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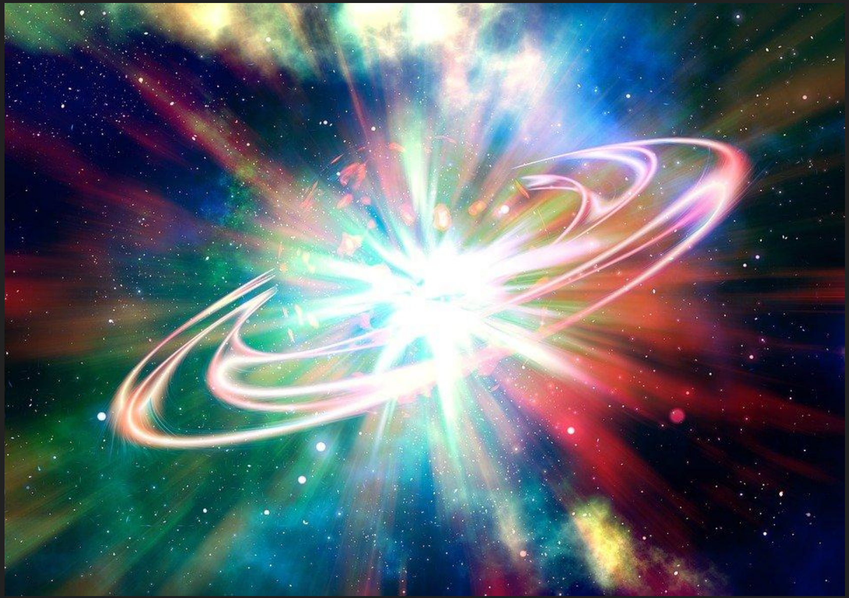
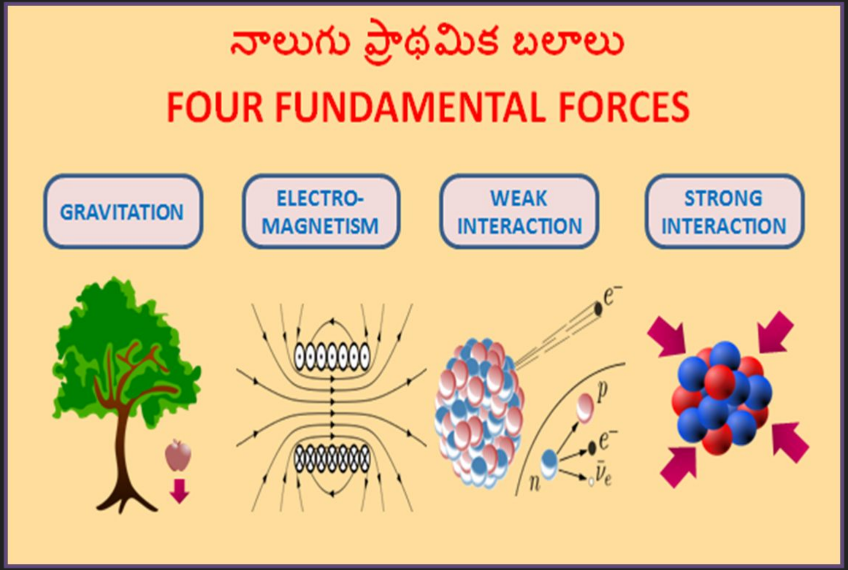
Age of Origin

Big Bang (0 nanoseconds)



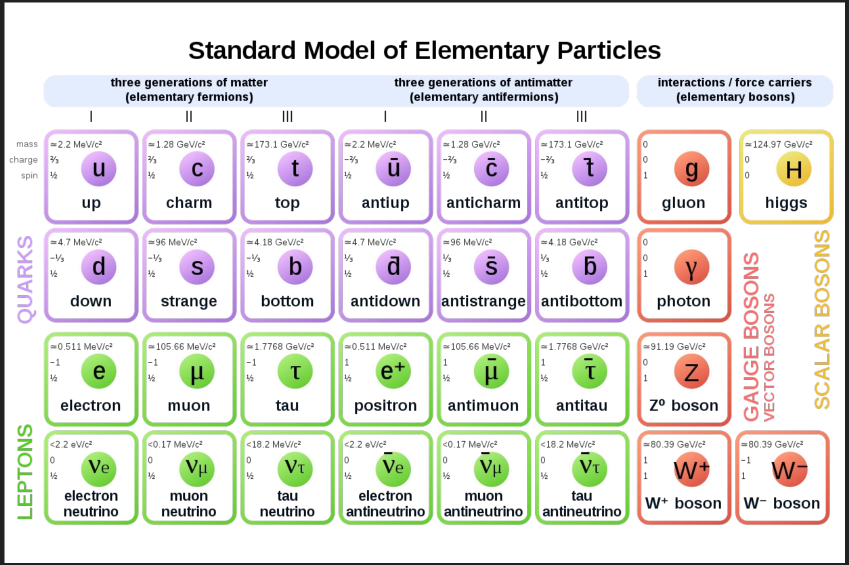
- Nobody knows where the Big Bang came from.
- It is very likely, however, that it began as a black hole.
- Slowly, Hawking radiation caused the mass of this black hole to radiate away until eventually it exploded, causing the Big Bang.
- The Big Bang, also, did not occur at a particular location or time because space and time did not exist until the Big Bang exploded into existence.

Master Unified Era (Less than 1 nanosecond)



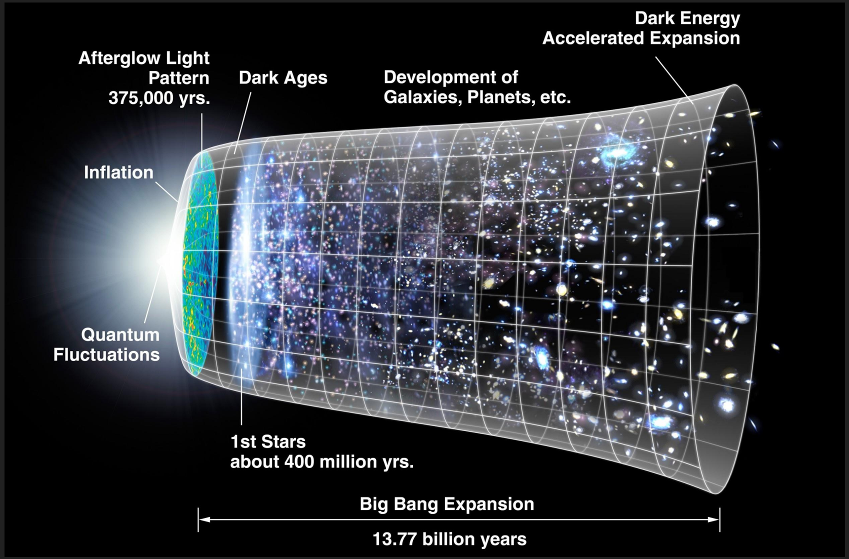
- At the dawn of the Big Bang, there was only light in the universe.
- This first light coalesced and organized itself for the first time to create the “master force”.
- From the single flip of a page to the colliding of two supermassive black holes, all forces, pushes and pulls are descended from this one “master force”.
- The universe was now a scorching hot mass of plasma.

Standard Unified Era (Less than 1 nanosecond)



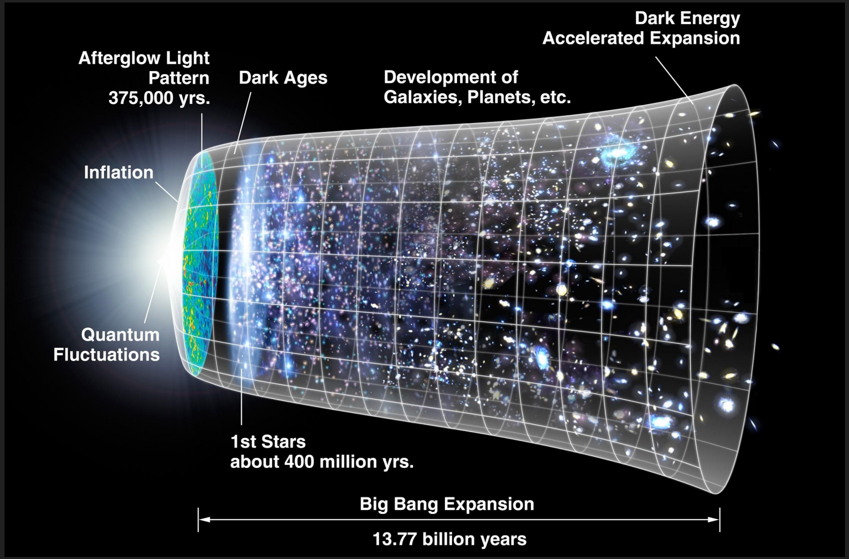
- Shortly after its emergence, the “master force” divided into gravity and the “unified force”.
- The “unified force” includes all forces except gravity, including electricity, magnetism, and the forces that hold atomic nuclei and protons and neutrons together.

