

The background is a dark blue gradient with a starry texture. On the left side, there are several overlapping circular elements. A prominent one is a large circular scale with tick marks and numbers ranging from 160 to 260. Other circles include dashed lines, solid lines, and arrows, some pointing clockwise and some counter-clockwise, suggesting a sense of motion or rotation.

CHRISTIAN APOLOGETICS

AN INTRODUCTION

CLASS INTRODUCTION

- It is best if this is a discussion, I can anticipate some of your questions but probably not all
- Take pictures of the slides if you want to
- Specific beliefs about creation is not a central tenet of the Christian Faith. A range of beliefs are fine... The How is less important than the Who.
- The purpose of this class to address the myriad of misinformation and disinformation in the public domain
- The purpose **IS** to honor God by showing you there is a way to understand both science and theology as being completely compatible with one another;
 - To address misunderstandings about both science and theology (these terms will be defined shortly)
 - To discuss how science and theology relate
 - To discuss the psychology of belief and how it relates to evidence and judgment
 - To build your faith and reassure you...
- Regardless of the HOW its most important to believe and acknowledge the WHO!

COURSE AGENDA – 8 WEEKS

In this first class, we are going to lay the groundwork for later discussions

- Compatibility between the Christian Theology and Science; Theology
- The scientific method: history, development, implementation
- Evidence and Theory for Creation of the Universe part 1
- Evidence and Theory for Creation of the Universe part 2
- Origins of life, information theory
- Origins of life, addressing macro and chemical evolution issues
- Origins of life, the fossil record, and chronology
- Human cognition and metacognition, mysteries of consciousness

The guiding verse of the Christian Apologist... 1 Peter 3:15

... always being ready to make a defense (apologia) to everyone who asks you to give an account for the hope that is in you, yet with gentleness and reverence...

CLASS AGENDA

In this first class, we are going to lay the groundwork for later discussions

- Compatibility between the Christian Theology and Science
- Why study Apologetics?
- Truth – Where do we get it?
- Belgic Confession of 1561
- Common questions
- Concerns and fears about studying Apologetics (common controversies)
- Discuss common outcomes from a study of Apologetics
- Why Christianity? What makes it different?

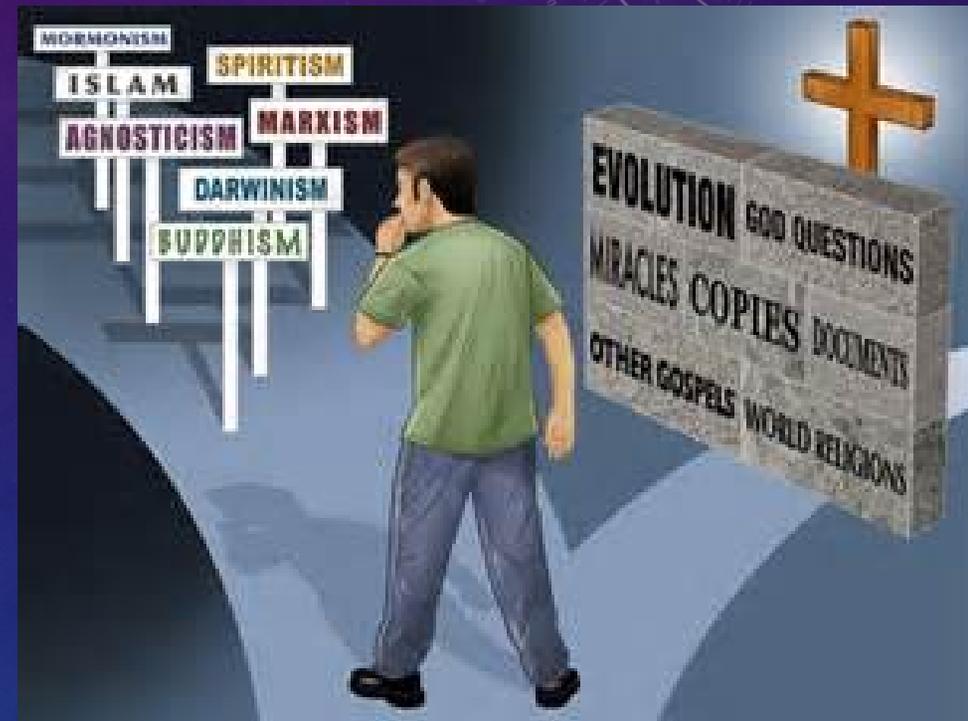
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WHAT IS CHRISTIAN APOLOGETICS AND WHY SHOULD WE STUDY IT?

Apologetics (from Greek apologia, "speaking in defense") is the discipline of defending a position (often religious) through the systematic use of information. Early Christian writers (c. 120–220) who defended their faith against critics and recommended their faith to outsiders were called apologists

Source: <http://en.wikipedia.org/wiki/Apologetics>



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WHAT ARE CHRISTIAN APOLOGETICS AND WHY SHOULD WE STUDY IT?

- “And to the Jews I became as a Jew, that I might win Jews; to those who are under the Law, as under the Law, though not being myself under the Law, that I might win those who are under the Law; to those who are without law, as without law, though not being without the law of God but under the law of Christ, that I might win those who are without law. To the weak I became weak, that I might win the weak; I have become all things to all men, that I may by all means save some”. (*1 Corinthians 9:20-22*)
- **Personal Motivation:**
 - For me, studying God’s physical Universe and His creation of the human mind is an act of worship. I look at His design for both and I gain insight into His nature and personality that I cannot get anywhere else.
 - It supplements my understand of theology AND it builds my faith, knowing there is order, discipline and meaning in the universe.
 - Sharing my understanding with other Christians and with non-believers who are searching for answers is an act of worship
 - To challenge and correct false narratives about science and theology

COMMON QUESTIONS ABOUT THEOLOGY AND SCIENCE

Is putting Science and the Bible together a bad idea?

Does Big Bang Cosmology contradict the Bible?

Did life evolve from a Primordial soup?

Doesn't the Bible contradict Science?

Does the fossil record prove Evolution?

Did humans evolve from apes?

Why Christianity and not other world religions?

What is the psychology of belief?

Other question you have?





Reason To Believe—

- This series is based in part on the work by a protestant, non-denominational organization, RTB
- RTB is dedicated to the proposition that science and faith converge
www.reasons.org
 - RTB's mission is to spread the Christian Gospel by demonstrating that sound reason and scientific research—including the very latest discoveries—consistently support, rather than erode, confidence in the truth of the Bible and faith in the personal, transcendent God revealed in both Scripture and nature.
- My personal belief is that the RTB model provides a compelling explanation for the convergence of science and theology.

The Discovery Institute—

- This series is also based in part on the work of the Discovery Institute www.discovery.org
- DI is slightly different from RTB in that they hold that living systems are best explained by an intelligent cause and not as undirected, unguided processes like natural selection <https://www.discovery.org/id/faqs/>
- DI describes itself as a secular think tank and not a religious organization; however, many religious traditions and philosophies are represented including agnosticism.
- The primary DI source used in this presentation is a book by Stephen C Meyer, *The Return of the God Hypothesis*

Let's define some terms...

- Science – Is humanity's interpretation and attempts to understand of the metaphorical book of nature (General Revelation)
- Theology – Is humanity's interpretation and attempts to understand the literal book of scripture (Special Revelation)
- Question – If we perceive a conflict between special and general revelation where do you think the problem lies?
 - We always need to remember that our knowledge of both science and theology is inadequate and incomplete.
 - We all have biases that cause our understanding to be imperfect and we lack complete information.
 - These allow for *apparent* conflicts between science and theology to occur.
- I Thessalonians 5:21 – But examine everything carefully; hold fast to that which is good.
- Acts 17... be like the Berean's

All Truth is God's Truth—

God is the source of ALL truth...

- Our Heavenly Father is the ONLY source of truth for humanity.
- Numbers 23:19 – **God is not human, that He should lie**, not a human being, that He should change His mind. Does He speak and then not act? Does He promise and not fulfill?
- Psalms 12:6 - And **the words of the LORD are flawless**, like silver purified in a crucible, like gold refined seven times
- Hebrews 6:18 - God did this so that, by two unchangeable things in which **it is impossible for God to lie**, we who have fled to take hold of the hope set before us may be greatly encouraged.
- Titus 1:2 - in the hope of eternal life, **which God, who does not lie**, promised before the beginning of time,
- I John 1:5 - This is the message we have heard from him and declare to you: **God is light; in him there is no darkness at all**
- John 14:16-17 - And I will ask the Father, and he will give you another advocate to help you and be with you forever— ¹⁷**the Spirit of truth**...
 - The role of the Holy Spirit is to help us discern truth if we have the right heart to do so... (John 14 and 16)
- Romans 3:4; Psalms 19:7-8; Psalms 119:160; Proverbs 30:5, John 16
- Truth may come to us by any appropriate means, whether from believers or unbelievers

COURSE AGENDA – 8 WEEKS

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CLASS AGENDA

Last week we:

- Defined Science and Theology
- Why study Apologetics?
- Truth – Where do we get it?

Today we will start:

- Belgic Confession of 1561
- Concerns and fears about studying Apologetics (common controversies)
- Discuss common outcomes from a study of Apologetics
- Why Christianity? What makes it different?

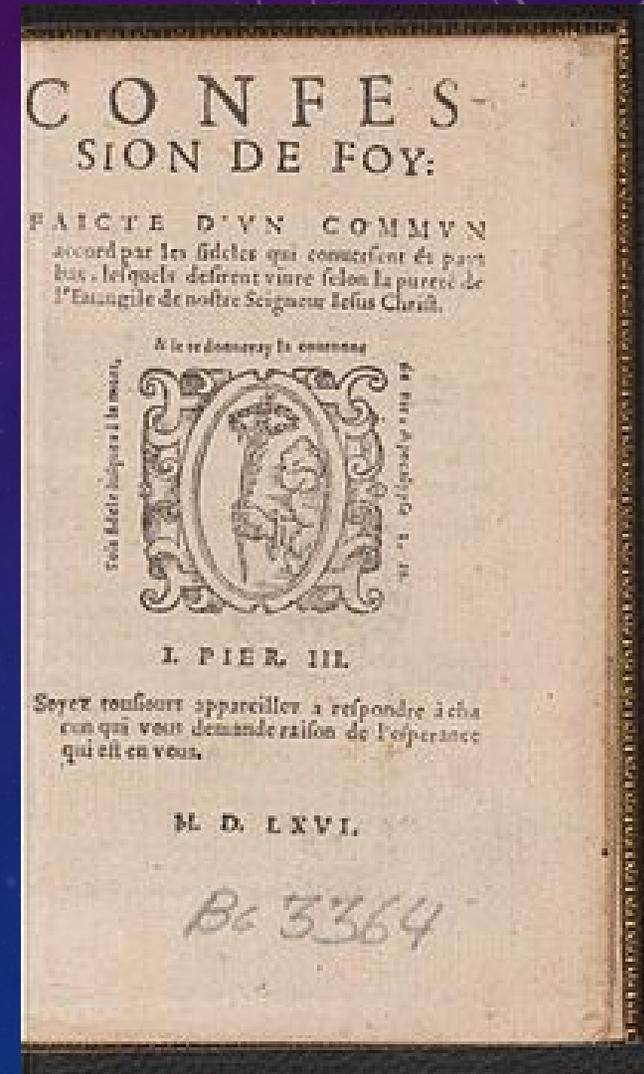
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The Belgic Confession Article II –

The means by which we know God...

- We know Him by two means...
- First, by the creation, preservation, and government of the universe, since that universe is before our eyes like a beautiful book (emphasis added) in which all creatures, great and small, are as letters to make us ponder the invisible things of God: His eternal power and His Divinity, as the apostle Paul says in Romans 1:20:
- *All these things are enough to convict men and to leave them without excuse.*
- Second, He makes Himself known to us more openly by His holy and divine Word, as much as we need in this life, for His glory and for the salvation of His own
 - Source: http://www.prca.org/bc_text1.html#a2
 - Written in 1561 by Guido de Bres



What are some fears people have about combined evidences from Bible and Science?

- Concerns that Genesis 1-11 damages the credibility of the Gospel
- Concerns that they may learn something that will cause them to question their faith...
- Not necessary for honorable Christian living and salvation
- Science is confusing
- Not necessary, the message of the Gospel is simple



What are some fears people have about combined evidences from Bible and Science?

- If we cannot take the first book (or chapters) of the Bible literally, then how can we believe any of the Bible?
 - Any biblical interpretation (hermeneutics) requires an understanding of the **context** in which the book was written.
 - Who was the audience?
 - What was the stated, apparent or implied purpose?

What are some fears people have about combined evidences from Bible and Science?

- If we cannot take the first book (or chapters) of the Bible literally, then how can we believe any of the Bible?
 - Do we literally interpret all of the Bible?
 - The Psalms? Parables?
 - Genealogies?
 - Visions written about by the apostle John, Daniel, Ezekiel, Jeremiah and others?
 - Are parables literal stories?
 - God speaks to His covenant people on a level they can understand.
 - Parables in the NT are realistic stories intended to convey truths about the kingdom of Heaven and Gods nature in way the hearers can understand.

What are some fears people have about combined evidences from Bible and Science?

- Creation controversies result in divisions within the church...
 - They certainly can if we let em...
 - The golden rule of apologetics is:
 - *Treat others opinions and views the way you would want yours treated*
 - As Christians there are tenants central to our faith we must agree on. There are also many things we have not been given to understand yet
 - *For now we see only a reflection as in a mirror; then we shall see face to face. Now I know in part; then I shall know fully, even as I am fully known* I Cor. 13:12
 - Our understanding and interpretations of the book of scripture and the book of nature are incomplete...
 - Perceived contradictions must be attributed to our lack of full understanding or “knowing in part.”
 - We must approach the study of scripture and nature with humility

What outcomes can we expect in a study of Christian Apologetics?

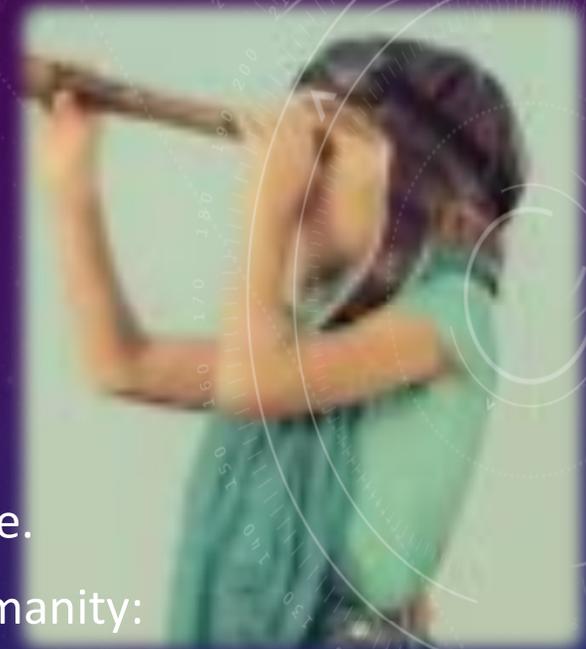
- First, there is no “smoking gun” evidence that we can point to that explicitly proves the existence of God... using the scientific method.
 - This is by design...
 - God wants to give us to freely choose to follow Him, this is why
 - We were created for the purpose of serving and dwelling with God Eph. 1:4&5; Jeremiah 29:11
 - God gave us sufficient evidence in His creation to find Him Romans 1:19,20
 - Only a fool (Hebrew: nabal) saith in his heart there is no God (Psalms 14:1, 53:1)

What outcomes can we expect in a study of Christian Apologetics?

- Second, God gives us evidence for what He asks us to believe.
 - This is also by design...
 - What is Christian faith?
 - Now faith is the substance of things hoped for, the evidence of things not seen. For by it the elders obtained a good testimony. Hebrews 11:1,2 (NKJV)
 - The very definition of Christian faith requires evidence be presented and evaluated by all of us.
 - Atheists often say that Christian faith is based on blind belief, this is a false narrative and couldn't be further from the truth.

WHAT OUTCOMES CAN WE EXPECT IN A STUDY OF CHRISTIAN APOLOGETICS?

- Second, God gives us evidence for what He asks us to believe.
 - Does it seem reasonable to you that God would give humanity:
 - The intellectual ability to comprehend and understand much of His creation (including ourselves)
 - Give us the motivation to pursue that knowledge and understanding,
 - Give us the means to explore by positioning our planet in a quiet part of the galaxy
 - Give us the means to extend our senses through technology built on a foundation of inexpensive energy
 - And then just expect us to accept His word without evidence? This seems absurd.
 - We have abundant evidence for God's existence because He has made Himself known in His creation Romans 1:18-20



Theological Apologetics

Did Jesus actually live on the earth? What is the evidence?

- Jewish Talmud – may be regarded as a secular writing, is a record of 2nd through 5th century teachings and debates about the Torah (first five books of OT).
- Two versions of the Talmud, the Palestinian and the Babylonian of which the Babylonian version is considered the most complete ²
- There are many references to Jesus from this source ¹, although none of them are flattering to any degree. He is often referred to as the “blasphemer and idolater”
- 1 Source: <https://press.princeton.edu/books/paperback/9780691143187/jesus-in-the-talmud>
- 2 Source: <https://www.bl.uk/collection-items/babylonian-talmund#:~:text=The%20Talmud%20developed%20in%20two,edited%20for%20another%20two%20centuries.>

Theological Apologetics

Did Jesus actually live on the earth? What is the evidence?

- Changed lives of the apostles; the empty tomb recorded by both in the Bible and in secular sources of literature.
- Roman Guards AWOL – especially interesting considering harsh discipline they would have faced
- Jesus appeared to both friendly and hostile witnesses; over 500 whom at the time of Paul's writing, most of whom were still alive 1 Corinthians 15:3-6
- All of the apostles (save John) died martyr's deaths along with hundreds of disciples, thousands more since
- Source:
<http://christianity.about.com/od/biblestorysummaries/p/theresurrection.htm>

Theological Apologetics

Numerous and diverse sources are available listing OT prophecies and NT Fulfillment in Jesus

This website alone has 351 OT prophecies fulfilled in Jesus Christ

<https://www.newtestamentchristians.com/bible-study-resources/351-old-testament-prophecies-fulfilled-in-jesus-christ/>

These prophecies occurred hundreds and sometimes thousands of years before the fulfillment. They were written by many individuals over spans of thousands of years...

