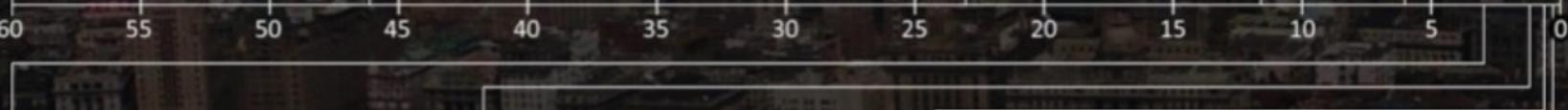
2,500 Years Ago



Judaism and Buddhism launched modern religion, including inventions like the Ten Commandments



Known from artifacts, DNA extraction from remains, radiocarbon dating



-3.2 Seconds

1,500 Years Ago



The Roman Empire Collapsed and Mohammed started Islam, beginning a period of religious rule in the West

-1.2 Seconds

500 Years Ago



Columbus Arrived in America looking for new trade routes, connecting the continents into a global economy

-0.5 Seconds

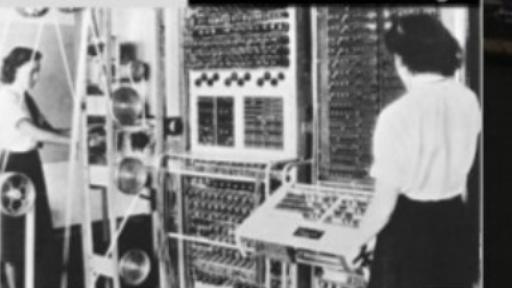
200 Years Ago



The Industrial Revolution was powered by the Steam Engine, shifting physical labor to machines and people to cities

-0.2 Seconds

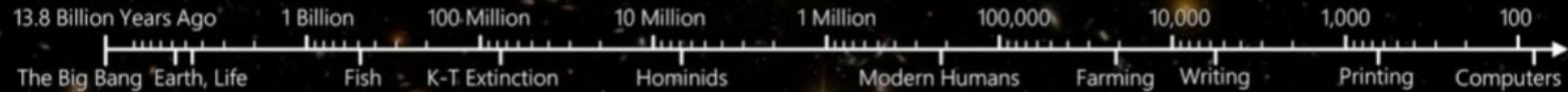
75 Years Ago



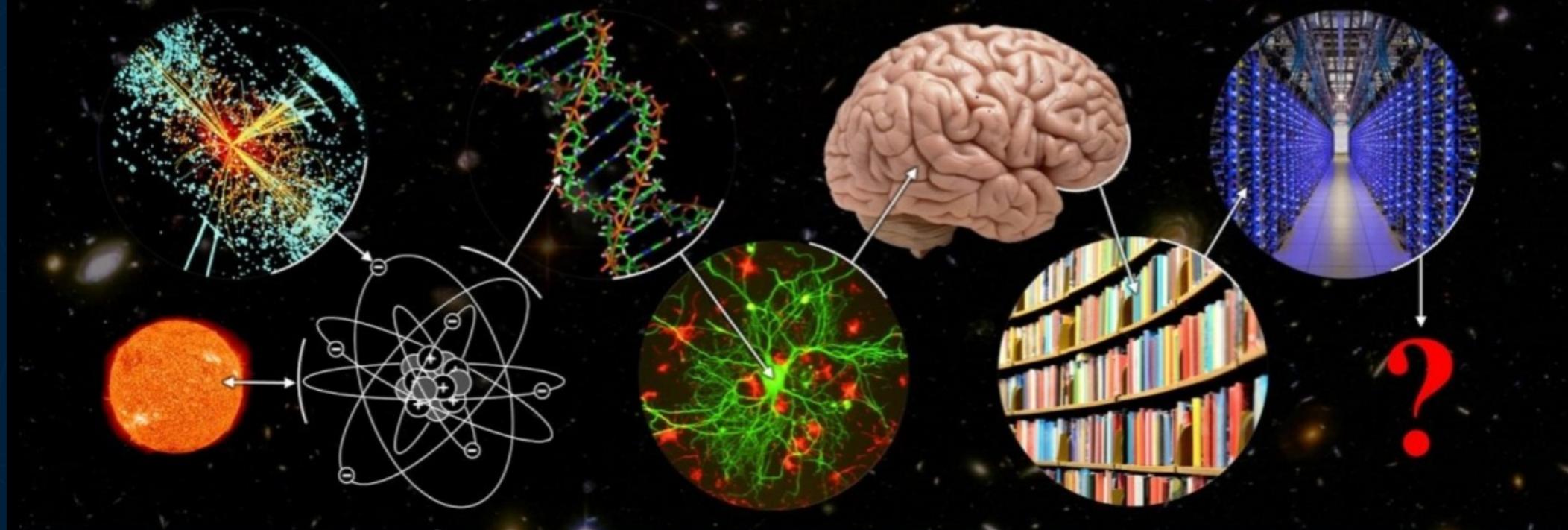
World War 2 code cracking led to the computer, with capacity doubling every 18 months since then