Inflation Era, Part 1 (Less than 1 nanosecond)



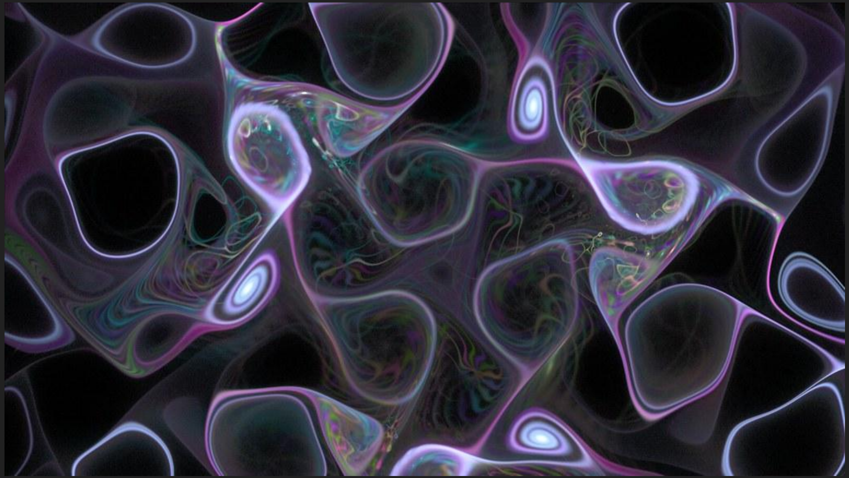
- Now, the “unified force” divided into the remaining forces: electricity, magnetism, and the forces associated with atomic nuclei, protons and neutrons.
- Light from the dawn of the Big Bang was able to transform into the first matter, antimatter and dark matter, including quarks and electrons as well as their antimatter counterparts.

Inflation Era, Part 2 (Less than 1 nanosecond)



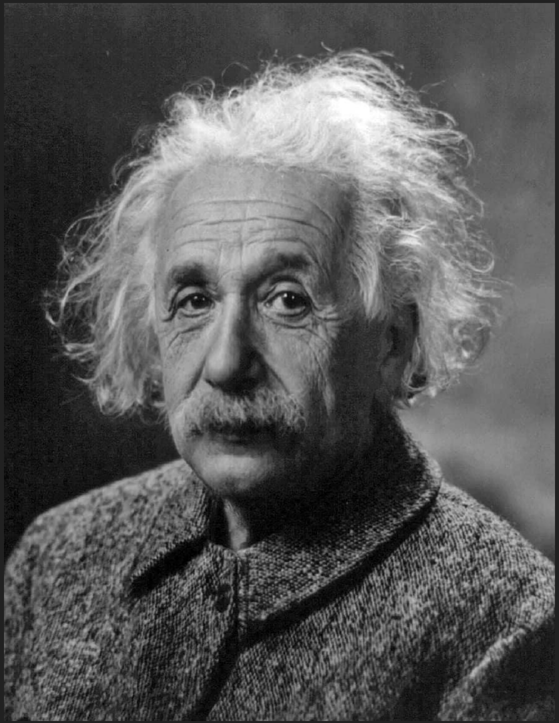
- After that, the universe expanded from being smaller than a single electron to being about one milliliter in volume.

Higgs Era (Less than 1 nanosecond)



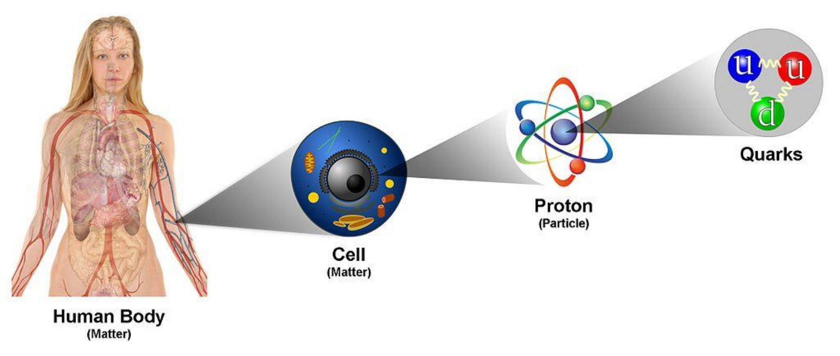
- The laws of physics were first established when the mass field (Higgs field) formed.
- The mass field (Higgs field) is a special field that surrounds, permeates and binds the entire universe by providing all basic subatomic particles their mass, therefore dictating the way they interact with each other and also dictating the way these particles organized themselves to form literally everything in the universe.

Physical Era (0.1 nanoseconds - 20 microseconds)



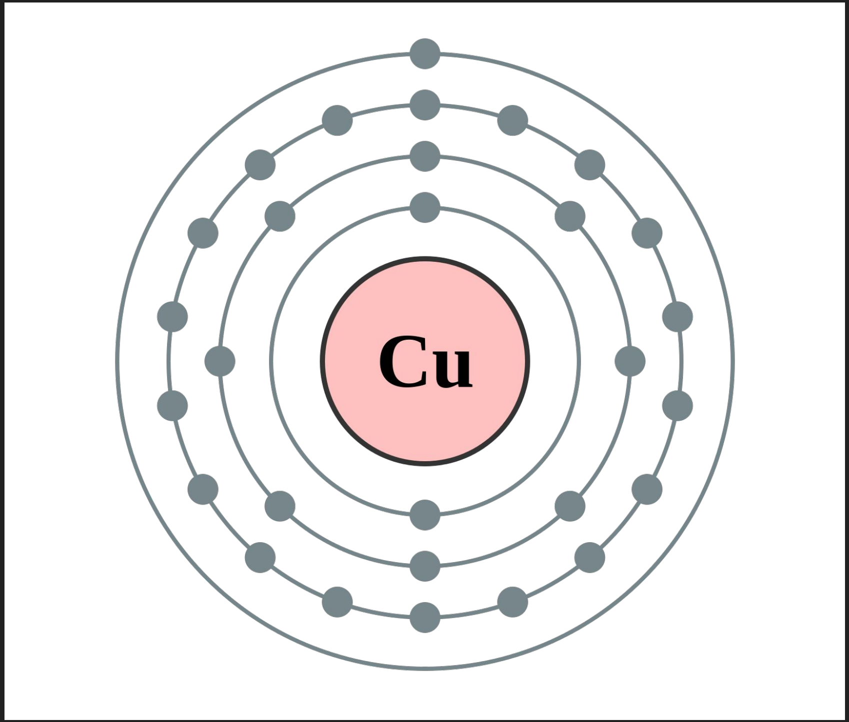
- Before this era, the laws of physics were constantly changing and growing.
- But now, all of the basic subatomic particles that constitute the universe, and the laws of physics that govern it, were completely and firmly established.

Composite Era (20 microseconds - 1 second)



- All of the quarks and their antimatter counterparts that formed in the Inflation Era combined to create the first protons and neutrons as well as their antimatter counterparts.
- Almost all protons and neutrons and all of their antimatter counterparts combined and annihilated each other, causing only a miniscule amount of matter to remain.