Yet remain entirely consistent with one another

Theological Apologetics

Did Jesus actually live on the earth? What is the evidence?

(Most compelling for me)

- Jesus Half-Brothers James, Joseph, Simon and Judas (Matthew 13:55)
- James – Clearly not a believer early in Jesus ministry (John 7:5)
- James was one of the people Jesus appeared to after His resurrection (1 Cor 15:7)
- He became one of the first leaders of the Church in Jerusalem (Gal 2:9), wrote the powerful book of James and was martyred by the Jews

What outcomes can we expect in a study of Christian Apologetics?

Did Jesus actually live on the earth? What is the evidence?

- What about Jude?
- He wrote the NT book of Jude (Jude 1:1) and (by tradition) was likely a church leader also and was martyred.
- Although not mentioned in the NT, tradition holds that Simon, the half-brother of Jesus, was martyred.
- No known references to Jesus's half-brother Joseph
- Mother Mary had some idea of who Jesus was – Gabriel's Announcement (Lk 1); Water into Wine story (John 2:1-11)

What outcomes can we expect in a study of Christian Apologetics?

- Types of reasoning deductive, inductive and abductive
 - Deductive – general information to specific (detective solving a case)
 - Inductive – from specific to general (a psychologist experimenting on a sample of a population then generalizing the results to that population)
 - Abductive – Reasoning in such a way as to construct a story to fit the available facts. This reasoning seems to be more natural for us.

Example of Abductive Reasoning

- Any thoughts about how these mysterious markings came to be on this wall?



Why the Christian Faith? Abductive Reasoning

- A thought experiment
 - If you could sit down and invent your own religion, what would it look like? You cannot use Christian morality to define the parameters of the religion... Would your religion include...
 - A God who gives us free will to accept Him or not?
 - A God who knew before time we needed a plan of redemption for reconciliation to Him? 2 Tim 1:9; Titus 1:2-3
 - Part of that plan was to willingly suffer humiliation and death at the hands of His creation? John 3:16; Romans 5:8
 - Create a most powerful angelic majesty who would rebel against Him? And become enemy to all creation? Ezekiel 28
 - Give His “image” to any part of His creation? Genesis 1:26-27

Why the Christian Faith?

- A thought experiment
 - If you could sit down and invent your own religion, what would it look like?
 - Use natural processes to miraculously lovingly and painstakingly create a perfect home for those with His image? Psalms 104; Job 38-40
 - Send His very Spirit to dwell with His creation to help and to discern truth? John 14 & 16
 - Write a book Himself explaining our place in the universe, our role and expectations of us? John 15; Matthew 5-7; Micah 6:6-8

Why the Christian Faith?

- A thought experiment
 - If you could sit down and invent your own religion, what would it look like?
 - What about a God who greatly desires to have a loving relationship with His creation? See God's reaction at the apostasy of Ephraim (Israel)
 - God taught them to walk, raised them as a parent raises a child and when that child becomes an adult it rebels against its parent... Hosea 11; God describes His heart as being turned over within Him vs. 8 (KJV).
 - He is grief stricken at the rejection of Him by His covenant people

Why the Christian Faith?

- A thought experiment
 - If you could sit down and invent your own religion, what would it look like?
 - A God who greatly desires everyone to willingly choose Him but does not require it of us II Peter 3:9
 - According to Lewis, *“Reality, in fact, is usually something you could not have guessed. That is one of the reasons I believe Christianity. **It is a religion you could not have guessed.** If it offered us just the kind of universe we had always expected, I should feel we were making it up. But, in fact, it is not the sort of thing anyone would have made up. It has just that queer twist about it that real things have”.*
 - Source:
<https://www.dacc.edu/assets/pdfs/PCM/merechristianitylewis.pdf>
page 26

Final Thoughts on this section?

Summary

- Two books – metaphorical book of nature and actual book of scripture
- All truth is God's truth – Discernment is a gift from the Holy Spirit
- Integrating Genesis/Creation with Science will enhance the credibility of both by providing a more complete picture.
- Apologetic creed 1 Peter 3:15 ...always being ready to make a defense (apologia) to everyone who ask you to give an account for the hope that is in you, yet with gentleness and reverence...
- Christianity, there is nothing else like it, this is evidence. All other religions are explainable and predictable to some extent, however Christianity is “so unexpected” as Lewis puts it.

Discussion? / Questions?

If you wish to email questions later my email address is:

thowell2books@gmail.com

End of section



What are some fears people have about combined evidences from Bible and Science?

- Genealogies controversy
 - Hebrew yalad, (3205) is translated by NIV as begat.
 - Like the word for father (ab) and son (ben), in context, yalad has much broader meaning
 - Deut. 32:18 God “begat” then (Israel)
 - Numbers 11:12, Moses declares he had not “begotten” Israel himself
 - Daniel 5:22 Belshazzar is described as “son” of Nebuchadnezzar and likewise Neb... is called his “father” but they were not biologically related. Belshazzar was the literal son of Nabonidus.
 - Ruth 4:13-17 uses the same word “son” to describe Obed as the son of Naomi. Obed was the biological son of Ruth and Boaz, Naomi was the mother of Boaz.
 - Genesis 48 Manasseh and Ephraim were described as sons of Jacob (Israel), when in fact they were the biological sons of Joseph and grandsons of Jacob. Jacob adopted his grandsons so that they might have a full inheritance in the land of Israel.
 - Source: <http://www.reasons.org/articles/the-genesis-genealogies>

What are some fears people have about combined evidences from Bible and Science?

- Genealogies controversy
 - 1650 Bishop Usser, Catholic Archbishop of Ireland calculated a timeline based on a genealogies from Genesis 5 and 11. The result was that Adam and Eve were thought to have been created around 4004 BC.
 - His assumption was that the genealogies were complete and without gaps.
- Purposes of Genealogies in the Bible
 - Familial – used to establish inheritances
 - Legal / Political – used to establish tribe, land allocations for tribe and service
 - Religious – establishment of the priesthood (Levites); Establish lineage for Jesus Christ
 - Genesis 5 – Adam to Noah
 - Genesis 11 – Noah to Abraham
 - Matthew 1 – Abraham to Jesus Christ in order to fulfill OT prophesy (e.g. provide evidence of fulfillment)
 - Genesis 12:3; 17:19; 49:10; Numbers 24:17; Isaiah 11:10; Jeremiah 23:5&6
 - See other references <http://www.godandscience.org/apologetics/prophchr.html>

What outcomes can we expect in a study of Christian Apologetics?

- First, there is no “smoking gun” evidence that we can point to that explicitly proves the existence of God... using the scientific method.
- I believe I can show through both theological and scientific lines of evidence and abductive reasoning, that God is the best explanation...
- Why doesn't God just show Himself?
 - This is by design... Several passages in the Bible describe visions of God and encounters with both Him and created beings (Angels)
 - Then the LORD spoke to Moses, "Go down, warn the people, so that they do not break through to the LORD to gaze, and many of them perish Exodus 19:21
 - In the year of King Uzziah's death I saw the Lord sitting on a throne, lofty and exalted, with the train of His robe filling the temple... “Woe to me”, I cried “I am ruined”... my eyes have seen the King the Lord Almighty... Isaiah 6:1-5

What outcomes can we expect in a study of Christian Apologetics?

- First, there is no “smoking gun” evidence that we can point to that explicitly proves the existence of God... using the scientific method.
 - This is by design... Several passages in the Bible describe visions of God and encounters with both Him and created beings (Angels)
 - As I looked, behold, a storm wind was coming from the north, a great cloud with fire flashing forth continually and a bright light around it, and in its midst something like glowing metal in the midst of the fire and on that which resembled a throne, high up, was a figure with the appearance of a man. Then I noticed from **the appearance of His loins and upward something like glowing metal that looked like fire all around within it, and from the appearance of His loins and downward I saw something like fire; and there was a radiance around Him.** As the appearance of the rainbow in the clouds on a rainy day, so was the appearance of the surrounding radiance Such was the appearance of the likeness of the glory of the LORD And when I saw it, I **fell on my face** and heard a voice speaking. Ezekiel 1:1-28; 10:1 ff

What outcomes can we expect in a study of Christian Apologetics?

- First, there is no “smoking gun” evidence that we can point to that explicitly proves the existence of God... using the scientific method.
 - This is by design... Several passages in the Bible describe visions of God and encounters with both Him and created beings (Angels)
 - And I heard a man’s voice from the Ulai calling, “Gabriel, tell this man the meaning of the vision.” As he came near the place where I was standing, **I was terrified and fell prostrate**. “Son of man”, he said to me, “understand that the vision concerns the time of the end.” Daniel 8:16,17

What outcomes can we expect in a study of Christian Apologetics?

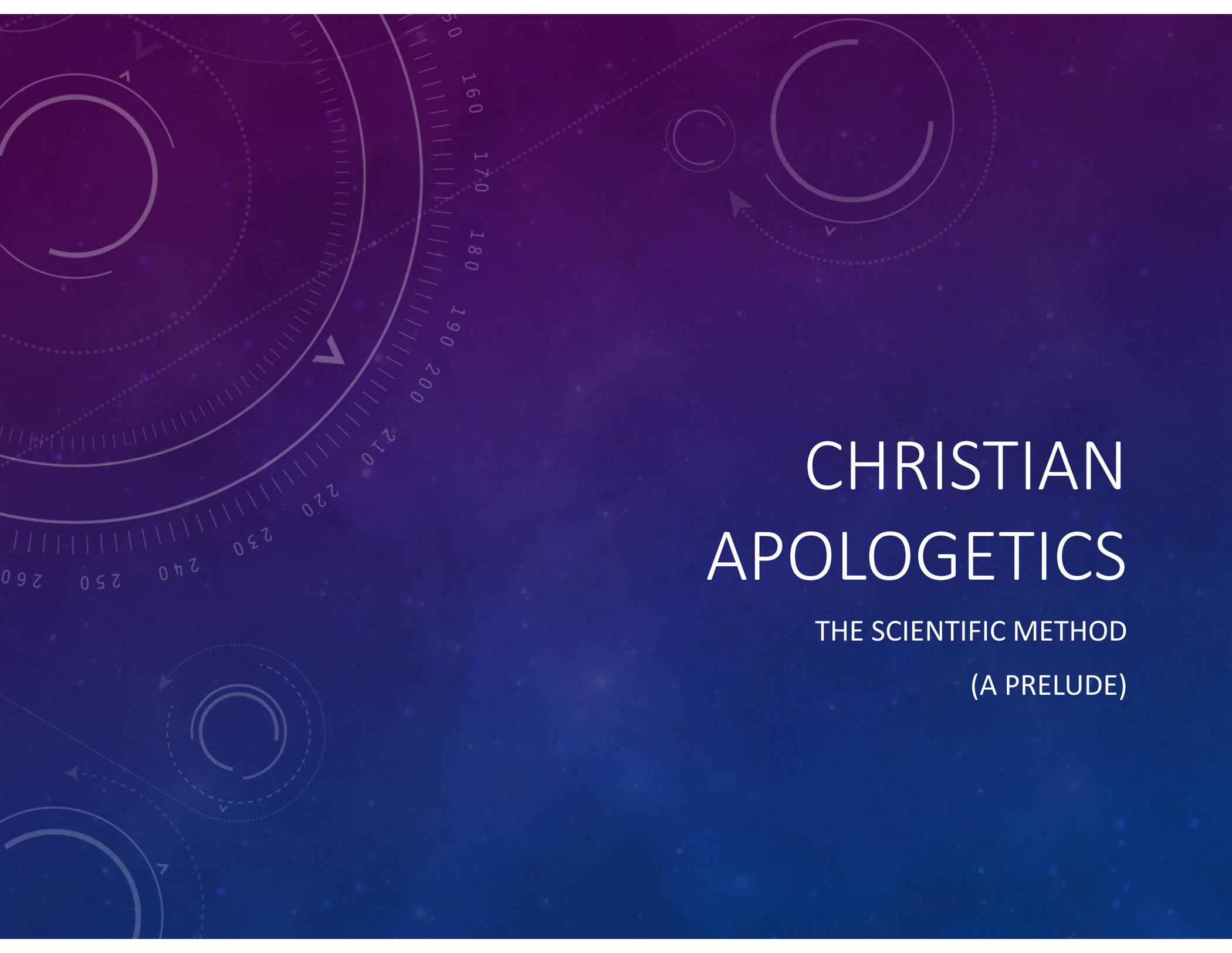
- First, there is no “smoking gun” evidence that we can point to that explicitly proves the existence of God... using the scientific method.
 - This is by design... Several passages in the Bible describe visions of God and encounters with both Him and created beings (Angels)
 - I looked up and there before me was a man dressed in linen, with a belt of fine gold from Uphaz around his waist. His body was like topaz, **his face like lightning, his eyes like flaming torches, his arms and legs like the gleam of burnished bronze, and his voice like the sound of a multitude.** I, Daniel, was the only one who saw the vision; those who were with me did not see it, but such terror overwhelmed them that they fled and hid themselves. 8 So I was left alone, gazing at this great vision; I had no strength left, my face turned deathly pale and I was helpless. Then I heard him speaking, and as I listened to him, I fell into a deep sleep, my face to the ground. Daniel 10:5-9
 - Consider Daniel’s reaction to Angels who had just been in the presence of the Lord... And the reactions of the Roman guards who guarded the empty tomb... they shook and became like dead men Matthew 28:4

What outcomes can we expect in a study of Christian Apologetics?

- First, there is no “smoking gun” evidence that we can point to that explicitly proves the existence of God... using the scientific method.
 - This is by design...
 - God wants to give us a fair chance and freely choose to follow Him, this is why
 - He does not allow us to be tempted beyond what we can bear 1 Cor. 10:13
 - He desires all people to be saved and come to a knowledge of truth 1 Tim 2:4
 - We have the sermon on the mount Matthew 5-7, we are given the values that please our Heavenly Father , e.g. rules of living a successful life
 - God incarnate paid the ransom Himself for our sins John 10:18, Eph. 2:8&9 and Romans 5:8
 - He loves us John 3:16
 - He wants us to choose to serve Him of our own free will Revelations 22:17; Ezekiel 3:27; Luke 13:34

What outcomes can we expect in a study of Christian Apologetics?

- Finally, there is great assurance in Understanding there is agreement between evidence from Theology and Science
 - Much has been made by atheists and Christian skeptics that faith and science are mutually exclusive
 - We will look at this closely in the next segment on the scientific method.
 - Part of why we may avoid the study of science is that we might uncover something that will challenge our faith
 - Challenge our expectations – challenging our beliefs, causing us to doubt our faith
 - This is exactly how our adversary has makes effective use of this perceived lack of concurrence between Science and Faith
 - We are afraid of having our beliefs challenged...
 - In Reality, a study of Science and Theology has the effect of BUILDING UP our faith.
 - As people dedicated to truth, we must courageously and humbly follow the evidence, wherever it may lead
 - If God is whom He claims to be, can He not write a book and create a universe that are compatible?

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CHRISTIAN APOLOGETICS

THE SCIENTIFIC METHOD

(A PRELUDE)

Judeo-Christian Origins of the Scientific Method (SM)

According to Meyer (2021), researchers from Cambridge University posed questions about the rise of SM in 15th and 16th century western Europe

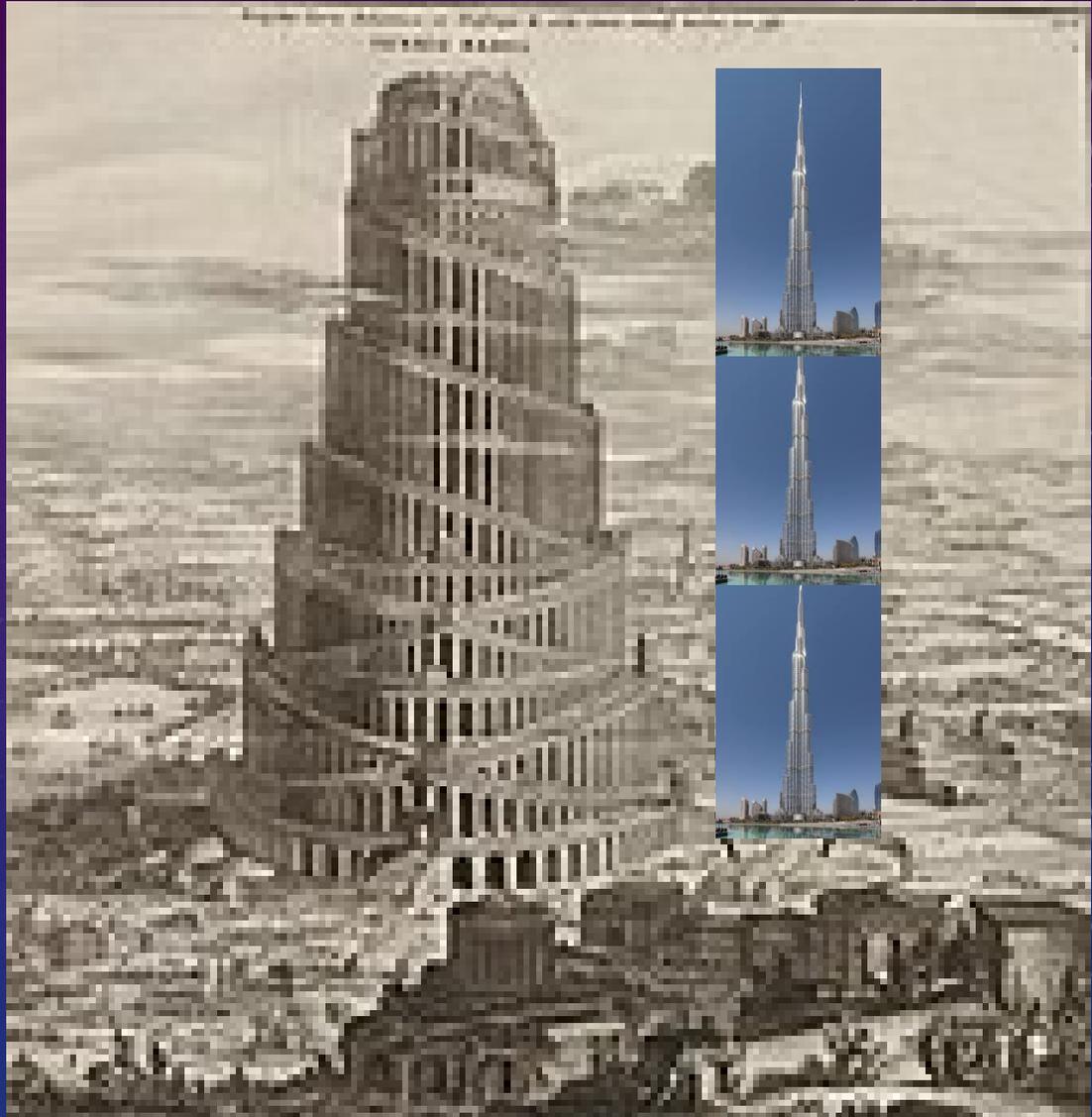
Needham and Hodgson investigated why western Europe and why at this time?