From Particles To People

Scientific systems have been built up one atop the next through time



Physical Sciences Physics, Chemistry, Astronomy	Life Sciences Biochemistry, Anatomy, Ecology	Social Sciences Linguistics, Psychology, Sociology	Applied Sciences Agriculture, Engineering, Medicine
Particles follow fundamental forces to form atoms and then stars, which fused the types of atoms needed for self-copying molecules on Earth	Evolution selects DNA molecules that are best able to copy themselves through time, from bacteria to animals with specialized cells like neurons	Human intelligence enables language for transmitting thoughts face to face, while writing transmits thoughts across large societies and across time	Technology leads to science as we creatively use systems and find verifiable, mathematical facts about how those systems work



THE END OF THE UNIVERSE

Four Ways the Universe Could End:



The Big Rip:

Under this scenario, dark energy keeps pulling the universe apart at an ever accelerating speed, until everything in the universe (including individual atoms) pulls itself apart.

The Big Freeze:

Similarly, if the expansion of the universe continues, planets, stars and galaxies will be pulled so far apart that the stars will no longer have access to raw material for star formation, thus the lights inevitably go out for good.



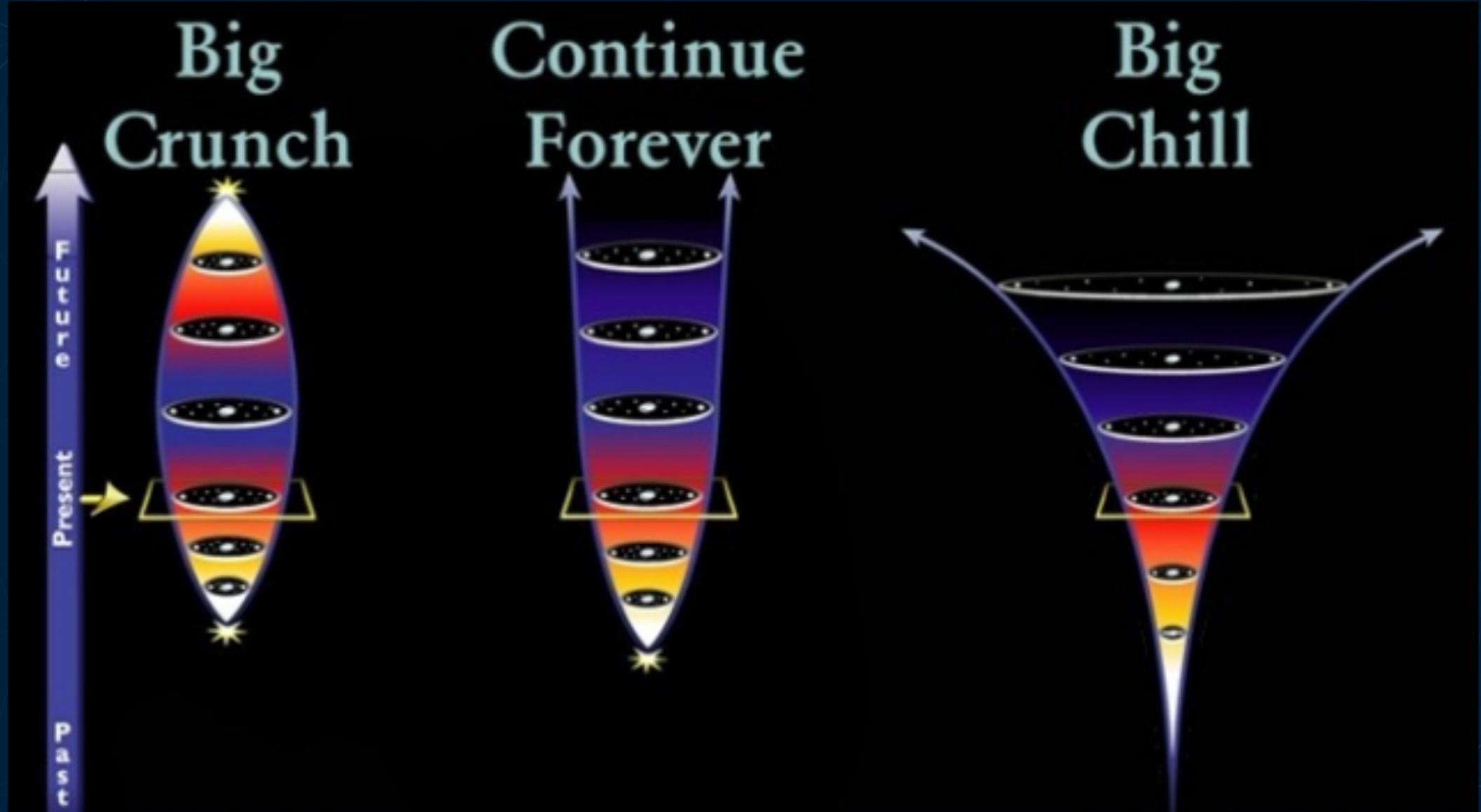
The Big Crunch:

The good news is that the universe is finally able to halt the expansion that is threatening to pull it apart. The bad news is that it will now begin to collapse in on itself, potentially sparking another big bang.