Electron Era (1 - 10 seconds)

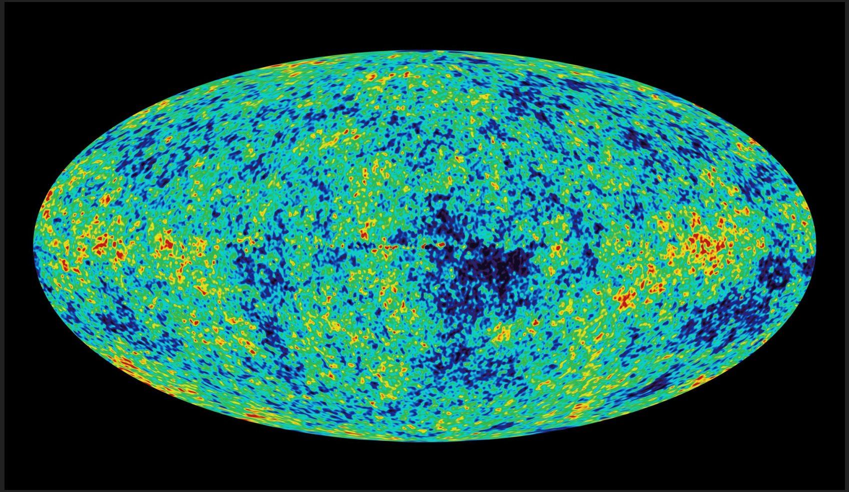


- **Almost all electrons and all of their antimatter counterparts combined and annihilated each other.**
- **Now there was even less matter in the universe.**

Nuclear Era (10 seconds - 370,000 years)

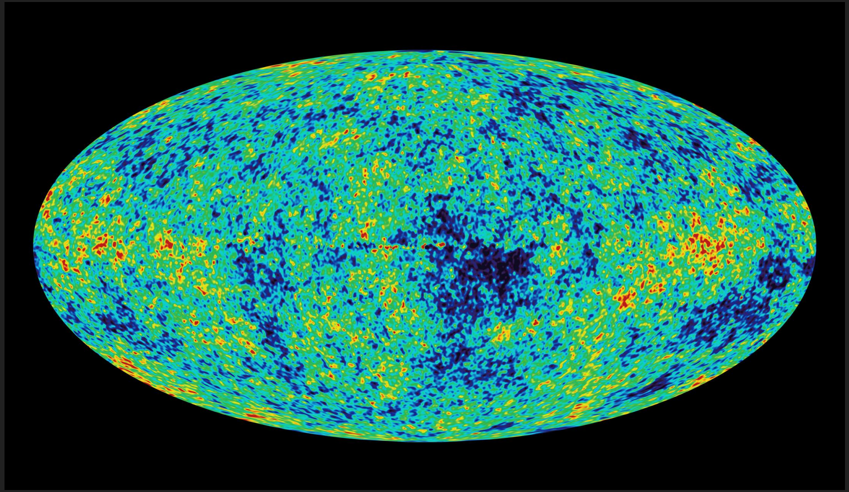
- Protons and neutrons stick together for the first time to create the first atomic nuclei.

Dark Era, Part 1 (370,000 - 100 million years)



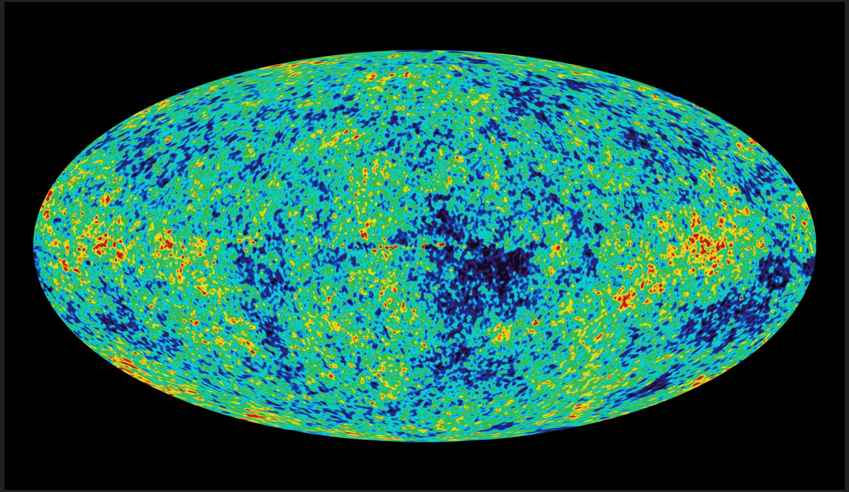
- Atomic nuclei and free-floating protons were able to attract electrons for the first time, allowing for the first atoms to form.
- These first atoms consisted mostly of hydrogen and helium atoms.
- Before the formation of the these first atoms, the universe was a scorching hot mass of opaque plasma.

Dark Era, Part 2 (370,000 - 100 million years)



- The early universe was opaque because almost no light could move or escape from it.
- This was due to the fact that, at this time, electrons were completely free and constantly whizzing around, absorbing and deflecting any light particles in their wake.
- However all of this changed when the first atoms formed.
- These first atoms captured and restricted the electrons, allowing light to roam free without being deflected or absorbed by electrons.

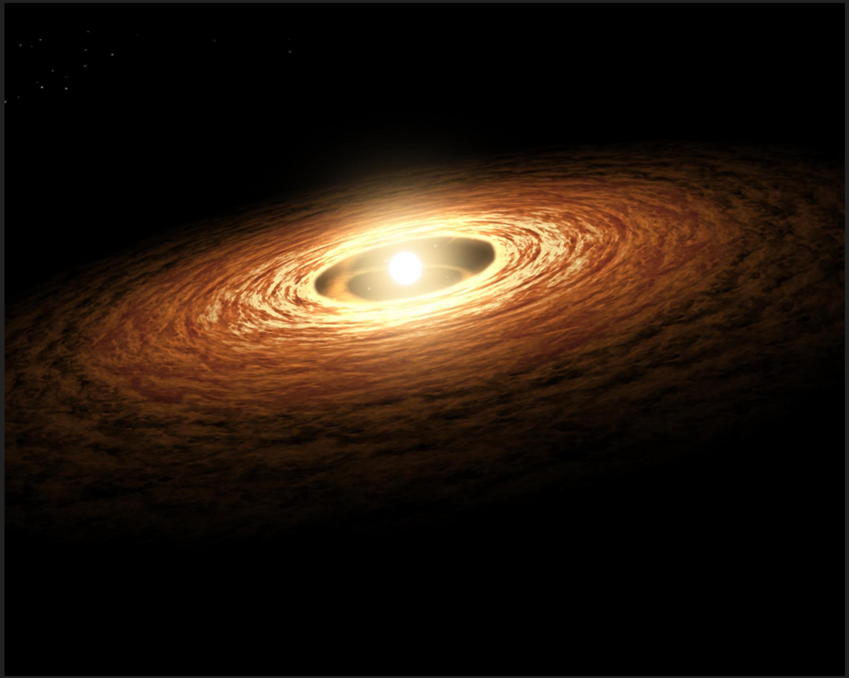
Dark Era, Part 3 (370,000 - 100 million years)



- Now, the light that was previously trapped within the early universe could escape, causing the universe to dramatically shift from being a hot mass of plasma to a dark, empty void, much like how it is today.
- The Cosmic Microwave Background, our earliest “baby picture” of the universe was emitted at the beginning of this era.

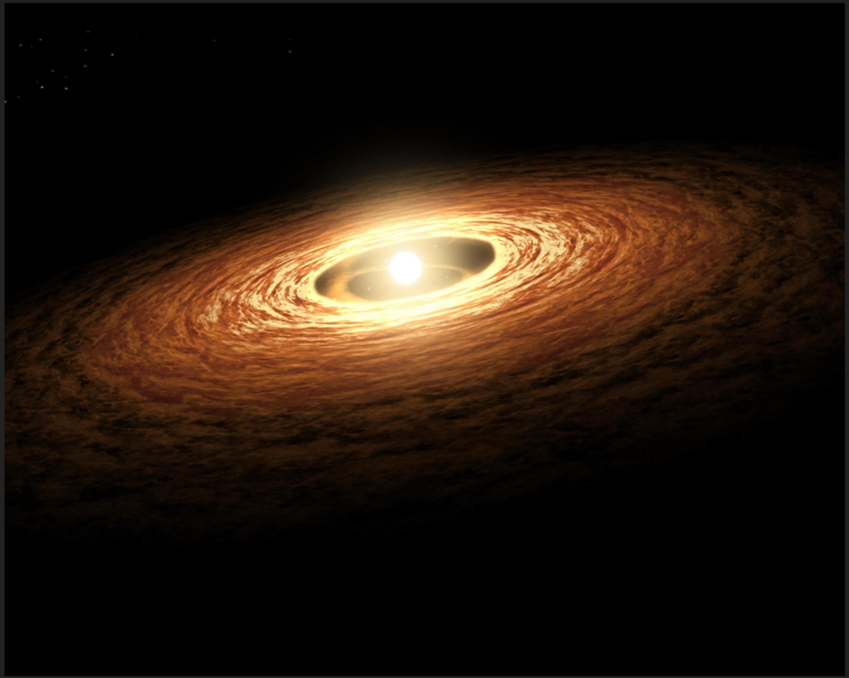
Age of Stars

Reignition Era, Part 1 (100 - 600 million years)



- After being plunged into darkness for nearly one hundred million years, the universe miraculously reignited.
- Hydrogen and helium atoms coalesced to form large clouds.
- These clouds then further collapsed to create the first stars.
- These first stars were extremely massive and contained no metal, causing them to burn faster and brighter than any stars that would come after them.