Many past civilizations, while very successful, were not able to advance scientific inquiry to an appreciable extent... Examples?

(Meyer, 2021)

Tower of Babel

The Book of Jubilees mentions the tower's height as being 5,433 cubits and 2 palms, or 2,484 m (8,150 ft) or about 1.6 miles high
Built circa 2200 BC



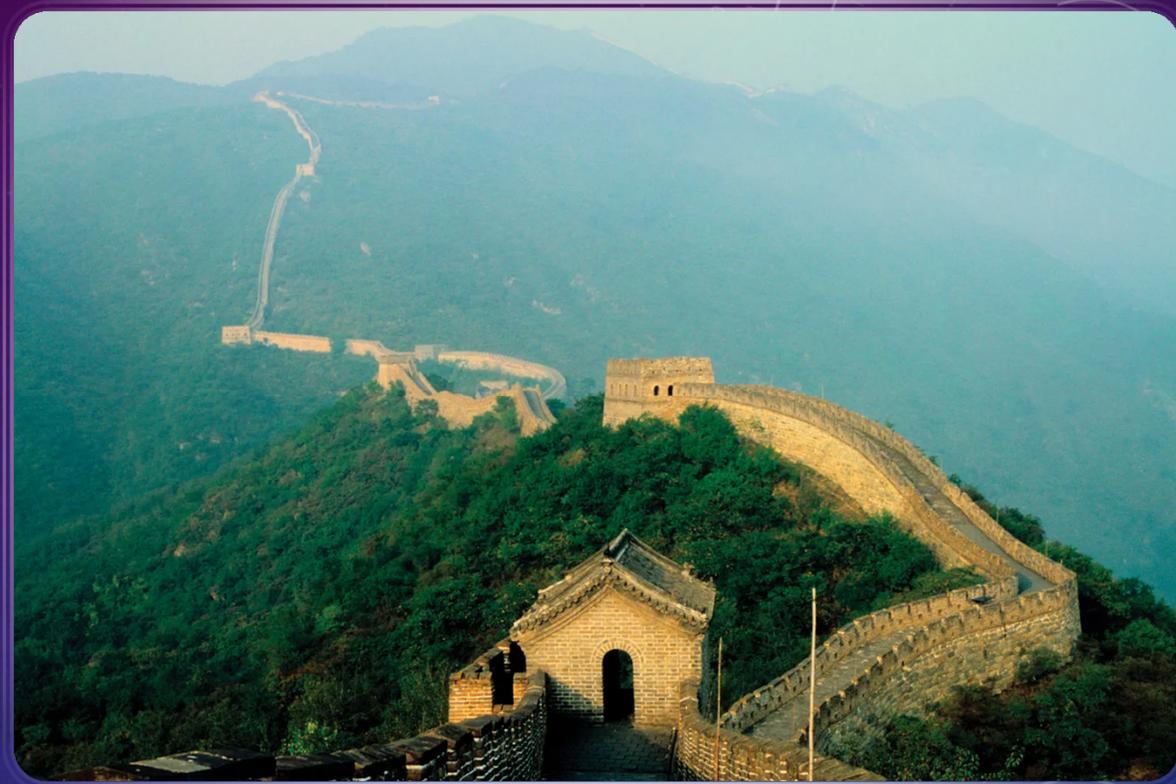
Source:

https://en.wikipedia.org/wiki/Tower_of_Babel#:~:text=The%20Book%20of%20Jubilees%20mentions,or%20roughly%201.6%20miles%20high

GREAT WALL OF CHINA

Nearly 22,200 km long
(13,170 miles)

Built over a period of
several centuries starting
around 700 BC with work
completing circa 1644 AD.



Source:

https://en.wikipedia.org/wiki/Great_Wall_of_China

Great Pyramid of Giza



Height is 146.6 m (481 ft) or 280 cubits (originally); 138.5 m (454 ft) (contemporary). Base 230.33 m (756 ft) or 440 cubits. Volume 2.6 million m³ (92 million cu ft)

Construction completion around 2570 BC

Source: https://en.wikipedia.org/wiki/Great_Pyramid_of_Giza

The background features a dark blue gradient with faint, glowing circular patterns and a scale. The scale is a semi-circular arc on the left side, with numerical markings from 160 to 260 in increments of 10. There are also several concentric circles and dashed lines with arrows, suggesting a scientific or technical theme.

CHRISTIAN APOLOGETICS

THE SCIENTIFIC METHOD

(REASONS FOR AND UNDERSTANDING THE SM)

COURSE AGENDA

In this first class, we are going to lay the groundwork for later discussions

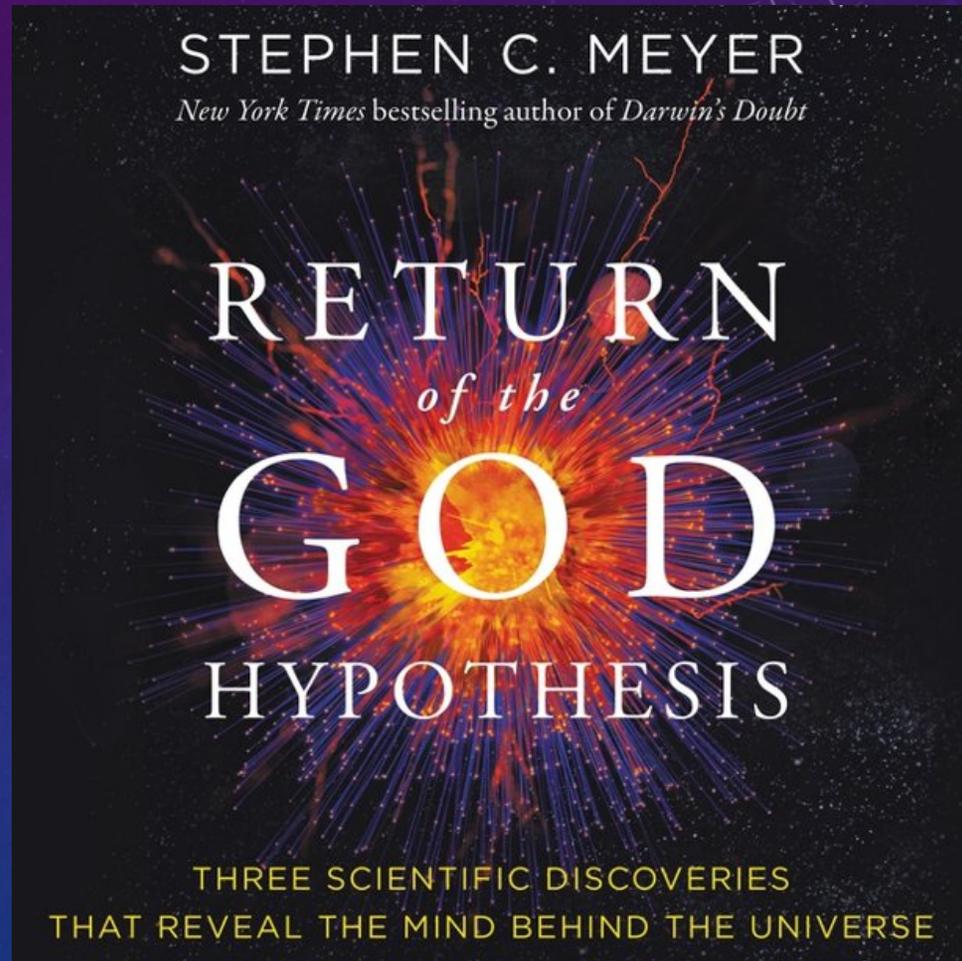
- Compatibility between the Christian Theology and Science; Theology
- **The scientific method: history, development, implementation**
- Evidence and Theory for Creation of the Universe part 1
- Evidence and Theory for Creation of the Universe part 2
- Origins of life, information theory
- Origins of life, addressing macro and chemical evolution issues
- Origins of life, the fossil record, and chronology
- Human cognition and metacognition, mysteries of consciousness

The guiding verse of the Christian Apologist... 1 Peter 3:15

... always being ready to make a defense (apologia) to everyone who asks you to give an account for the hope that is in you, yet with gentleness and reverence...

Judeo-Christian Origins of the Scientific Method (SM)

Note: much of this section is based on the book by Dr. Stephen C Meyer



Judeo-Christian Origins of the Scientific Method (SM)

According to Meyer (2021), researchers from Cambridge University posed questions about the rise of SM in 15th and 16th century western Europe

Many past civilizations, while very successful, were not able to advance scientific inquiry to an appreciable extent... Examples?

(Meyer, 2021)

Judeo-Christian Origins of the Scientific Method (SM)

Needham and Hodgson conclude that only in 15th and 16th century western Europe were the necessary “intellectual presuppositions” present.

Needham and Hodgson investigated why western Europe (there) and why at this time (then)?

So, what are these intellectual presuppositions?

(Meyer, 2021)

Judeo-Christian Origins of the Scientific Method (SM)

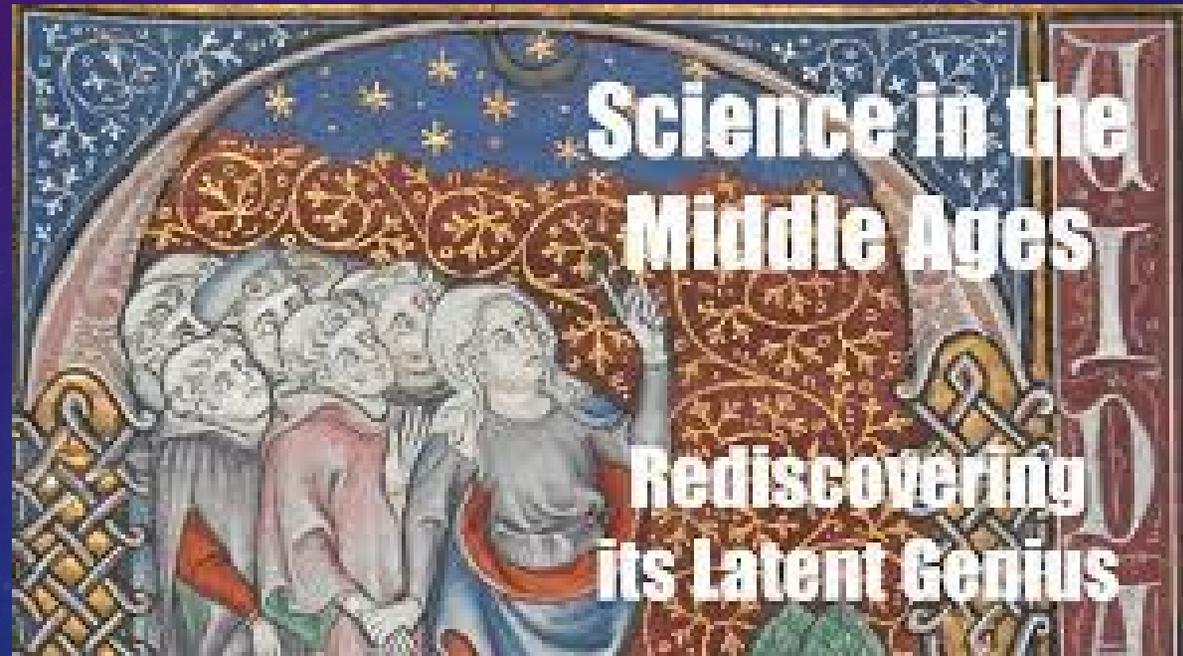
The intellectual presupposition's identified are:

Breaking with Greek thinking

The Contingency of Nature

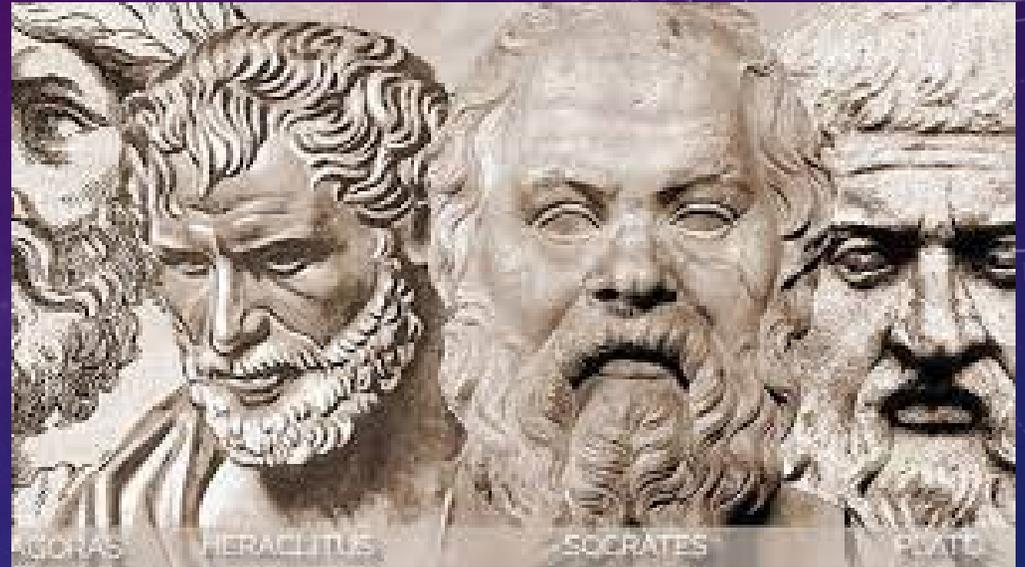
The Intelligibility of Nature

The Fallibility of Human Reasoning



(Meyer, 2021)

Judeo-Christian Origins of the Scientific Method (SM) – Breaking from Greek Assumptions



Greek assumptions about the nature of reality, while providing some observational value, ultimately impeded empirical study of nature.

(Meyer, 2021)

Judeo-Christian Origins of the Scientific Method (SM) – Breaking from Greek Assumptions

Contributions from the Greeks philosophers:

- Believed that nature reflected an underlying order
- this order is intrinsic, self-existent, requiring no mind
- believed that they could deduce how natural processes behaved from superficial observations and human reasoning alone (example the heliocentric & geocentric concepts of planetary motion)

(Meyer, 2021)

Judeo-Christian Origins of the Scientific Method (SM) – Breaking from Greek Assumptions

Often invoked Greek assumptions regarding how nature must work including:

- the universe must be eternal
- Greek gods cannot create new species
- Planetary orbits must be circular
- Greek gods cannot create empty space
- Greek gods created only one solar system

(Meyer, 2021)

Judeo-Christian Origins of the Scientific Method (SM) – The Contingency of Nature

Eventually, many came to understand through observation of nature that natural processes were unexpected and could not be predicted through human reasoning alone.

Western European natural philosophers began to move away from Greek reliance on pure reasoning alone being necessary

11th and 12th centuries, thought began to shift toward “contingent rationality” as proposed by Scottish Theologian Thomas Torrance.

While underlying order does exist in nature (Greeks) it is the product of a designing mind with a will, with deliberation, and making rational choices.

A reaffirmation of the Creation doctrine. Tempier’s 1277 decree*

(Meyer, 2021)

Judeo-Christian Origins of the Scientific Method (SM) – The Contingency of Nature

Briefly, Tempier's 1277 decree

Issued by Bishop Stephen Tempier of Paris in March of 1277, likely as a result of a papal mandate:

List of 219 condemned propositions relating to details of Aristotelian texts that were irreconcilable with the Christian worldview.

These propositions were not binding on Catholics; but served as a guide for the scholars at the University of Paris.

The decree largely dealt with the eternity, the world, and creation.

Source: <https://strangenotions.com/from-faith-came-science-the-condemnations-of-1277/>

Judeo-Christian Origins of the Scientific Method (SM) – The Contingency of Nature

The result is a change in perspective (nature is organized by a rational, deliberative mind making choices about how to order...)

There are many ways that nature could have been ordered and organized

The order of nature is **contingent** on the choices and deliberations of a rational mind

This leads to the inevitable conclusion that human beings cannot discover this order and organization of nature through superficial observation alone

As Robert Boyle (1627-1691), the father of chemistry stated it:

“it is the job of the natural philosopher to determine not what God **must** have done, but what God **actually did.**”

(Meyer, 2021)

Judeo-Christian Origins of the Scientific Method (SM) – The Intelligibility of Nature

Natural Philosophers and Theologians held an underlying assumption that both theology (the study of scripture) and science (the study of the natural world) could be comprehended by the human mind.

This assumption is grounded in both the Greek philosophical and Judeo-Christian idea that nature was an orderly group of systems and could be understood with sufficient observation and study.

Newton, Galileo, Kepler, Copernicus, Boyle, and many others believed a study of nature would reveal God's mind to some extent.

Kepler said it this way

“being created in the image of God and examining the natural laws of His creation, allows us to share in His thoughts.”

(Meyer, 2021)

Judeo-Christian Origins of the Scientific Method (SM) – The Fallibility of Human Reasoning

13th century, Oxford University Natural Philosophers and Theologians Robert Grosseteste (1175-1253) and his student Roger Bacon (1220-1292) first recognized the possibility of self-deception and fallible thinking in natural inquiry.

They were the first to develop a systematic methodology for scientific inquiry they called “resolution and composition” and

the concepts of testing they termed “Verification and Falsification” that closely resembles modern isolation of variables.