The Big Slurp

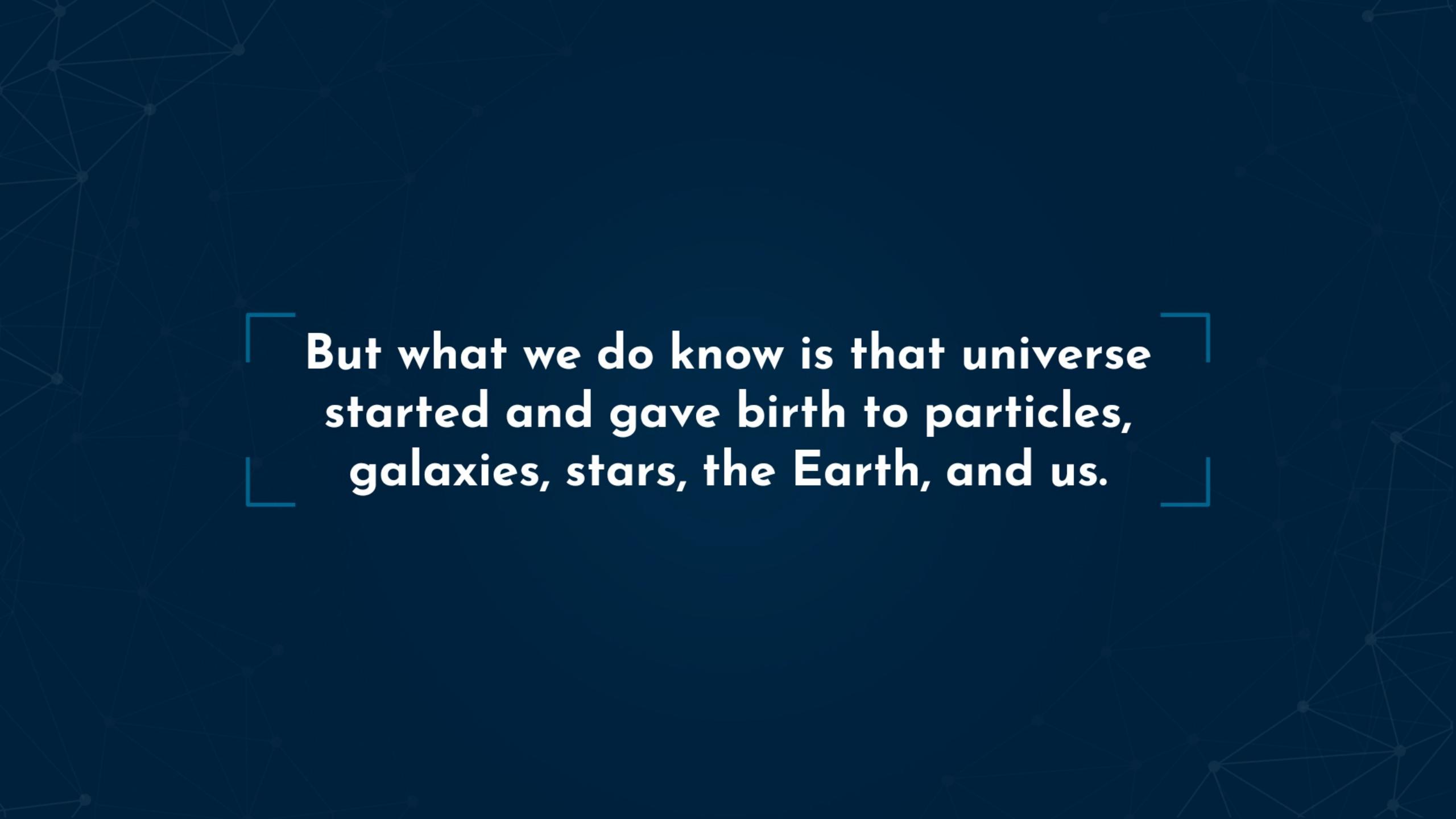
As the Higgs findings allude to, the universe is likely inherently unstable, which could make way for a vacuum metastability event to occur.





THE QUESTIONS THAT ARE STILL UNANSWERED

- **Were there universes before our own?**
- **Is this the first and the only universe?**
- **What started the Big Bang or it just occurred naturally based on laws we don't understand yet?**
- **What is Dark Energy?**
- **What is Dark Matter?**
- **Will our universe die? Or is it eternal?**
- **If it will die, then how actually?**



**But what we do know is that universe
started and gave birth to particles,
galaxies, stars, the Earth, and us.**

SEE MORE ON.....

- <https://youtu.be/wNDGgL73ihY>
- https://youtu.be/4_aOIA-vyBo

THANK YOU

ANY QUESTIONS?