Reignition Era, Part 2 (100 - 600 million years)

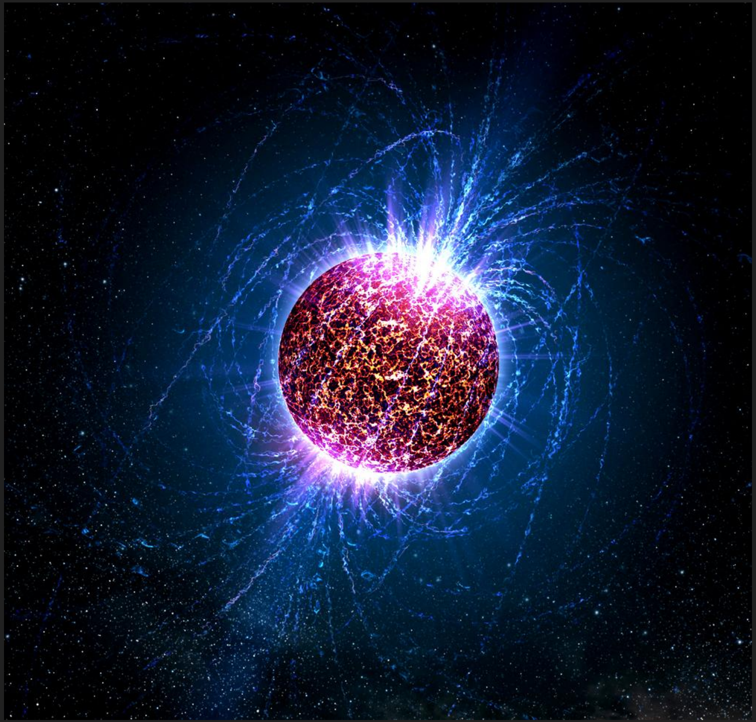


- Surprisingly, these stars are still around today: they became the supermassive black holes at the centers of galaxies.
- These first stars were collectively known as the first generation stars.

Galactic Era (600 - 1,000 million years)

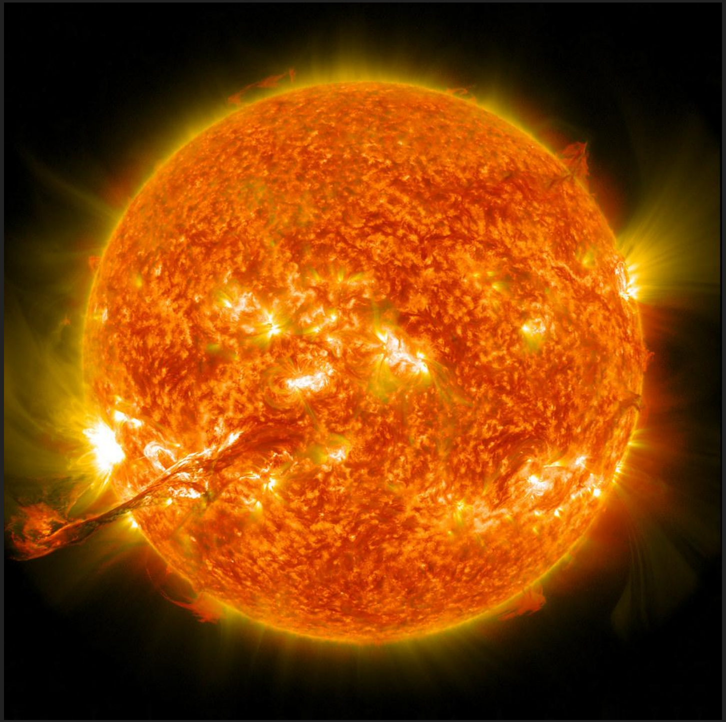
- Many of the original first generation stars consumed all of their fuel and collapsed into the first black holes.
- These first black holes then collided and merged with one another until they reached masses of millions or billions of suns, becoming the supermassive black holes at the centers of galaxies.
- Younger stars then crowded around these first supermassive black holes to create the first galaxies, including the Milky Way.

Star Generation II Era (1 - 4 billion years)



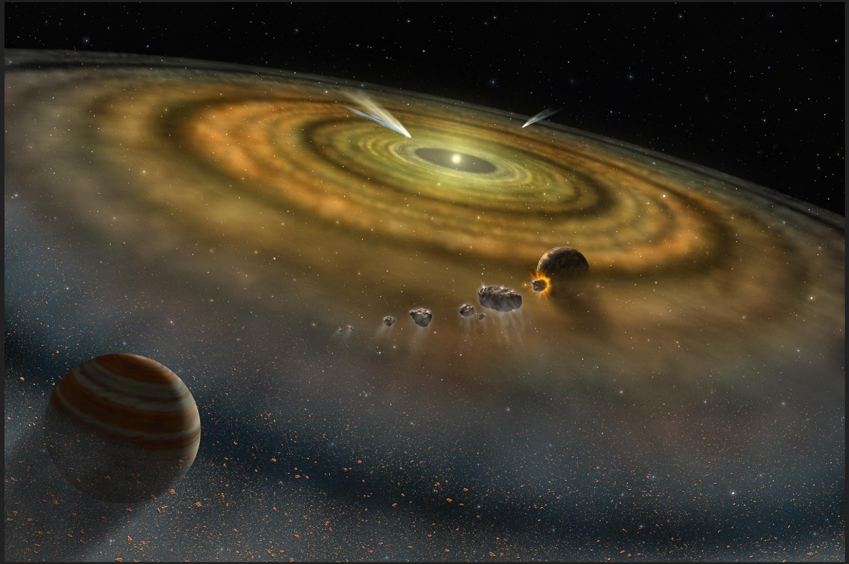
- All first generation stars that were too small to collapse into black holes exploded violently as hypernovas, extremely massive supernovas.
- These first hypernovas ejected the first heavy elements into the universe, including carbon, nitrogen, oxygen, silicon and iron.
- From the remains of these semi-metallic hypernovas, the second generation stars were born.

Star Generation III Era (4 - 9 billion years)



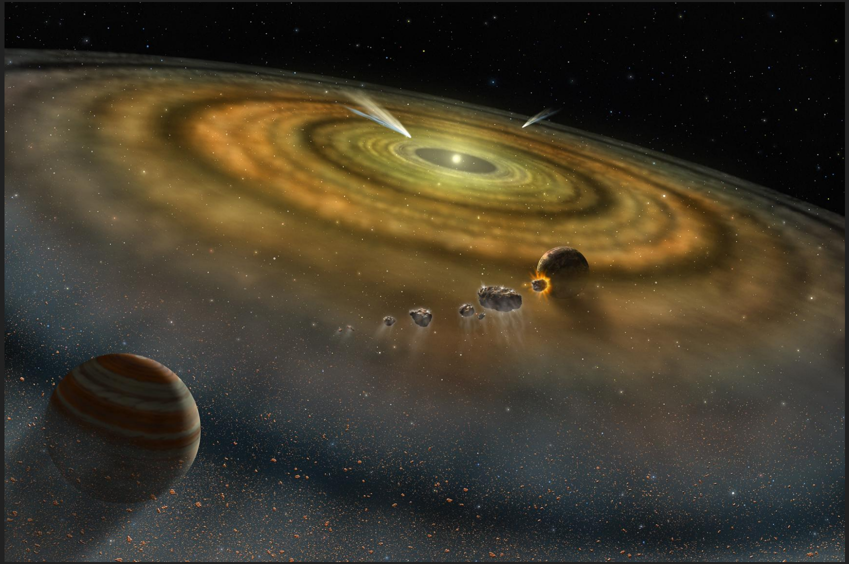
- Because the second generation stars formed from hypernova remains with metallic elements, they did not burn as brightly and as efficiently as their predecessors.
- When these stars died in violent supernovas, they left behind even more metallic elements.
- From these metallic supernovas, the third generation of stars arose which burned the least brightly and efficiently of all the generations.

Expansion Era, Part 1 (9 - 10 billion years)



- As the Big Bang inflated and cooled, its expansion slowed down because of the force of gravity between the matter within it.
- It seemed as if, eventually, its expansion would come to a screeching halt, but mysteriously, nine billion years after its emergence, its expansion began accelerating.
- This was due to a mysterious force known as dark energy, which will eventually lead to the death of the universe.

Expansion Era, Part 2 (9 - 10 billion years)



- Nine billion years after the Big Bang, the Sun and solar system form from a second generation supernova.
- The Sun is a third generation star.
- Shortly after, the Earth, planets and moons coalesced from a disc of gas and dust around the forming Sun.
- Earth developed its second atmosphere and oceans from volcanic exhaust.
- Our planet also developed a magnetic field at about the same time.