These process are the forerunners of the modern scientific method

(Meyer, 2021)

Judeo-Christian Origins of the Scientific Method (SM) – The Fallibility of Human Reasoning

13th century, Oxford University Natural Philosophers and Theologian Robert Grosseteste (1175-1253) quote



In the beginning of time, light drew out matter along with itself into a mass as great as the fabric of the world.

~ Robert Grosseteste

Judeo-Christian Origins of the Scientific Method (SM) – The Fallibility of Human Reasoning

Natural Philosophers and Theologians of the 11th - 16th centuries generally held human reasoning as a gift from God.

They also recognized the possibilities for self-deception, premature conclusions and biases leading to wrong conclusions

During and after the protestant reformation (1577-circa 1648), the doctrine of the fall influenced thinking about taking natural observations at face value

Australian historian Peter Harrison noted that natural philosopher's acknowledgement of humanity's fall and subsequent movement toward a need to “interrogate” nature using experimental methods.

Francis Bacon, William Whewell adopted this position of humanity having both capability and fallibility of human reason

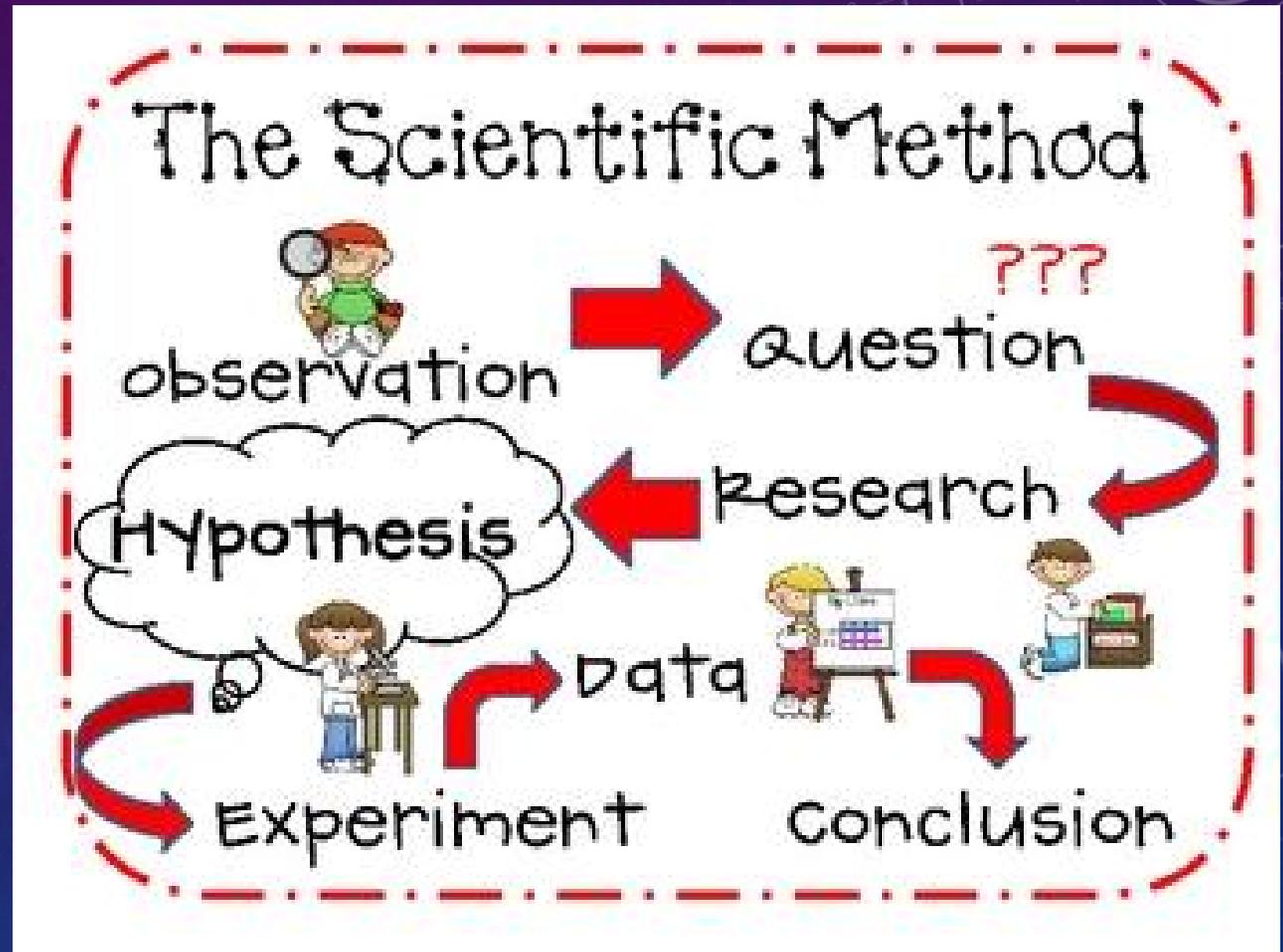
(Meyer, 2021)

The Baconian/Scientific Method

Source:

<https://pioneerinstitute.org/covid/covid-edu/eduresources/knowledge-is-power-sir-francis-bacon-and-the-scientific-method-10-resources-for-high-school-students/>

Published by Francis Bacon (1561-1626) in 1620



Judeo-Christian Origins of the Scientific Method (SM) Summary

The intellectual presuppositions identified by Needham and Hodgson in 11th - 16th century western Europe, that are necessary for a systematic and methodical process of natural inquiry are:

Breaking with Greek thinking

The Contingency of Nature

The Intelligibility of Nature

The Fallibility of Human Reasoning

The Desire to understand what God actually did (need for Truth)

These factors all contribute to the need for a formal investigative methodology into the nature of the universe

(Meyer, 2021)

The background is a dark blue gradient with a starry texture. On the left side, there are several overlapping circular elements. One prominent feature is a large circular scale with tick marks and numbers ranging from 160 to 260. Other circles include dashed lines, solid lines, and arrows, suggesting a scientific or technical theme.

CHRISTIAN APOLOGETICS

AN INTRODUCTION
(THE SCIENTIFIC METHOD)

The scientific method

Source:

<https://www.sciencebuddies.org/science-fair-projects/science-fair/steps-of-the-scientific-method>

Before experimental results are added to a “body of knowledge” those results must be independently reproduced by other researchers

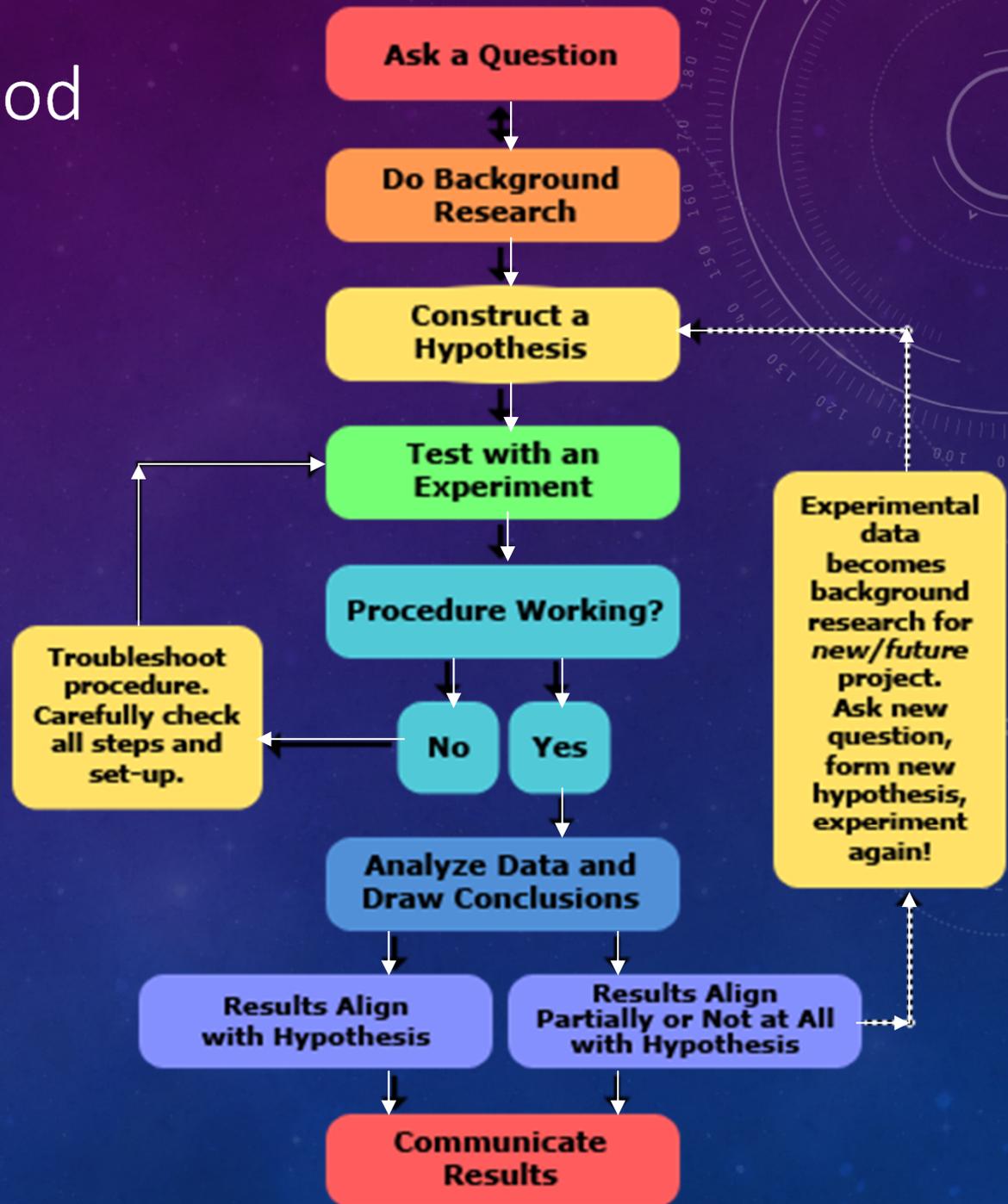


Table in Lucie Comber, 28 January 2016

My degree is: Ph.D.	
My program emphasis is: Psychology, with emphasis on cognition and learning	
Cap Statement: There is a need to study correlations of human values theory as identified in the PIVOR validated instrument (Forsythe & He, 2009; Giniem, & Farnon, 2010; Schwartz, 2011; Thompson, Geringer, Kohnen, & Bruchler, 2010; Johnson, Geringer, Schwartz, Geringer, & Geringer, 2010), with behaviors identified in the P-Well, five-factor wellness inventory (Ang, Lee, Peng, & Lee, 2012; Myers, Wilson, & Yonke, 2011; Ward, Thompson, Thompson, & Swickard, 2014) in an adult, North American population.	
Two Strategic Goals	Comments or Feedback
Research Topic Area (1-1.5 words)	
Background of the problem/topic	
<ul style="list-style-type: none"> a) Values describe the basic, far important beliefs by individuals in life. Values represent desirable goals, important specific situations, are standards of behavior, and guide our long term goals (Ingleh, Gierman, & Joseph, 2006; Schwartz, 2002; Schwartz, 2011). b) Originally, Schwartz (1992) developed the Basic Human Values Theory based primarily upon the work of Milton Rokeach in the early 1970s and Gordon Allport's work from the 1950s. <ul style="list-style-type: none"> 1. Values assessment statements used initially are the validated Schwartz Values Survey (SVS), and later the personal values questionnaire (PVQ). 2. The basic theory identifies ten basic human values and describes their relationship as a circular continuum. 3) The refined theory includes the original ten values plus adds several more and divides several original values into the refined ten to 10. 	

THE SCIENTIFIC METHOD – CORRUPTED?

*“Other scientists say that the definitions of “evidence” and “proof” need an upgrade. Richard Dawid of the Munich Center for Mathematical Philosophy believes scientists could support their hypotheses, like the multiverse—without actually finding physical support. He laid out his ideas in a book called *String Theory and the Scientific Method*. Inside is a kind of rubric, called **“Non-Empirical Theory Assessment,”** that is like a science-fair judging sheet for professional physicists. If a theory fulfills three criteria, it is probably true.*

Source: <http://www.smithsonianmag.com/science-nature/can-physicists-ever-prove-multiverse-real-180958813/#Z6ekeFwgrhGRATgj.99>

- *“First, if scientists have tried, and failed, to come up with an alternative theory that explains a phenomenon adequately, that counts as evidence in favor of the original theory. “*
- *“Second, if a theory keeps seeming like a better idea the more you study it, that’s another plus.”*

DOES THE “PROOF” DEFINITION NEED TO EVOLVE?

- *“Third, if a line of thought produced a theory that evidence later supported, chances are it will again.”*

Radin Dardashti, also of the Munich Center for Mathematical Philosophy, thinks Dawid is straddling the right track. “The most basic idea undergirding all of this is that if we have a theory that seems like it works, and we have come up with nothing that works better, chances are our idea is right,” he says.

REFERENCES

Meyer, S. C. (2021). *Return of the God Hypothesis* (First ed.). New York, NY, USA: Harper Collins. Retrieved 2022

The background is a dark blue gradient with a starry texture. On the left side, there is a large, semi-circular scale with tick marks and numbers ranging from 160 to 260. Several circular patterns, some solid and some dashed, are scattered across the image, some with arrows indicating direction. The overall aesthetic is technical and scientific.

CHRISTIAN APOLOGETICS

A WORD ON LITERARY HERMENEUTICS AND
INTERPRETATION

HERMENEUTICS-

Branch of knowledge that addresses interpretation of classical texts, including the Bible.

There are eight generally accepted rules for interpretation:

Source: <https://www.apologeticsindex.org/5846-biblical-interpretation-rules>

EIGHT RULES OF INTERPRETATION

1. **DEFINING TERMS-** Common definitions must be identified and consistently applied. The usually requires using a Hebrew/English or Greek/English lexicon.
2. **USAGE-** It must always be remembered that old Testament books are written to the Hebrews of that time, not a 21st century audience. Likewise, NT letters were written to a first century audience.
 1. It is very important not to impose modern usage and meaning
3. **CONTEXT-** All words read in a passage must be understood in context of all words before and after. Many passages will be misunderstood without contextual consideration.
4. **HISTORICAL & CULTURAL BACKGROUND-** Having an understanding of culture and historical significance in which the writings occurred and the intended audience.

EIGHT RULES OF INTERPRETATION

5. **LOGIC-** Interpretation is logical reasoning. Does the interpretation make sense? Is the interpretation consistent with other passages of scripture on the same topic? The Bible is to be interpreted applying the rules of language and grammatical syntax.
6. **PRECEDENT-** Word and phrase usage and definitions must follow precedents and not establish new meanings apart from the original.
7. **CONSISTENCY-** The parts of Scripture being interpreted must be consistent with the rest of Scripture.

EIGHT RULES OF INTERPRETATION

8. INFERENCE- An inference is a fact reasonably implied from another fact. It is a logical consequence.
 1. It derives a conclusion from a given fact or premise. It is the deduction of one proposition from another proposition.
 2. Such inferential facts or propositions are sufficiently binding when their truth is established by competent and satisfactory evidence.
 1. Competent evidence means credible, consistent, logical, and in agreement with other similar lines of evidence.
 2. Satisfactory evidence means that amount of proof which would ordinarily satisfy an unprejudiced mind beyond a reasonable doubt.

Finally, we must always remember the role of the Holy Spirit, who guides us in all truthfulness (John 14:16-18; 16:13).

EIGHT RULES OF INTERPRETATION- Summary

DEFINING TERMS– Are the terms consistent with the authors intent?

USEAGE – Who was the intended audience?

CONTEXT – places boundaries on the interpretation

HISTORICAL & CULTURAL BACKGROUND – significance of and influences on the writing

LOGIC – Is the interpretation reasonable and consistent?

PRESCEDENT – Is the interpretation consistent with previous interpretations or does it significantly depart from them?

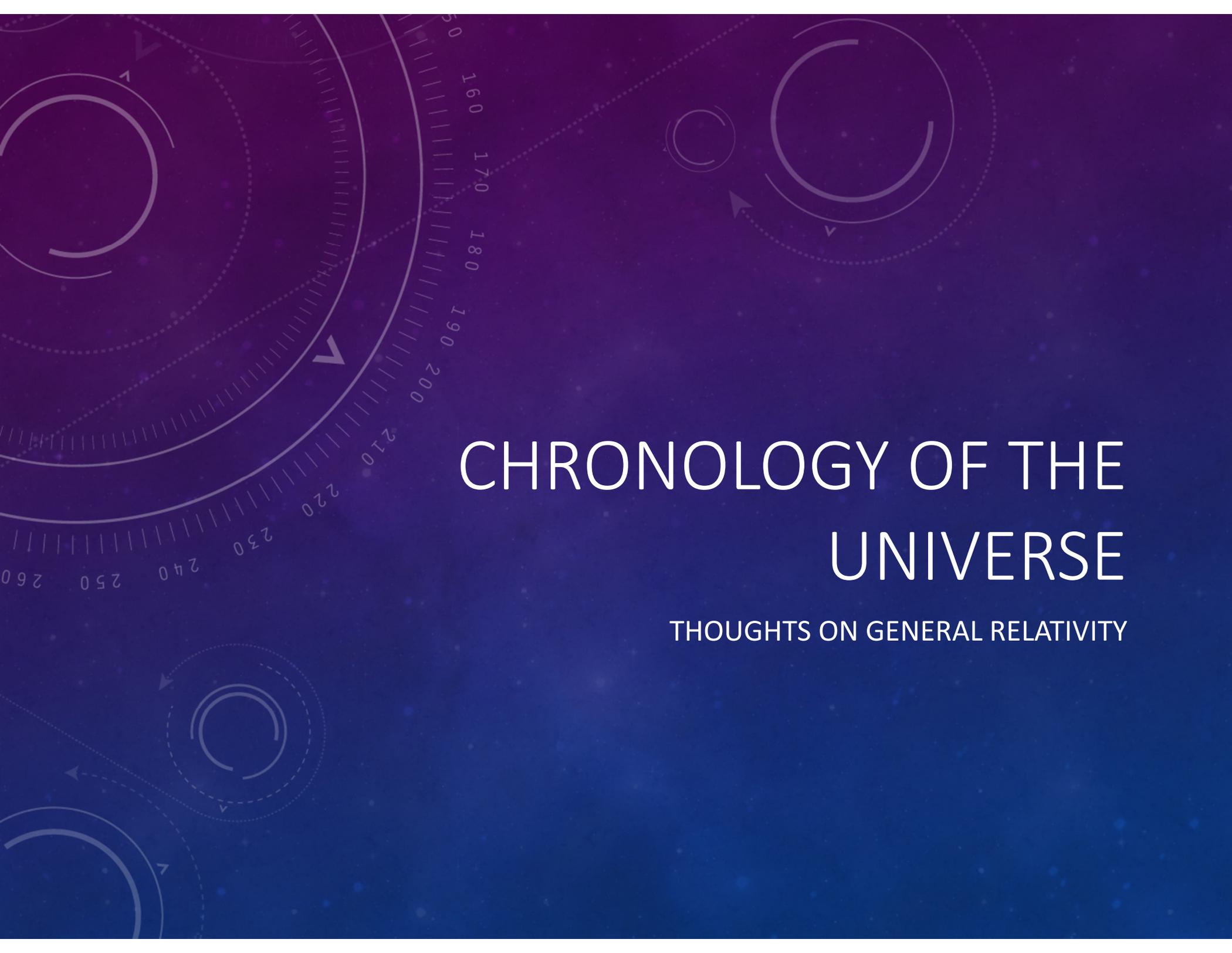
CONSISTENCY – Is the interpretation consistent with other similar passages of scripture?