Biological Era, Part 1 (10 - 18 billion years)

- The first life appeared in Australia, ten billion years after the Big Bang.
- Eleven years after the Big Bang, the first complex life emerged.
- Plants, algae and amoebas appeared twelve billion years after the Big Bang.
- When the universe was thirteen billion years old, the first animals and fungi emerged.
- Humans finally discover the Big Bang fourteen billion years after it occured.
- We have now reached the present.

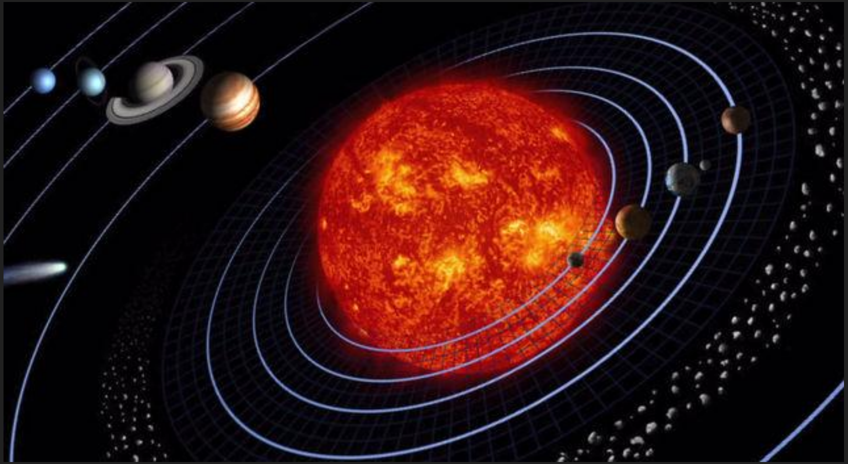
Biological Era, Part 2 (10 - 18 billion years)

- Now, let's move on to the future of the universe.
- What will happen from here on out will be a result of a universe-long struggle between two forces: entropy and gravity.
- Gravity is the ultimate hero of the universe, trying to pull and keep everything together in hopes that it will be able to prevent if not slow the inevitable death of the universe.

Biological Era, Part 3 (10 - 18 billion years)

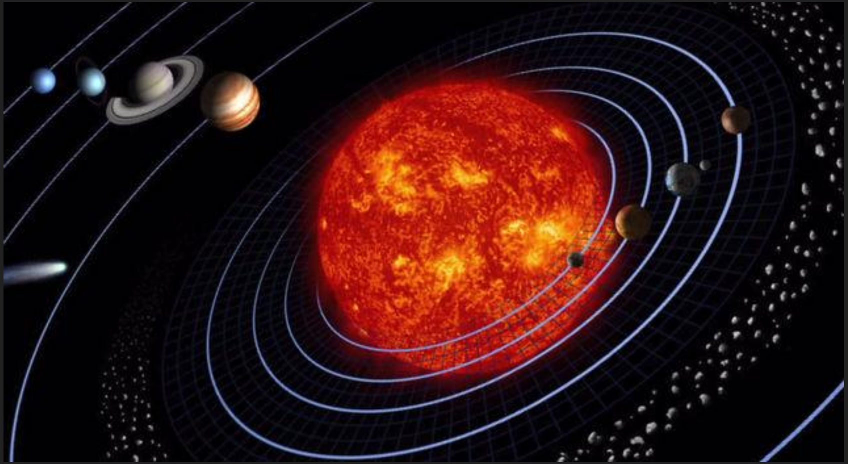
- Entropy is the ultimate villain of the universe, trying to destroy and tear everything apart; it is the reason why batteries deplete, building collapse and we die.
- If entropy wins, everything will reach total equilibrium and nothing will happen anymore.
- Fifteen billion years after the Big Bang, all of the oceans are boiled away by the Sun's intense heat.
- Eighteen billion years after the Big Bang, all life on Earth is ultimately vaporized by the sun.

Metallic Era, Part 1 (18 billion - 100 trillion years)



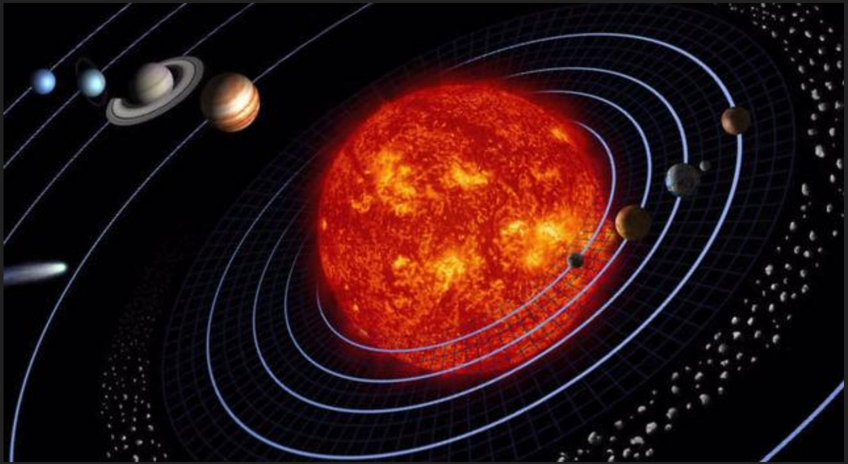
- As the Sun converts more hydrogen into helium, it becomes hotter and hotter.
- Eventually, nineteen billion years after the Big Bang, the Sun swells into a red giant star.
- It continues to swell until Mercury and Venus are both swallowed whole.
- And then sadly, our home planet, Earth, will also be swallowed whole by the expanding sun.

Metallic Era, Part 2 (18 billion - 100 trillion years)

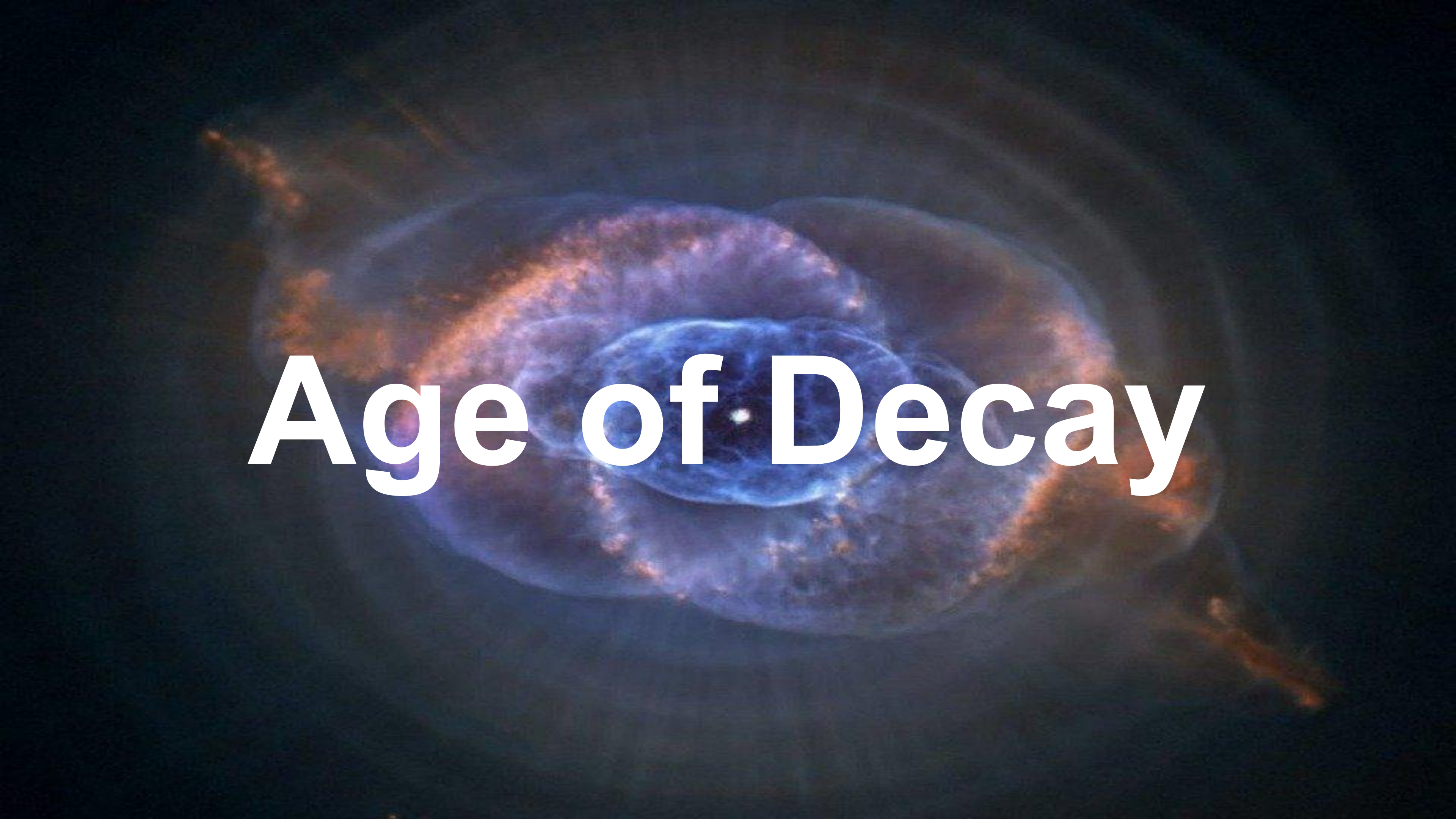


- The red giant Sun collapses under its own gravity, becoming a giant, hot, dense, earth-sized diamond, known as a white dwarf star.
- Over the next tens of billions of years, the universe's supply of star-forming gases will be gradually converted into metal.
- This residual metal will be too heavy for the small, dim, metallic stars present in this era to use for fuel.

Metallic Era, Part 3 (18 billion - 100 trillion years)



- By trillions of years after the Big Bang, only one cloud of star-forming gases remains in the universe.
- This cloud coalesces to form the last stars in the universe; these stars flicker out one by one until there is only one star remaining in the entire universe.
- About a hundred trillion years after the Big Bang, this last star fades, plunging the entire universe into darkness once again.


Age of Decay

Depletion Era (100 trillion - 10^15 years)

- At this point, no more stars exist in the universe, but there is still light.
- All low-mass stars such as our Sun have already collapsed to create giant, hot, dense, earth-sized diamonds known as white dwarf stars.
- Even though these bodies cannot create any more light, they can still shine due to the heat reserves they have stored up.

Black Era, Part 1 (10^15 - 10^34 years)

- Approximately 10^15 (one thousand trillion) years after the Big Bang, all heat reserves that had previously been stored up within white dwarf stars and neutron stars, completely depletes, causing them to become dark.
- The universe is a dark, empty void once again.
- Then, the forces of entropy and dark energy become so powerful that all solar systems are violently ripped apart.

Black Era, Part 2 (10^15 - 10^34 years)

- In our solar system, Mars and all the gas giants are ripped away from the dark Sun.
- Dark energy and entropy become even stronger, causing all galactic orbits to decay.
- All bodies close to the centers of galaxies, fall into the supermassive black holes.
- While the bodies towards the outskirts of galaxies, including our dark Sun, are luckily able to escape the gravity of the supermassive black holes.

Radioactive Era, Part 1 (10^34 - 10^39 years)

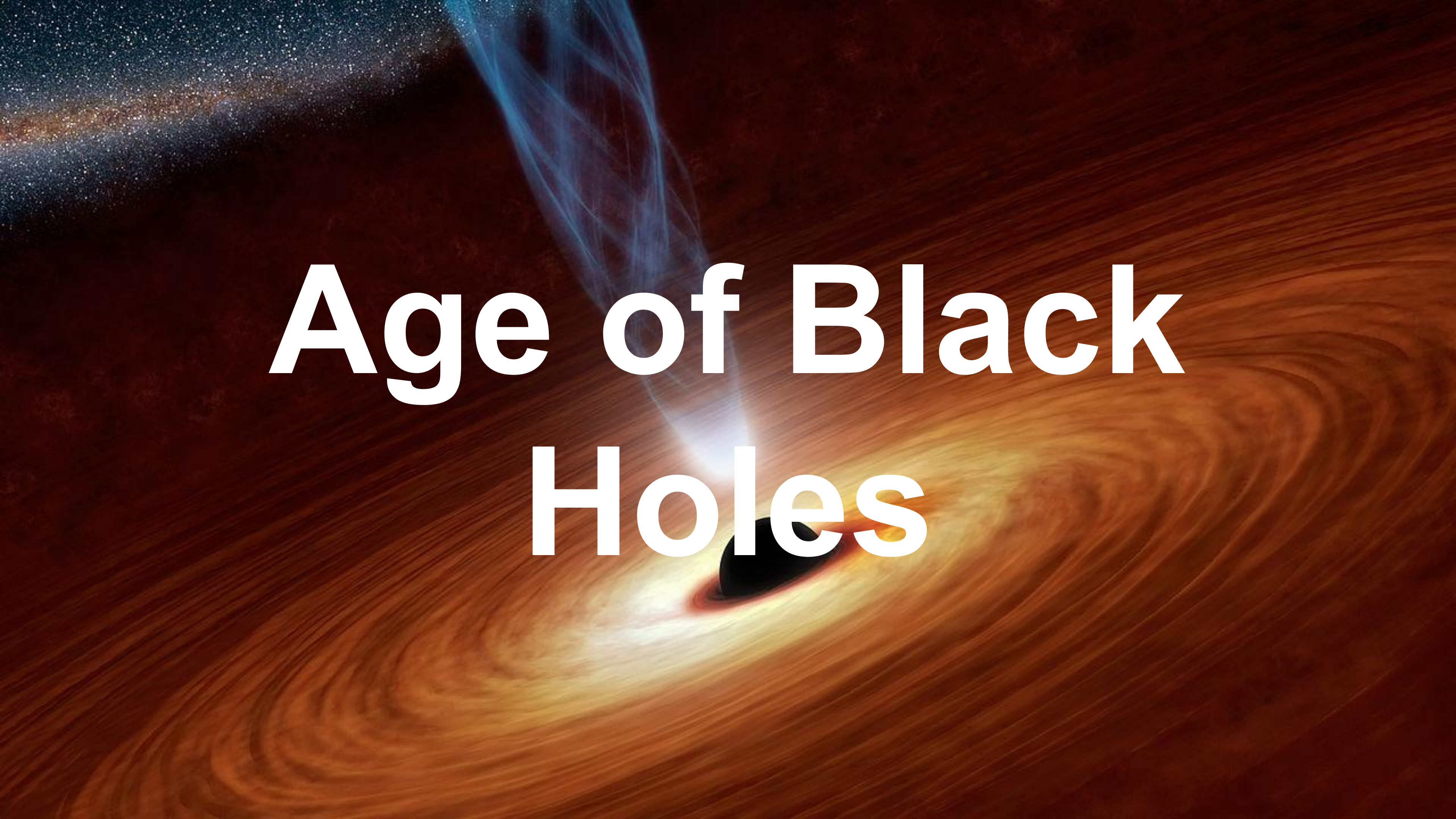
- 10^34 (one hundred million trillion trillion) years after the Big Bang, matter, itself, starts to decay.
- The forces holding protons together become unstable causing them to break down into their individual components.
- All bodies including the dark Sun shine once again, but in the form of deadly radiation from proton decay.
- Slowly, over trillions of years, all bodies, including our dark Sun, shrink smaller and smaller as they continue to lose protons.

Radioactive Era, Part 2 (10^34 - 10^39 years)

- Eventually, 10^39 (one thousand trillion trillion trillion) years after the Big Bang, all bodies, including the dark Sun, fully decay into a soup of electrons and neutrons.
- The electrons radiate out into space, never to be seen again.
- While all of the neutrons decay into protons over the next fifteen minutes.
- The last protons burst one by one, hurling all of their energy and mass into space until there is only one proton remaining.

Radioactive Era, Part 3 (10^34 - 10^39 years)

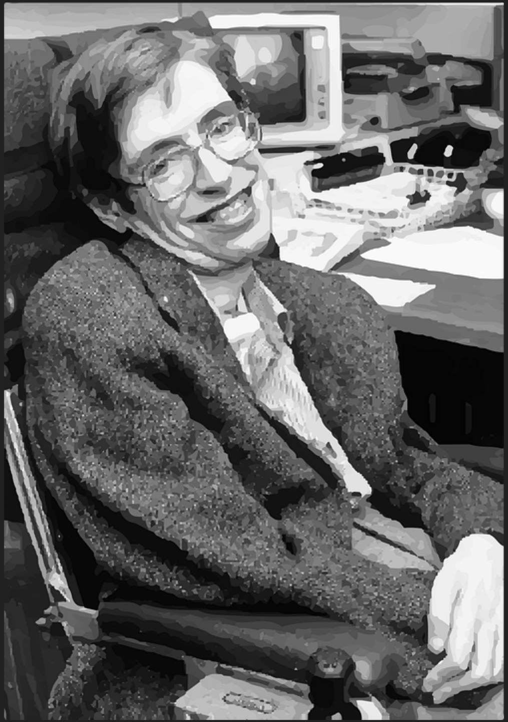
- This last proton bursts, plunging the entire universe into darkness once again.