INFERENCE – are the logical extension(s) consistent with all the above? Is the interpretation credible, consistent & satisfactory?

The background is a dark blue gradient with a starry texture. On the left side, there are several circular elements: a large scale with numbers from 160 to 260, and several smaller circles with arrows indicating rotation. On the right side, there are more circular patterns, including a large circle with a smaller one inside it, and arrows indicating movement.

CHRISTIAN APOLOGETICS

END OF SECTION
(THE SCIENTIFIC METHOD)



CHRONOLOGY OF THE UNIVERSE

THOUGHTS ON GENERAL RELATIVITY

HOW DOES OUR HEAVENLY FATHER DESCRIBE HIMSELF IN SCRIPTURE?

²⁵ “To whom then will you liken Me, Or *to whom* shall I be equal?” says the Holy One.

²⁶ Lift up your eyes on high, And see who has created these *things*,
Who brings out their host by number; He calls them all by name,
By the greatness of His might And the strength of *His* power;
Not one is missing (Isaiah 40:25-26).



THE GRANDEUR

First deep field image (July '22) from new James Webb Space Telescope

Galaxy cluster SMACS 0723 in center

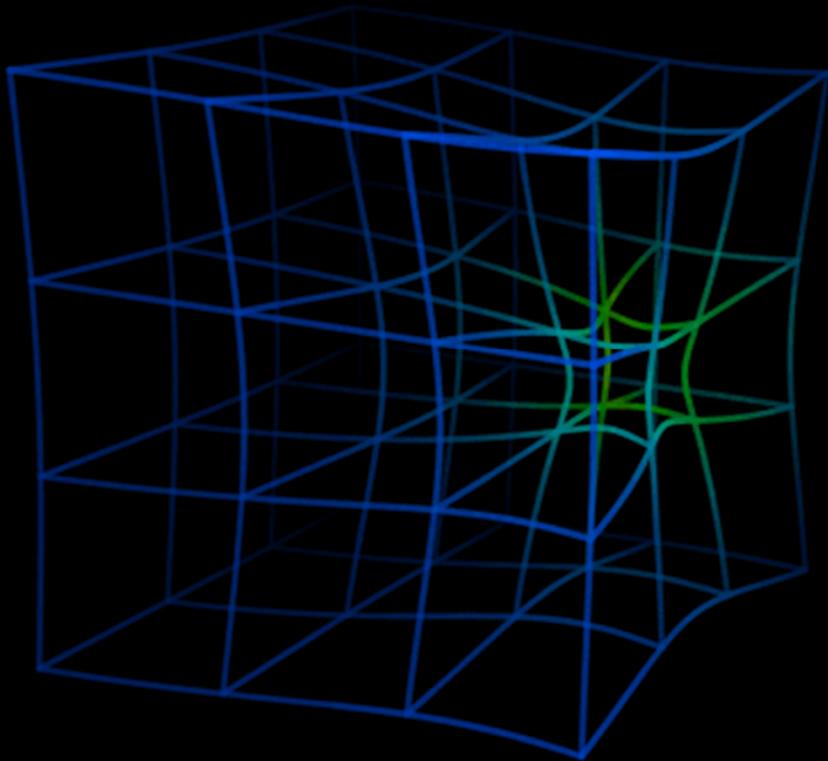
Viewed in infrared spectrum

Shows what the galactic cluster looked like about 4.6 BYA

<https://www.digitaltrends.com/space/james-webb-first-image-released/>

He counts the number of the stars; He calls them all by name (Psalms 147:4)

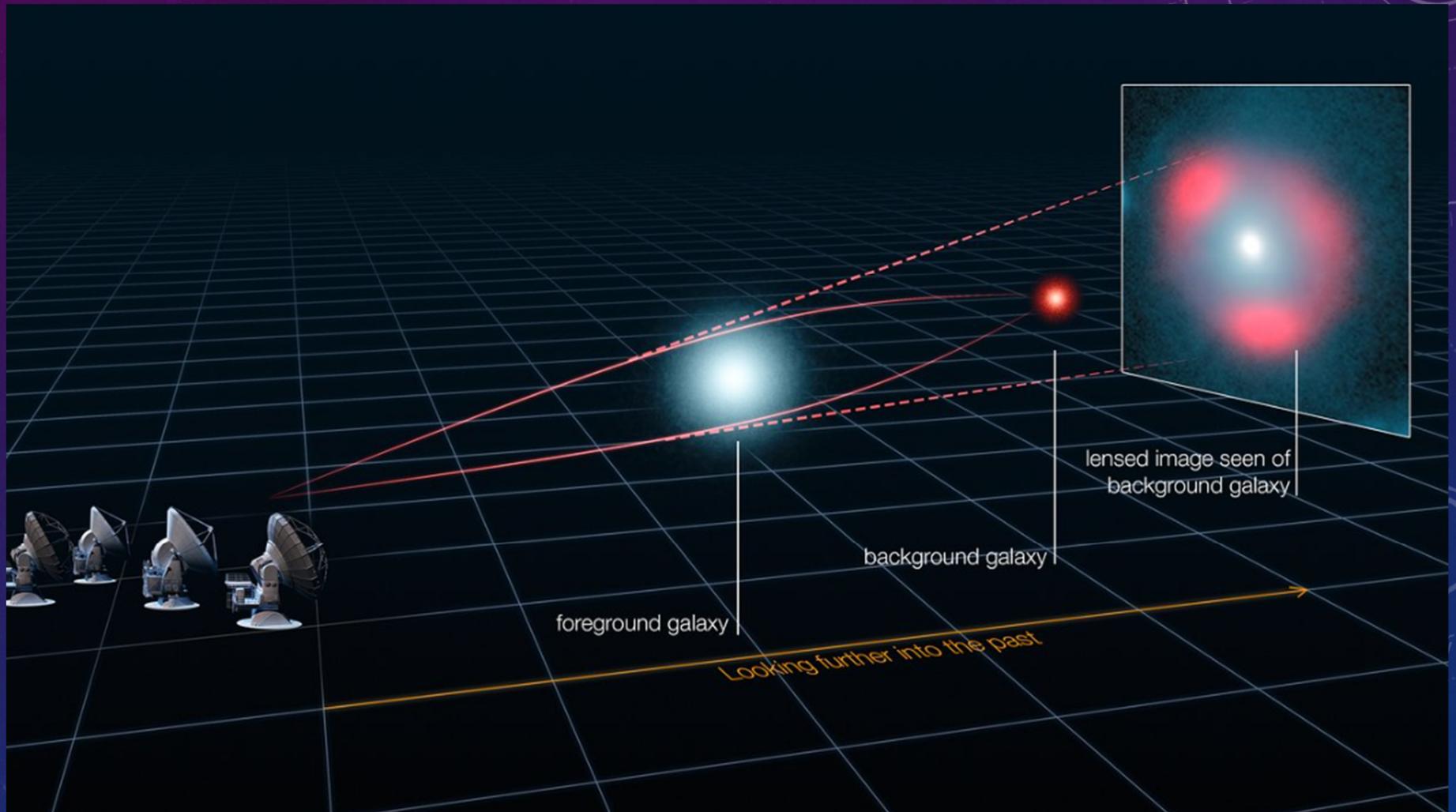
GR illustration

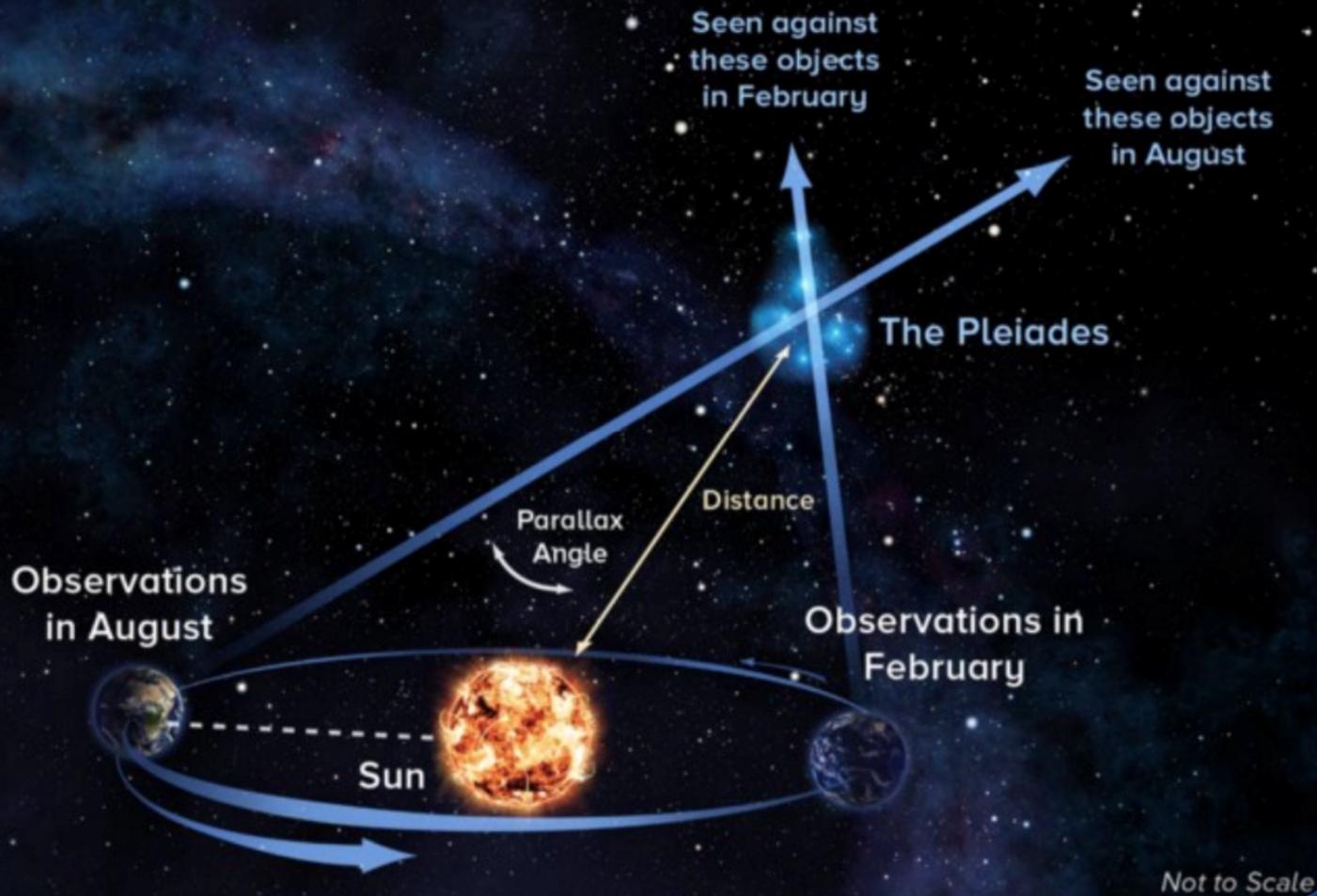


$$R_{\mu\nu} - \frac{1}{2}R g_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu}$$

$$F = G \frac{m_1 m_2}{r^2}$$

Gravitational Lensing – GR prediction





CALCULATING DISTANCE IN SPACE-TIME: PARALLAX



CALCULATING DISTANCE IN SPACE-TIME: CEPHID VARIABLE STARS

$$d = 10^{(m-M+5)/5} \text{ parsecs}$$

m is the apparent magnitude of the object

M is the absolute magnitude of the object

d is the distance to the object in parsecs

https://svs.gsfc.nasa.gov/vis/a010000/a010100/a010145/Cepheidin_HD_LARGE_QT_Video_1.mp4

<https://lco.global/spacebook/distance/what-is-distance-modulus/>

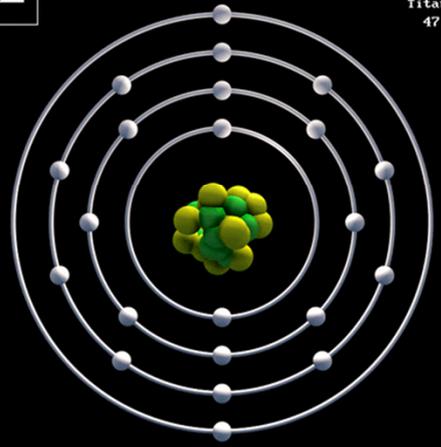
Periodic Table of the Elements

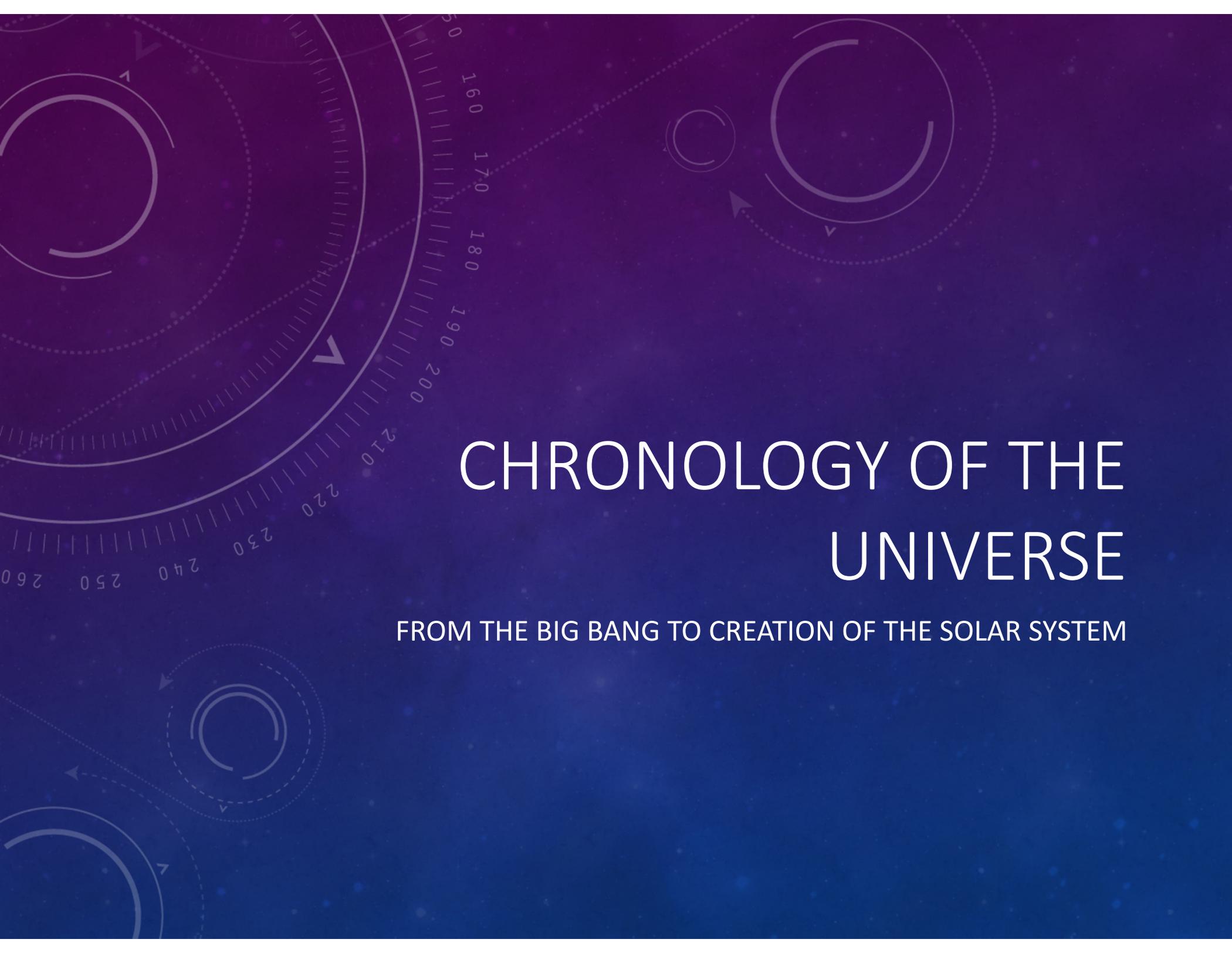
1 H Hydrogen 1.008												2 He Helium 4.0026	
3 Li Lithium 6.94												4 Be Beryllium 9.0122	
11 Na Sodium 22.990												12 Mg Magnesium 24.305	
19 K Potassium 39.099												20 Ca Calcium 40.078	
37 Rb Rubidium 85.468												38 Sr Strontium 87.62	
55 Cs Cesium 132.91												56 Ba Barium 137.33	
87 Fr Francium (223)												88 Ra Radium (226)	
1 H												2 He	
3 Li												4 Be	
11 Na												12 Mg	
19 K												20 Ca	
37 Rb												38 Sr	
55 Cs												56 Ba	
87 Fr												88 Ra	
24 Cr Chromium 51.996												2 He	
3 Li												4 Be	
11 Na												12 Mg	
19 K												20 Ca	
37 Rb												38 Sr	
55 Cs												56 Ba	
87 Fr												88 Ra	
24 Cr												2 He	
3 Li												4 Be	
11 Na												12 Mg	
19 K												20 Ca	
37 Rb												38 Sr	
55 Cs												56 Ba	
87 Fr												88 Ra	

57 La Lanthanum 138.91	58 Ce Cerium 140.12	59 Pr Praseodymium 140.91	60 Nd Neodymium 144.24	61 Pm Promethium (145)	62 Sm Samarium 150.35	63 Eu Europium 151.96	64 Gd Gadolinium 157.25	65 Tb Terbium 158.93	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93	68 Er Erbium 167.26	69 Tm Thulium 173.05	70 Yb Ytterbium 173.05	71 Lu Lutetium 174.97
89 Ac Actinium (227)	90 Th Thorium 232.04	91 Pa Protactinium 231.04	92 U Uranium 238.03	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (260)

22

Ti
Titanium
47.867
p:22
n:26





CHRONOLOGY OF THE UNIVERSE

FROM THE BIG BANG TO CREATION OF THE SOLAR SYSTEM

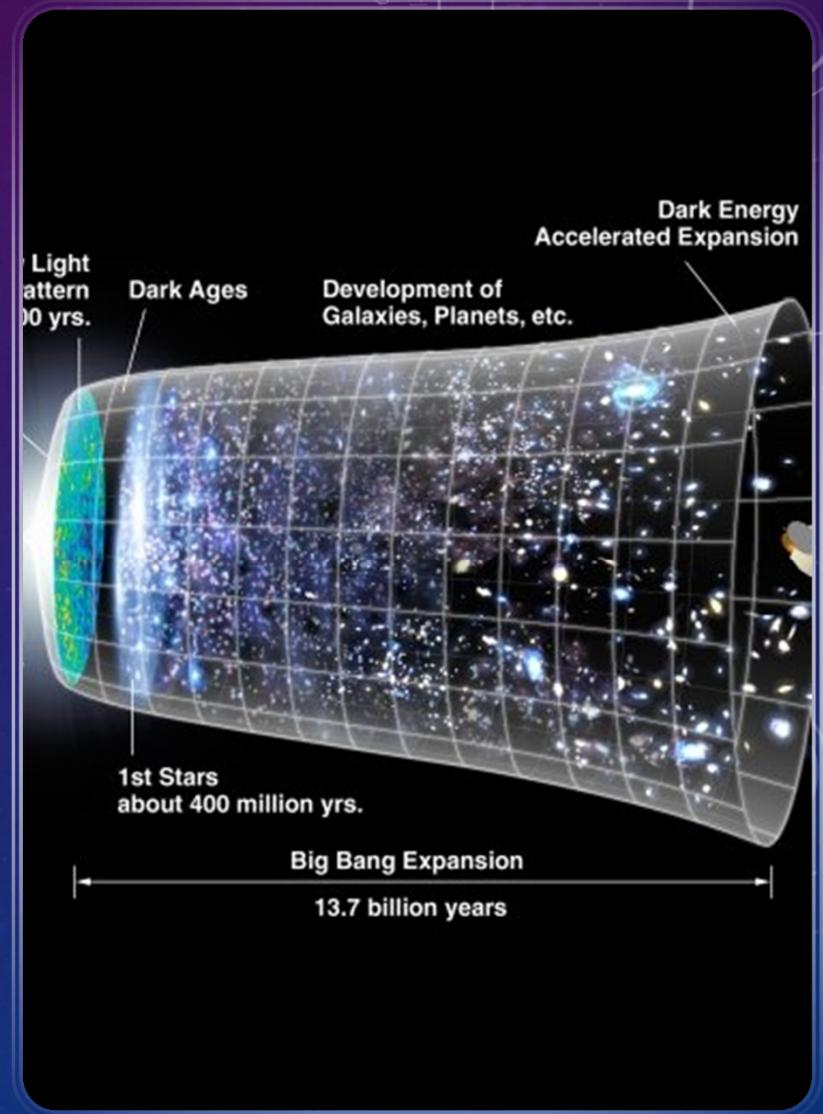
First let's review the evidence from cosmology today

- What follows is a physical description of creation...
- This description incorporates no theological implications or significance
 - It is our best estimation as to what physically occurred based on evidence from observations and experimentation
 - Theological implications will be discussed after.



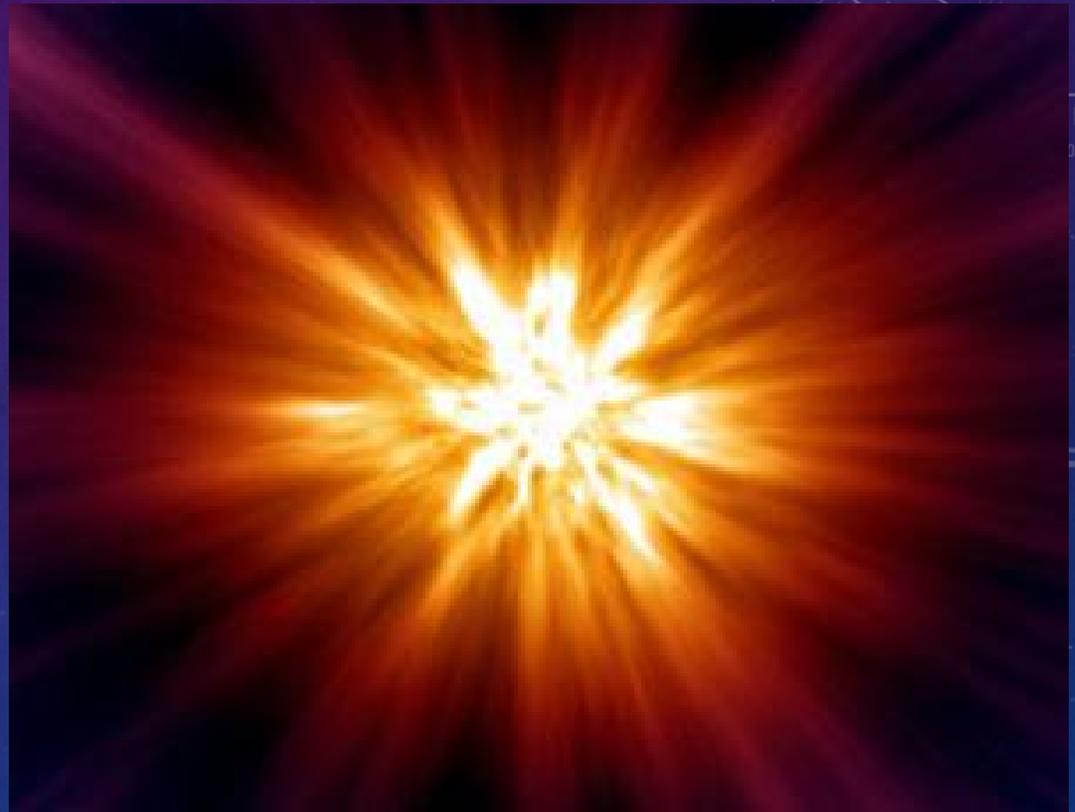
HOT INFLATIONARY BIG BANG COSMOLOGY & CREATION

- No one knows for sure what happened up until what is known as the Planck Epoch (next slide) or what occurred before the instant of the big bang
 - Science does not have the ability to probe these times
 - Predicted by General Relativity
- Creation of Space-Time itself
- It was not an explosion – rather a massive release of energy with a rapid expansion, thought to have been contained within a “quantum singularity”
 - A quantum singularity is a region of space time of near infinitely high temperature and density.



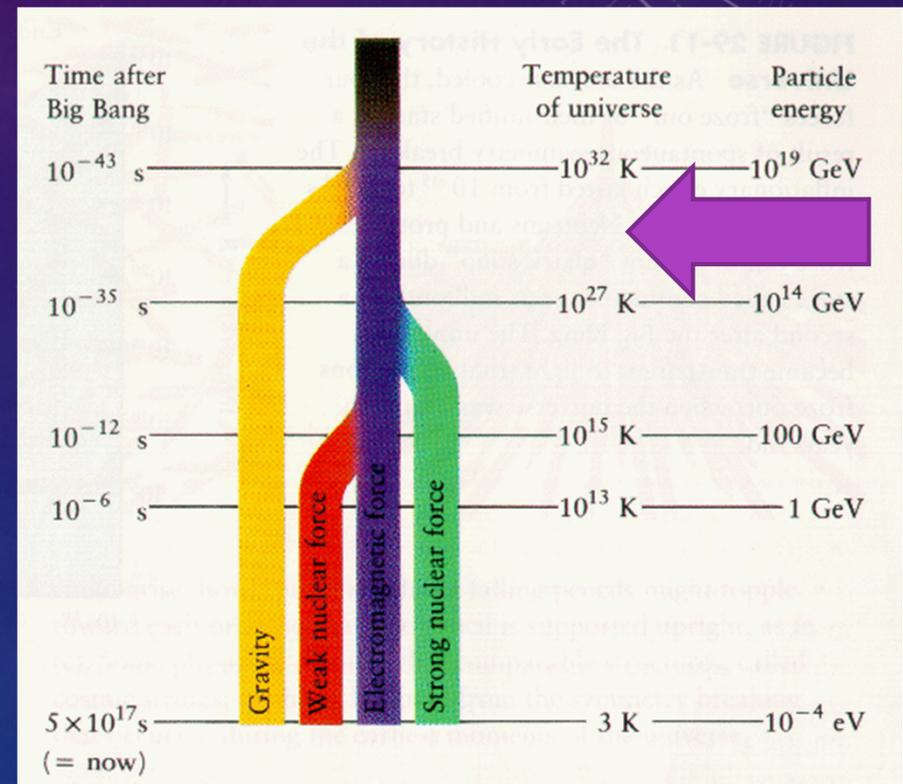
Plank Epoch: 0 to 10^{-43} seconds (1 plank time)

- Very little known about this time period
- GR suggests a gravitational singularity existed before this time
- Its possible all of the forces of the universe are combined into a single force having the same strength
- The diameter of the currently observable universe calculated to be approximately 10^{-33} cm

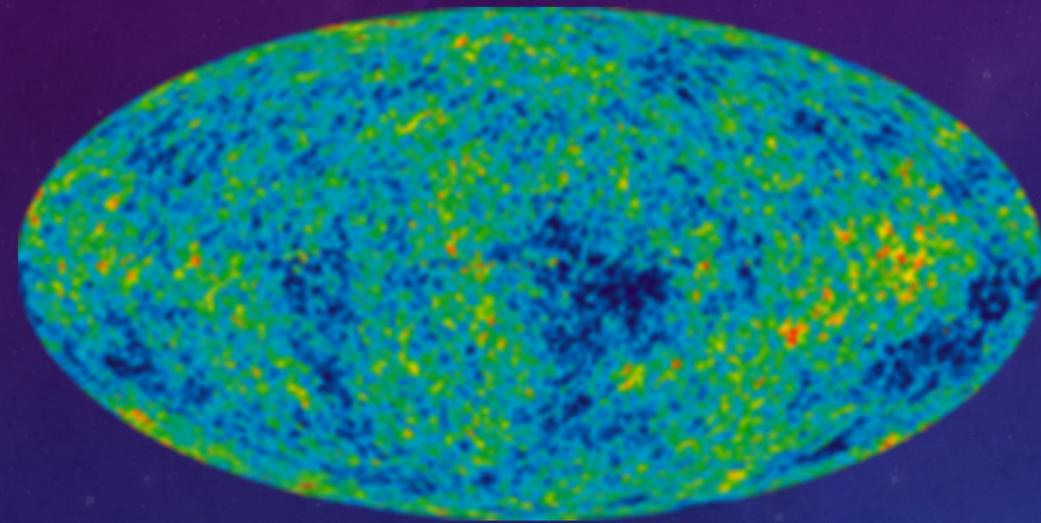


Grand Unification Epoch: 10^{-43} to 10^{-36} seconds

- As the universe expands it continues to cool now approximately 10^{28} °kelvin
- ~~Force of Gravity~~ separates from the other fundamental (gauge) forces
- The observable universe thought to increase from 10^{20} cm to 10^{30} cm.
- Fundamental particles & antiparticles first appear
 - Quarks, electrons, neutrinos, photons, etc
- Quarks appear in particle-antiparticle pairs in the ratio of $\frac{1 \times 10^{9+1} \text{ Quarks}}{1 \times 10^9 \text{ Anti Quarks}}$
- Particle – Antiparticle annihilation reactions occur to produce photons and 1 Quark per billion annihilation reactions



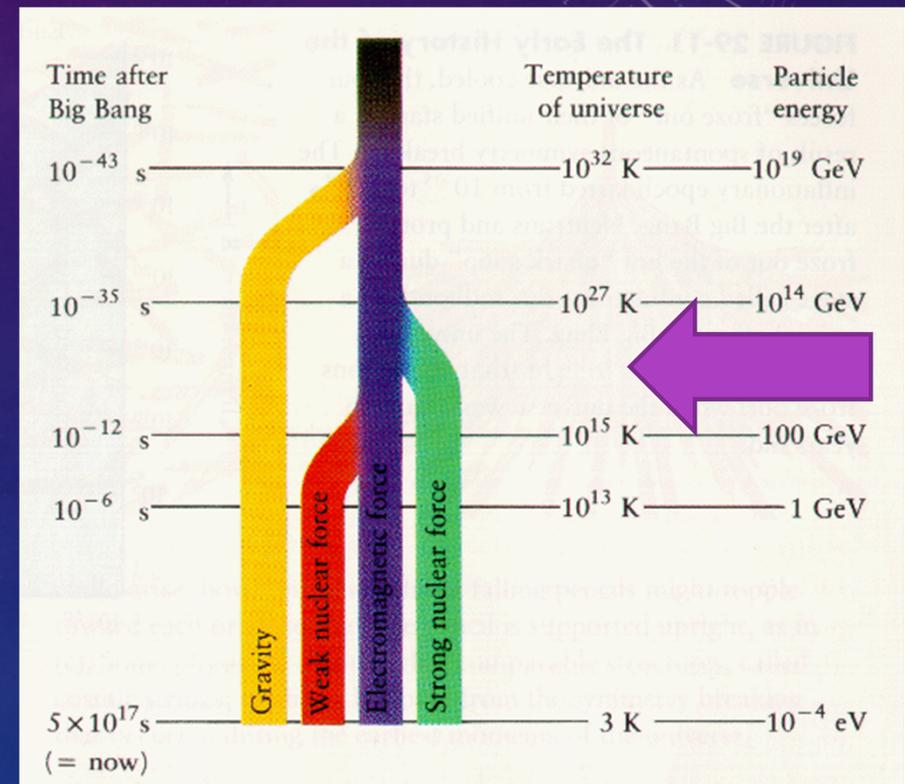
Inflationary Epoch: 10^{-36} to 10^{-32} seconds



- Extremely rapid, exponential expansion of space time – Universe expanded faster than the speed of light
- During this epoch,
 - As the universe expands it continues to cool now less than 10^{28} °kelvin (°F)
 - Volume of the universe increased by a factor of 10^{78} in less than 10^{-32} seconds
 - Accounts for the cosmological principle – premise that distribution of matter in the universe is both homogenous and isotropic
 - (similar in composition /structure and uniform in all orientations)
 - Thought to account for the “flatness” of the universe
 - Universe thought to exist now as a quark-gluon plasma (QGP)

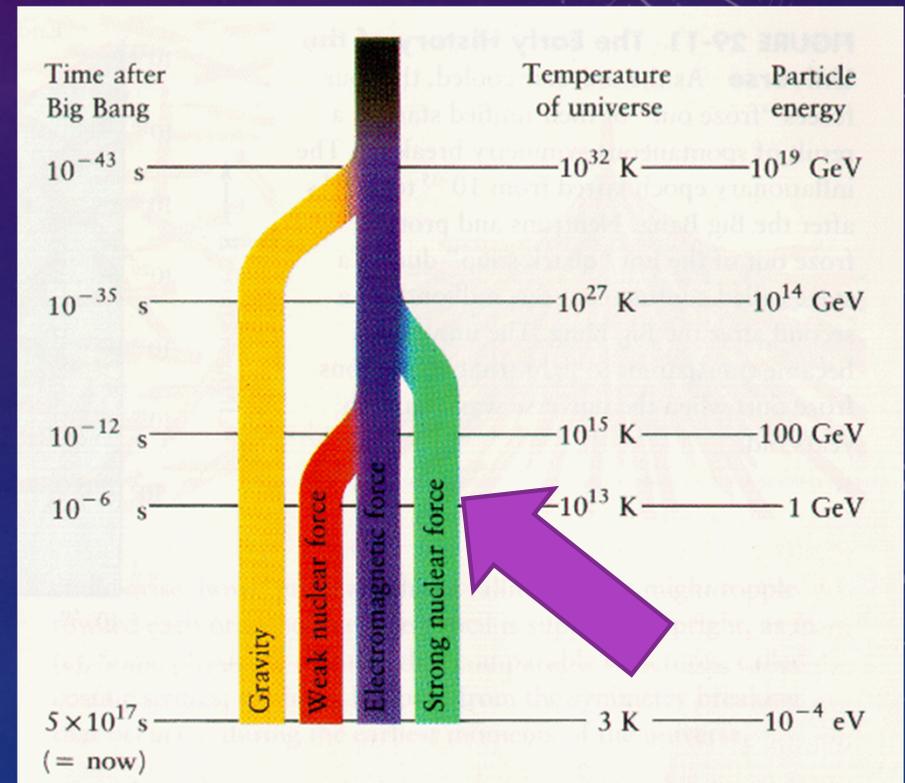
Electroweak Epoch: 10^{-32} to 10^{-12} seconds

- During this epoch,
 - The strong nuclear force separated from the remaining electroweak force
 - The electroweak force separates into the electromagnetic force and weak nuclear force
 - Creation of W and Z bosons – are particles that mediate the weak nuclear force.
 - WN Force responsible for radioactive decay and nuclear fusion of Hydrogen
 - Photons mediate the electromagnetic force
 - Good empirical evidence for this epoch from accelerator experiments
 - Observable universe increases to approximately 10^{13} meters in size.