Age of Black Holes

Black Hole Era (10^39 - 10^67 years)

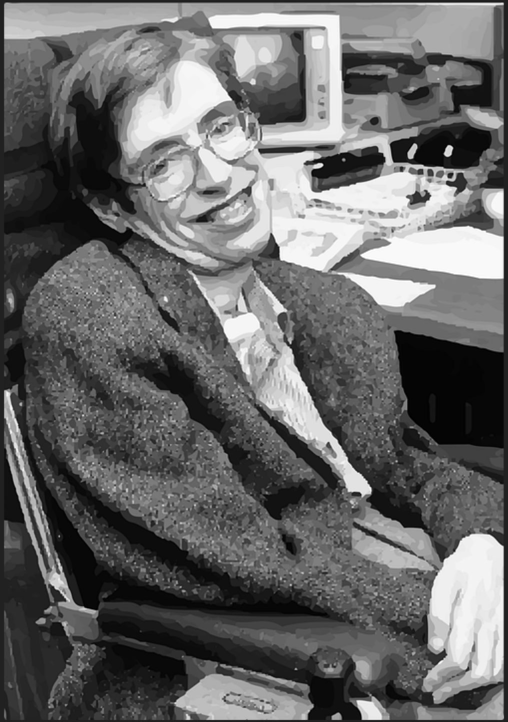
- With the decay of the last proton, there is no more matter left in the entire universe.
- Now, only black holes remain.
- However, there are still galaxies, but, at this point, they consist entirely of smaller black holes orbiting larger black holes.
- The black holes will try their best to resist the now overwhelming forces of entropy and dark energy by merging with each other, but eventually they too, despite their extreme gravity, will be pulled apart.

Stellar Hawking Era, Part 1 (10^67 - 10^80 years)



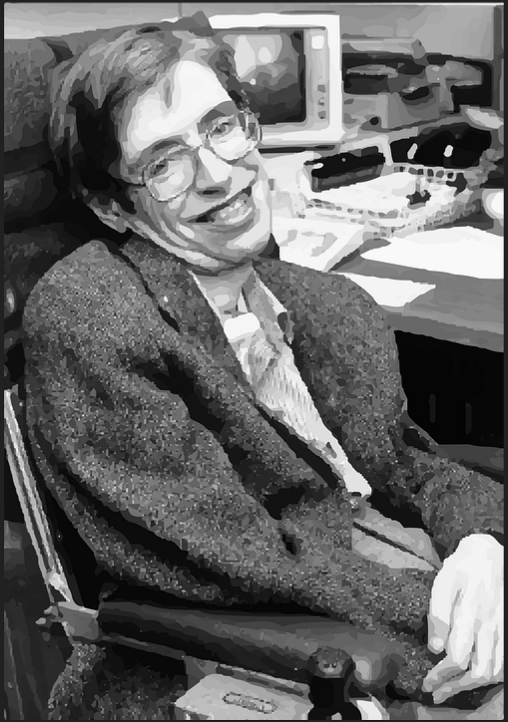
- By 10^67 (ten million trillion trillion trillion trillion trillion) years after the Big Bang, Hawking radiation begins to take its toll on black holes.
- Virtual particles are always spontaneously being created from the vacuum of space.
- Since space is completely and utterly neutral in every way, for particles to be created, one must be positive and the other negative.
- And this is what happens when virtual particles are created.

Stellar Hawking Era, Part 2 (10^67 - 10^80 years)



- But there is a catch: these virtual particles can only exist for less than a second before recombining and annihilating each other.
- However if they appear near a black hole, one might fall into the black hole while the other will escape.
- If this happens, they will not annihilate each other and the black hole will have to contribute some of its mass to make these virtual particles real.
- This is what Hawking radiation is.

Stellar Hawking Era, Part 2 (10^67 - 10^80 years)



- After 10^67 (ten million trillion trillion trillion trillion trillion) years of Hawking radiation, all the smallest black holes will explode like fireworks throughout space, ejecting their energy and mass into space, further propagating the entropy of the universe.

Supermassive Hawking Era (10^80 - 10^92 years)

- These black hole fireworks continue until there are no small, newer black holes remaining in the universe.
- But the first generation stars still remain in the form of supermassive black holes.
- However, like all that ended before them, they must end too.
- They too explode like fireworks in the night sky until there is only one black hole left in existence.

A Final Farewell To the Universe (10^92 years)

- After 10^92 (100 million trillion trillion trillion trillion trillion trillion trillion) years after the Big Bang, this last black hole explodes, ejecting the last light into the universe.
- This is last light the universe sees before plunging into eternal darkness.

Age of Annihilation

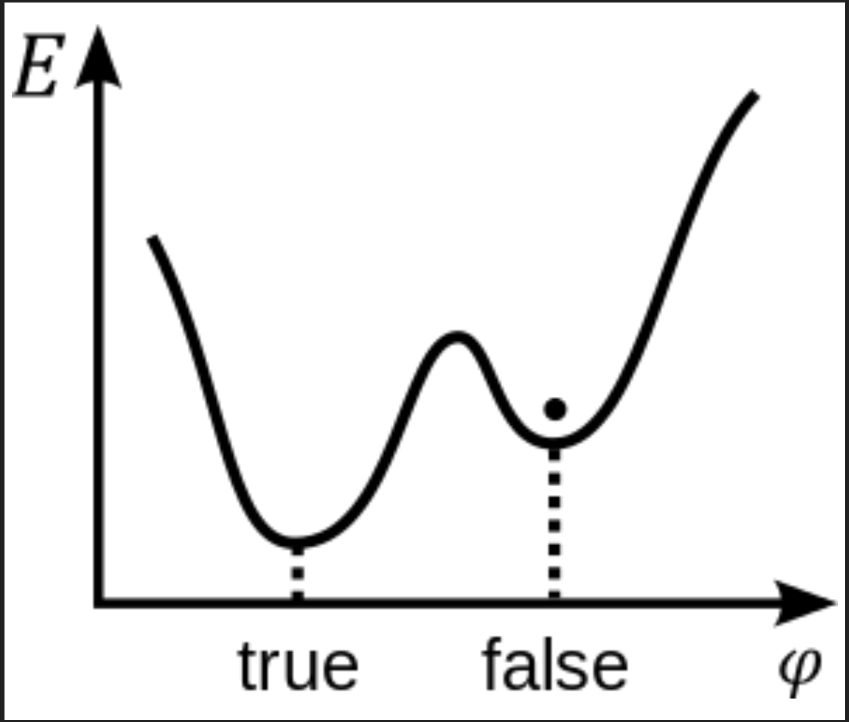
Entropy Era (10^92 - 1 googol years)

- All light and particles in the universe continue to disperse until they reach total equilibrium.
- In the end, entropy wins and gravity loses.
- The reason anything happens in our universe is because energy is unevenly distributed.
- Some places have more energy while others have less, and to compensate for this inequality, energy moves from places with higher energy concentration to those with lower.

Entropy Era (10^92 - 1 googol years)

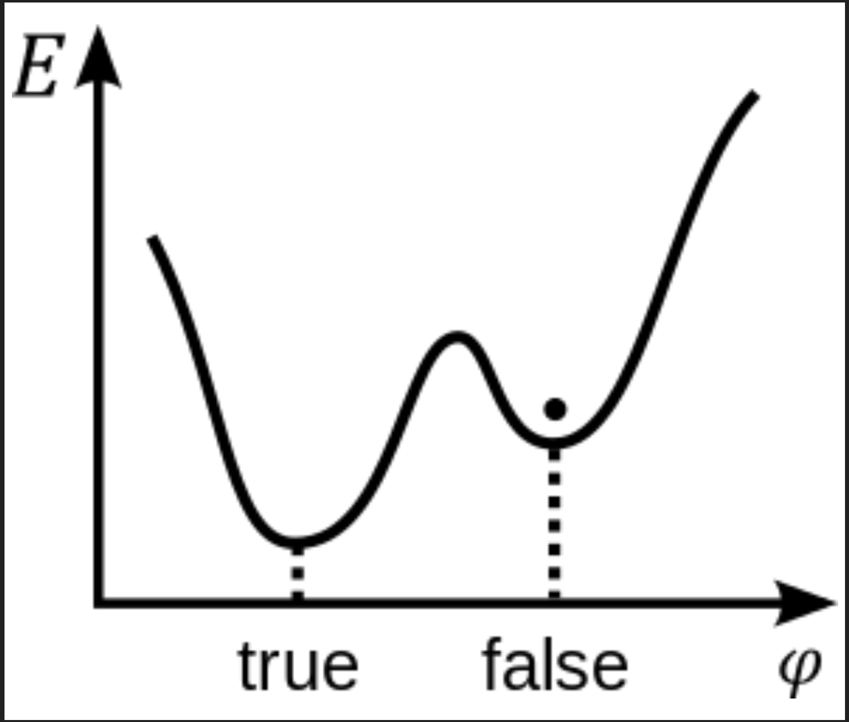
- Now, that everything in the universe has reached equilibrium, nothing can happen anymore and the universe is essentially dead and entropy wins.
- Time and space lose meaning.