Quark Epoch: 10^{-12} to 10^{-6} second

- As the universe expands it continues to cool now approximately 10^{12} °kelvin (°F)
- During this epoch,
 - The universe is made up of a quark-gluon plasma
 - The four fundamental forces have all separated
 - Energies still too high for condensation into hadrons (protons and neutrons)
 - These energies are the highest attained in the LHC (large hadron collider)



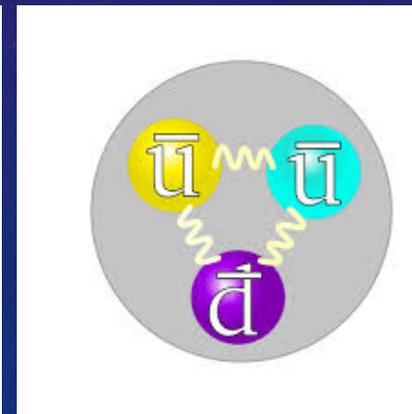
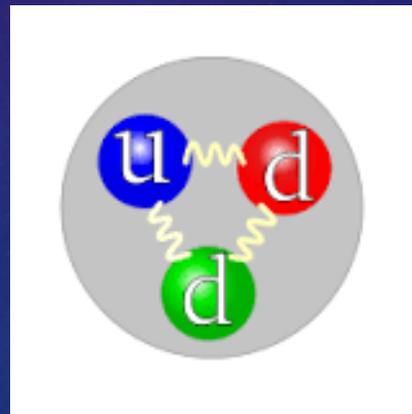
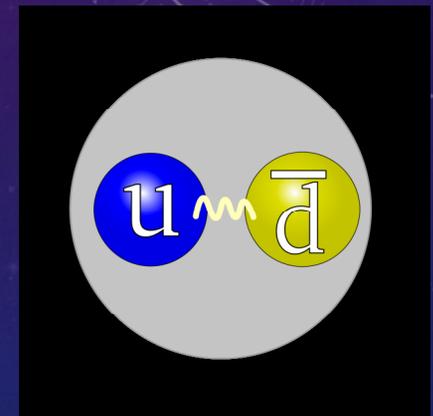
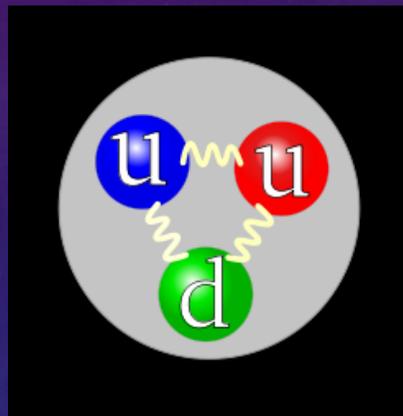
Hadron Epoch: 10^{-6} to 1 second

Hadrons

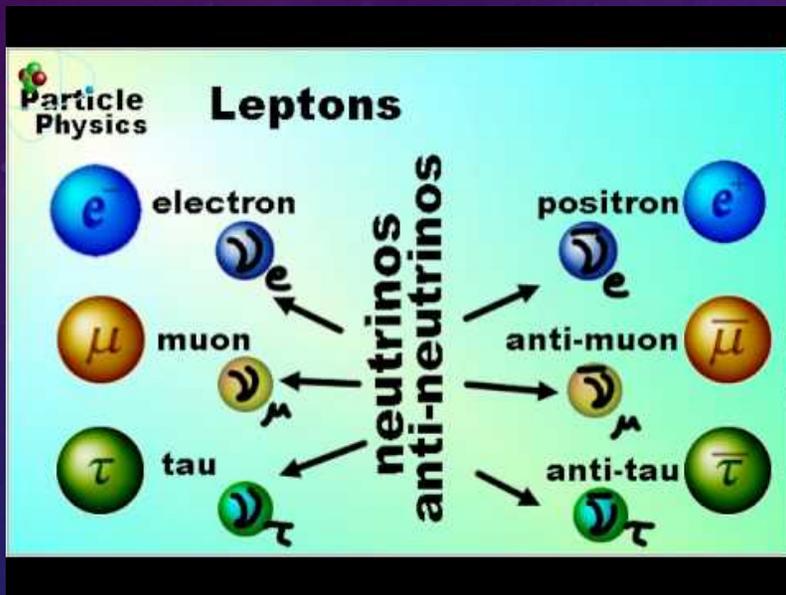
Baryons

Mesons

- As the universe expands it continues to cool now $>10^{12}$ ° kelvin (°F)
- Quarks form hadrons as the universe continues to expand and cool
 - (protons and neutrons among others)
- Mass of the universe at this time is dominated by hadrons
- Hadron / anti-hadron pairs annihilate leaving a small residue that makes up all of the normal mass in the universe today



Lepton Epoch: 1 second to 3 minutes

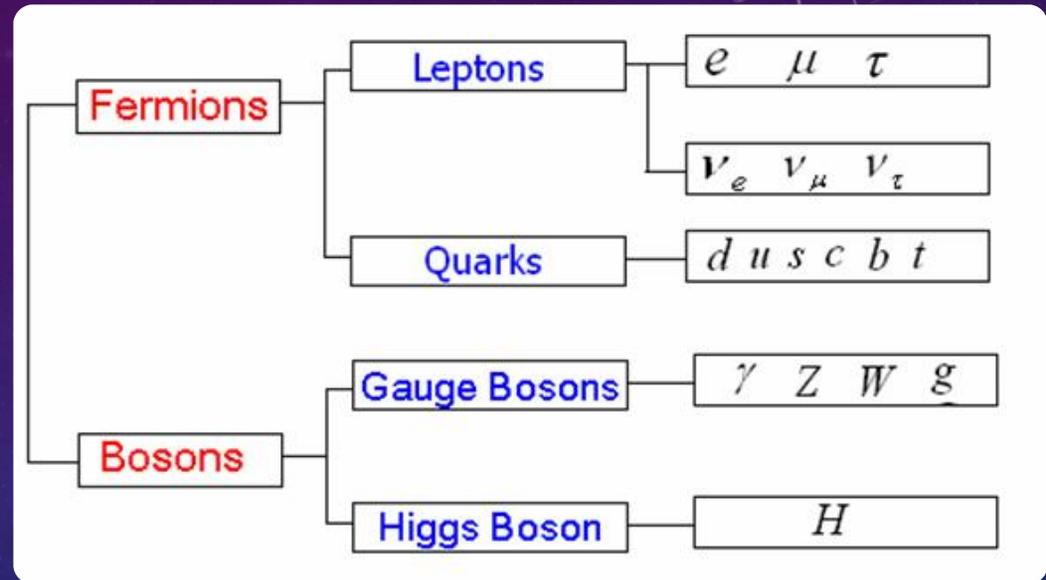


- As the universe expands it continues to cool now approximately 10^9 °kelvin (°F)
- Leptons have a half integer spin and does not interact with the strong nuclear force.
- During this epoch,
 - Charged leptons (electrons/positrons) and neutral leptons (neutrinos) dominate the mass of the universe.
 - Vast majority of lepton and anti-lepton pairs annihilate each other resulting in the production of photons
 - (Electrons, muon and tau particles and corresponding anti-particles and neutrinos)
 - Neutrinos exist on their own as a result of electron / anti-electron (positron) annihilations
 - The hydrogen nuclei (protons) combine to form helium. The universe comprised now of about 74% H^+ and 25% He with trace amounts of
 - Deuterium 2H / Tritium 3H
 - Lithium Li
 - Beryllium Be
- Observation of interstellar gas clouds confirm these elements and proportions
- No other elements of the periodic chart exist yet
- Electrons do not combine with atomic nuclei yet to form neutral atoms

Three Generations of Matter (Fermions)

	I	II	III	
mass	2.4 MeV/c ²	1.27 GeV/c ²	171.2 GeV/c ²	0
charge	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	0
spin	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1
name	u up	c charm	t top	γ photon
	4.8 MeV/c ²	104 MeV/c ²	4.2 GeV/c ²	0
	$-\frac{1}{3}$	$-\frac{1}{3}$	$-\frac{1}{3}$	0
	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1
Quarks	d down	s strange	b bottom	g gluon
	<2.2 eV/c ²	<0.17 MeV/c ²	<15.5 MeV/c ²	91.2 GeV/c ²
	0	0	0	0
	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1
Leptons	ν_e electron neutrino	ν_μ muon neutrino	ν_τ tau neutrino	Z⁰ Z boson
	0.511 MeV/c ²	105.7 MeV/c ²	1.777 GeV/c ²	80.4 GeV/c ²
	-1	-1	-1	±1
	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1
	e electron	μ muon	τ tau	W[±] W boson

Gauge Bosons

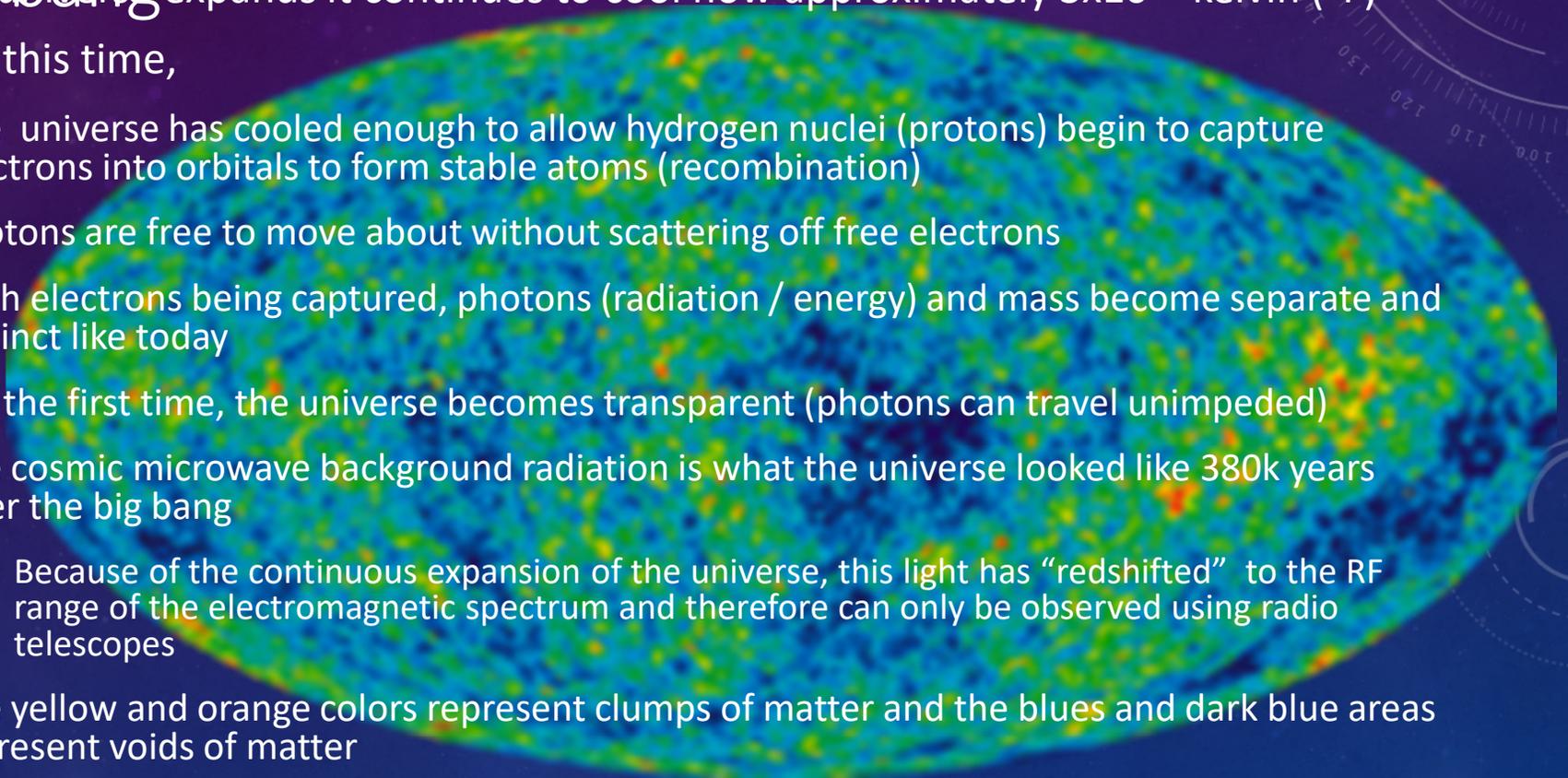


STANDARD MODEL OF PARTICLES

Nucleo-synthesis / Photon / Recombination Epoch: about 3 minutes to 380k years after the

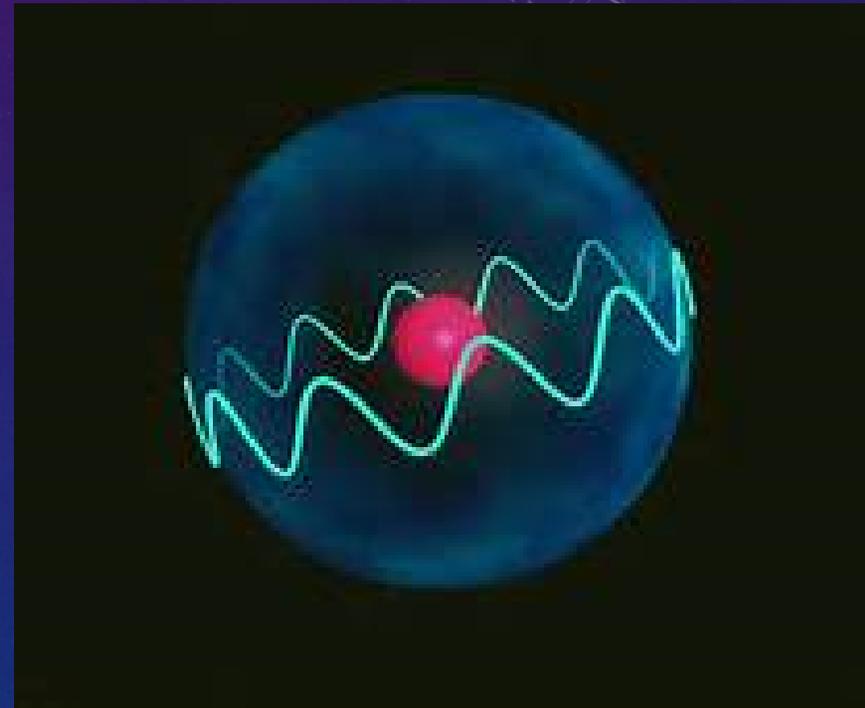
big bang

- As the universe expands it continues to cool now approximately 3×10^3 °kelvin (°F)
- During this time,
 - The universe has cooled enough to allow hydrogen nuclei (protons) begin to capture electrons into orbitals to form stable atoms (recombination)
 - Photons are free to move about without scattering off free electrons
 - With electrons being captured, photons (radiation / energy) and mass become separate and distinct like today
 - For the first time, the universe becomes transparent (photons can travel unimpeded)
 - The cosmic microwave background radiation is what the universe looked like 380k years after the big bang
 - Because of the continuous expansion of the universe, this light has “redshifted” to the RF range of the electromagnetic spectrum and therefore can only be observed using radio telescopes
 - The yellow and orange colors represent clumps of matter and the blues and dark blue areas represent voids of matter



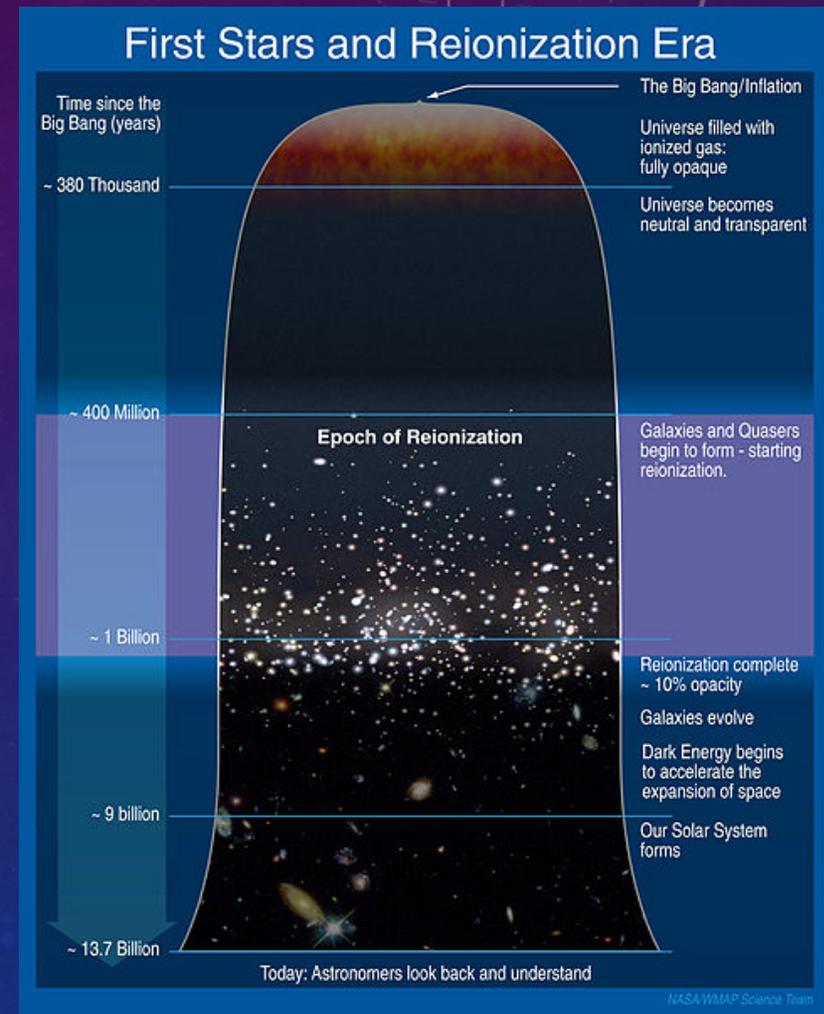
The Cosmic Dark Ages: 380k years to 800M (appx.) years

- This time occurs after the formation of neutral atoms and before the formation of the first luminous structures such as stars. Cosmic web structures thought to begin forming.
- The universe is literally dark across the EM spectrum
- During this epoch the main component of the universe was neutral hydrogen
- Dark matter and normal matter (ratio of 5.5/1) allows matter to come together and clump via gravity. This is necessary for the formation of stars and other stellar structures
- Glass-z13 shown in the Webb SMACS 0723 image would have been formed during this time.
 - Formed 300 MY after BB.
<https://earthsky.org/space/oldest-galaxy-yet-seen-by-webb-telescope/>