Universal Reboot?, Part 1 (1 googol years)



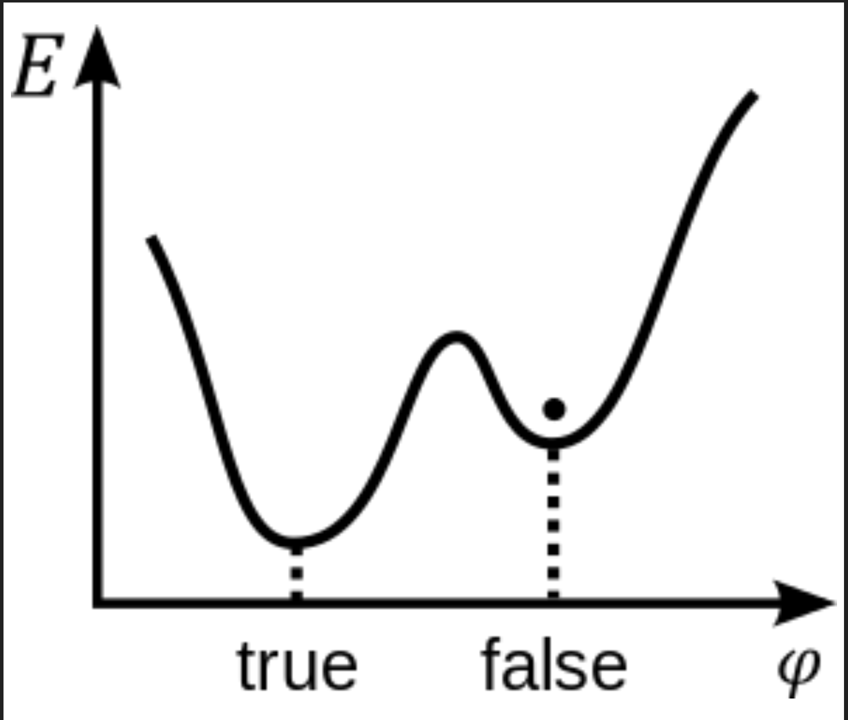
- Because of entropy, everything in the universe is trying to reach the least energetic state possible.
- This state is known as the vacuum state; it has nothing to do with vacuum cleaners or the vacuum of space.
- According to our current understanding of quantum physics, the mass field or Higgs field (remember the Higgs Era) has not yet reached this state.

Universal Reboot?, Part 2 (1 googol years)



- This means that the Higgs field is a false vacuum because it appears to be stable like if it has already achieved the vacuum state, but in reality, it is not.
- Eventually, after a googol (a one followed by one hundred zeroes) years after the Big Bang, enough stress from entropy, dark energy and quantum fluctuations accumulates, that the Higgs field is forced to occupy the vacuum state.

Universal Reboot?, Part 3 (1 googol years)



- Simultaneously, all over the universe, the Higgs field achieves the vacuum state.
- It spreads across the Higgs field at the speed of light in a massive chain reaction.

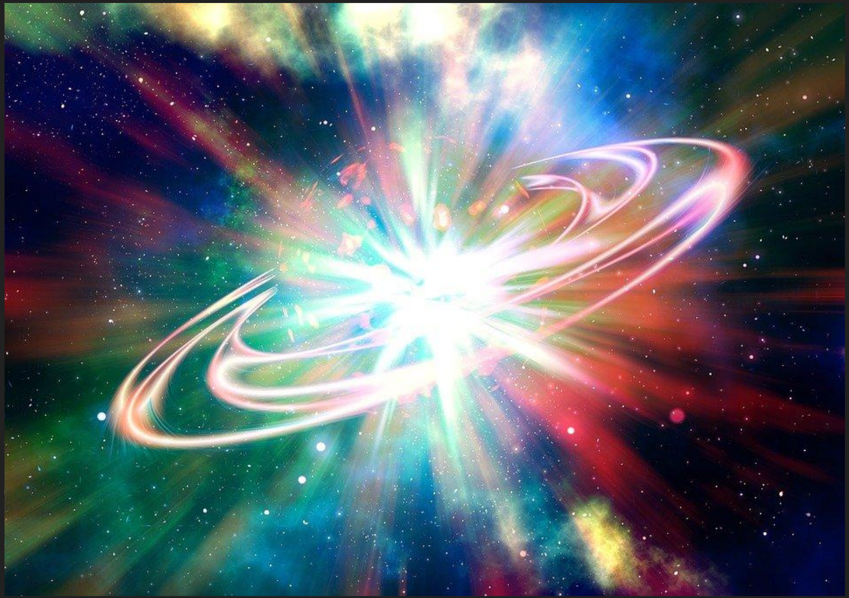
Vacuum Era, Part 1 (1 googol - ? years)

- **The regions of the Higgs field that achieved the vacuum state create massive, expanding bubble-like regions that instantly erase everything they touch.**
- **All energy, particles and even the laws of physics, themselves, are completely erased from existence by these bubbles.**
- **Once the entire universe is one, giant quantum vacuum bubble, the erased energy within it coalesces to form trillions of black holes.**

Vacuum Era, Part 2 (1 googol - ? years)

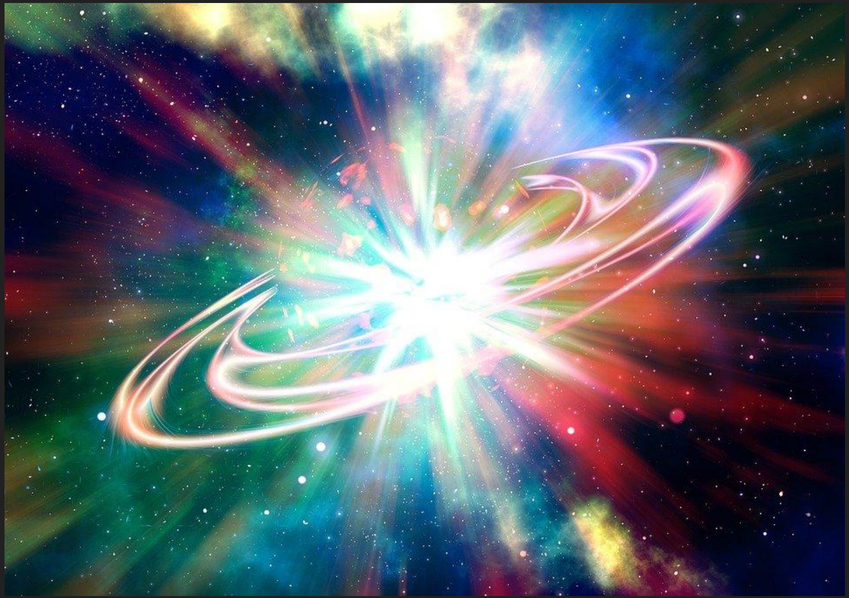
- The combined gravity of all these black holes is so great that it causes space to implode and time to begin running backwards.
- A googol years of entropy is undone.
- All the black holes merge to form one giant supermassive black hole containing all the energy, space and time in the universe.

Big Bang II, Part 1 (? - ? years)



- After more than a googol years of Hawking radiation, this black hole explodes, creating a second Big Bang in the process.
- From here on out, nobody knows what will happen because this next universe will have totally different laws of physics from our own.
- This may not be the first time our universe ended like this.
- Perhaps, our universe could have been born from the ashes of a previous universe, just like the universe that will come after ours.

Big Bang II, Part 2 (? - ? years)



- Our universe may even be cyclical, constantly being born, dying and then collapsing to be born again.
- And that brings us back to the beginning, where the universe may have originated as a black hole.
- This black hole would be a result of a previous universe collapsing.
- And that brings the life of our universe to a close.
- In the end, our universe does not end in fire or ice and it does not end in a bang or a whimper but instead ends as a whole new universe.


THANK YOU FOR
WATCHING!!!