Re-ionization Epoch: 350M years to 1B (appx.) years

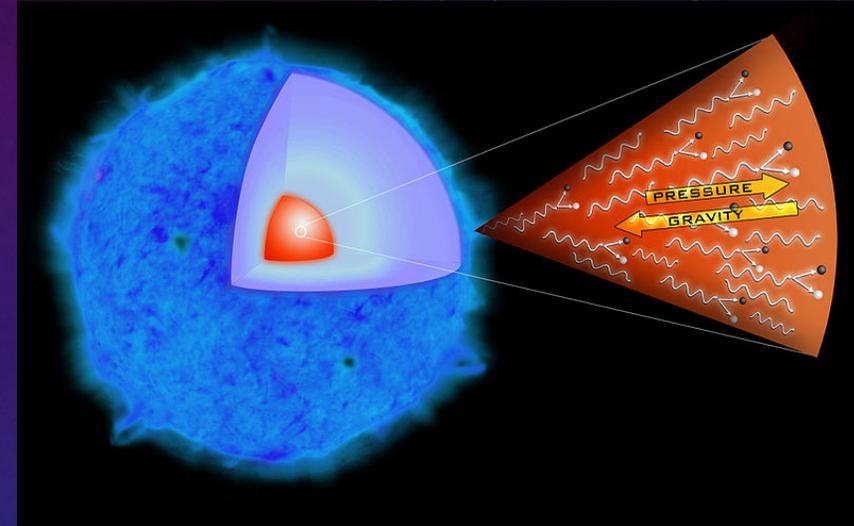
- First quasars formed from gravitational collapse and emitted high energy ultraviolet wavelength radiation, that effectively re-ionized all of the H in their vicinity ($H_2 + \lambda \rightarrow 2 p^+ + 2 e^-$)
- Gravity still dominates the universe and the expansion rate is slowing during this time
- The UV ionizing radiation travels freely (due to its high energy) throughout the neutral medium
- “Bubbles” of ionized plasma over time grew larger and eventually overlapped each other and subsequently allowed all EM wavelengths to travel the extents of the universe unimpeded; it allows us to see optical and infrared wavelengths (universe can now be observed)
- Interestingly, at the end of this epoch, dark energy begins to dominate the universe and the expansion starts to accelerate as we observe today



Source: <http://www.haystack.mit.edu/ast/science/epoch/>

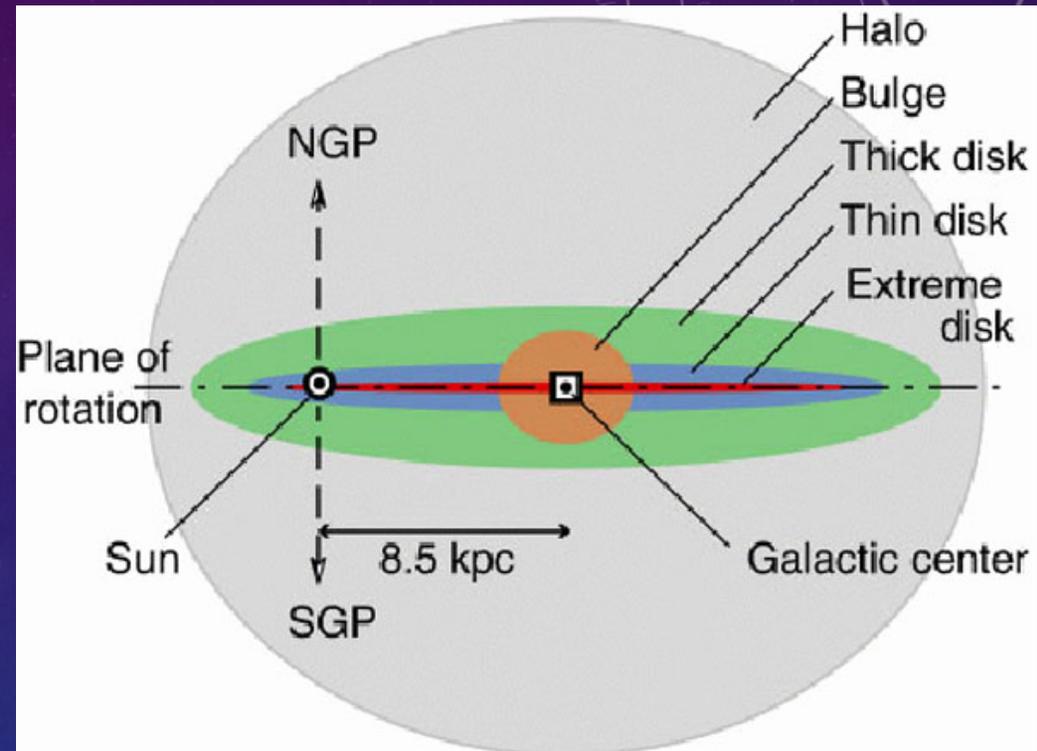
Population III Stars

- Population III Stars formed resulting from increased matter density due to gravitational force. As mass increases, it increases in temperature and pressure.
 - When the matter becomes hot enough, (around 10 million degrees F) hydrogen nuclear fusion reactions can begin and be sustained
- P III stars have no metals, are thought to be very large (100 to 400 times a solar mass)
 - As a consequence they burned through their fuel in only a few million years (very quickly by comparison to main sequence)
 - collapsed into supermassive black holes and forming (not the first) quasars; created elements heavier than Fe in supernovae
- Quasi stellar radio sources have the highest redshifts of any objects in the observable universe (among oldest objects)
- Stars are not observed today but the distant quasars are seen
 - Light travels at a fixed velocity (appx 3×10^8 m/sec),
 - Therefore objects farther away are older
 - Cosmologists/Astronomers can “see” back as far as 380,000 years after the BB



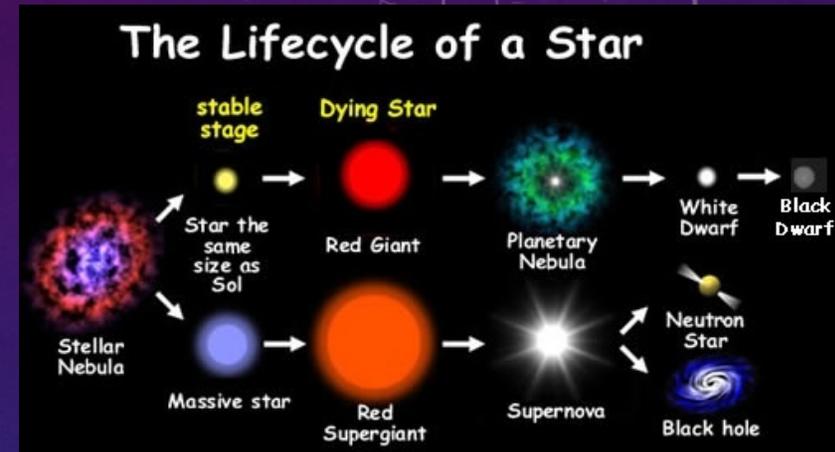
Population I and II Stars

- Population II Stars have lower metal content as compared to P I stars.
 - They are generally found around the outer rim of galaxies today (older stars); nebulae (stellar nurseries) are near the center
 - Unlike P III, they can be observed today
 - Theory and spectroscopic observations hold that all remaining elements in the periodic chart would be created by P II stars as they supernova.
 - In general, much longer lifespans than P III
- Population I Stars (youngest of all stars)
 - When formed in nebulae, pick up many metals (>Fe) created by previous generations of stars, hence metal rich
 - Our solar system begins to form about 9 BYA BB; more on this shortly...
 - In the meantime, generations of stars are creating heavy metals that are completely necessary for sustaining complex life and seeding nebulae with them.



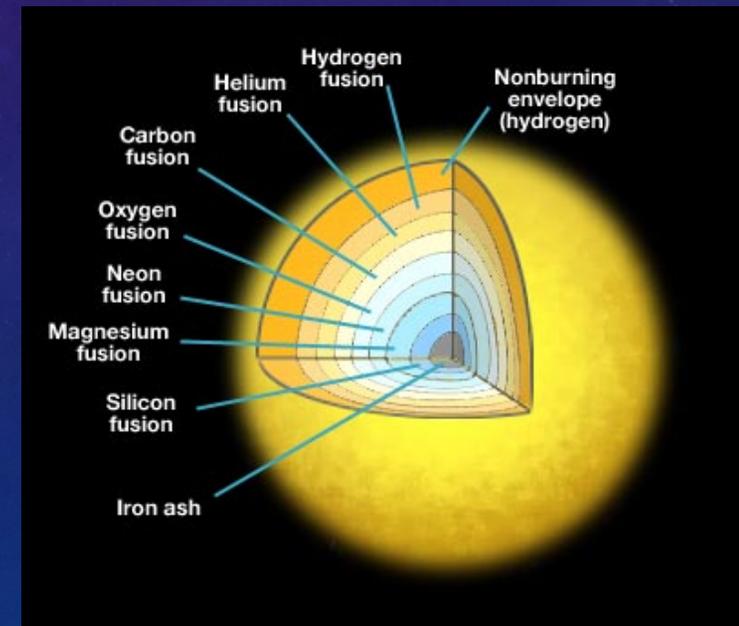
Life Cycle of Stars

- These supermassive stars produced the first metals (elements heavier than He) in the universe
 - during their fusion (up to iron, element 26) AND
 - subsequent supernovae (possibly up to uranium, element 92)
- As we shall see later, these heavy elements, especially thorium and uranium are absolutely necessary for sustaining complex life on earth.



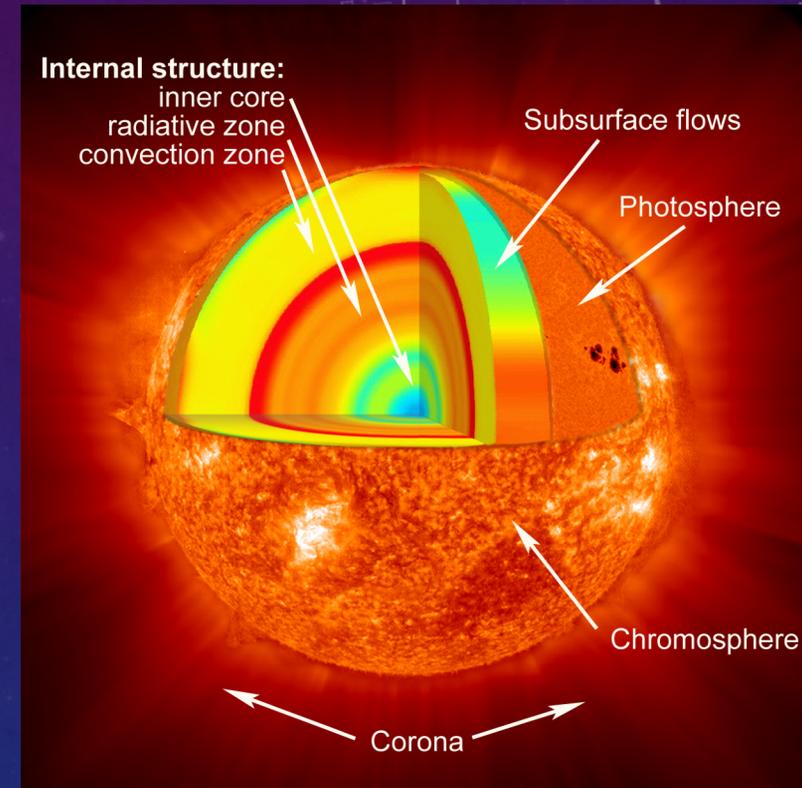
H B																	He B																
Li C	Be C															B C	C S L	N S L	O S L	F L	Ne S L												
Na L	Mg L															Al S L	Si S L	P L	S S L	Cl L	Ar L												
K L	Ca L	Sc L	Ti S L	V S L	Cr L	Mn L	Fe S L	Co S	Ni S	Cu L	Zn L	Ga S	Ge S	As L	Se S	Br S	Kr S																
Rb S	Sr L	Y L	Zr L	Nb L	Mo S L	Tc L	Ru S L	Rh S	Pd S L	Ag S L	Cd S L	In S L	Sn S L	Sb S	Te S	I S	Xe S																
Cs S	Ba L																	Hf S L	Ta S L	W S L	Re S	Os S	Ir S	Pt S	Au S	Hg S L	Tl S L	Pb S	Bi S	Po S	At S	Rn S	
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		La L	Ce L	Pr S L	Nd S L	Pm S L	Sm S L	Eu S	Gd S	Tb S	Dy S	Ho S	Er S	Tm S	Yb S L	Lu S																	
		Ac S	Th S	Pa S	U S	Np S	Pu S	Am M	Cm M	Bk M	Cf M	Es M	Fm M	Md M	No M	Lr M																	

B B	L Large stars	S Supernovae
C Cosmic rays	S Small stars	M Man-made

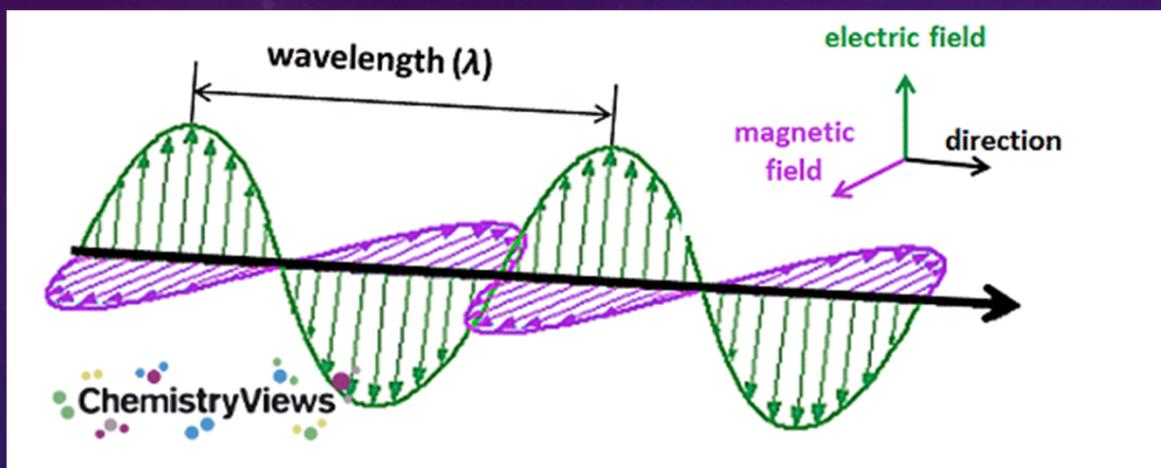


Our Sun

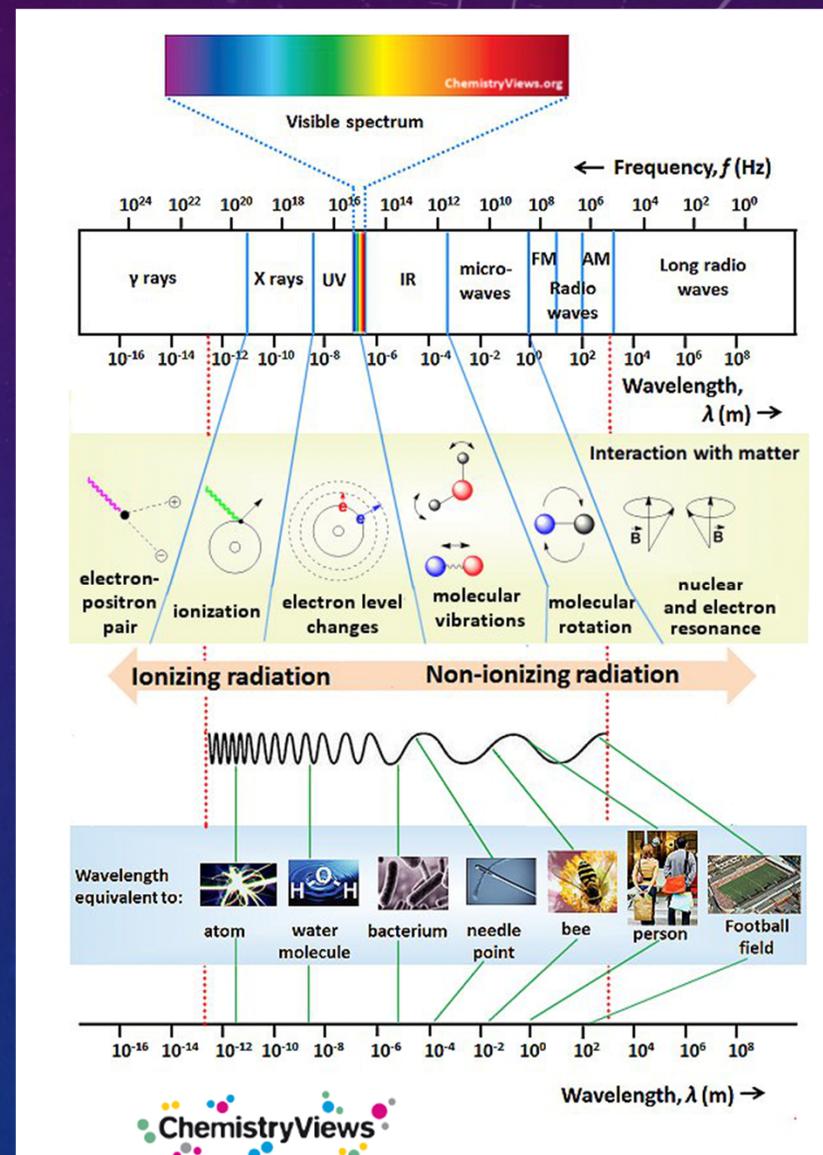
- The size of our star is crucial for supporting complex life
- Larger stars undergo rapid and unstable fusion with large surface temperature variations and significantly more CME's than our sun
- All stars increase in luminosity over their life span. Larger stars increase solar energy on the surface of a planet and must be compensated for by the atmosphere
 - More solar energy, then fewer greenhouse gases must be present to trap heat
- Smaller stars burn in a more stable manner but
 - Planets must be closer to the star to support life
 - This causes stronger gravitational effects on the planets



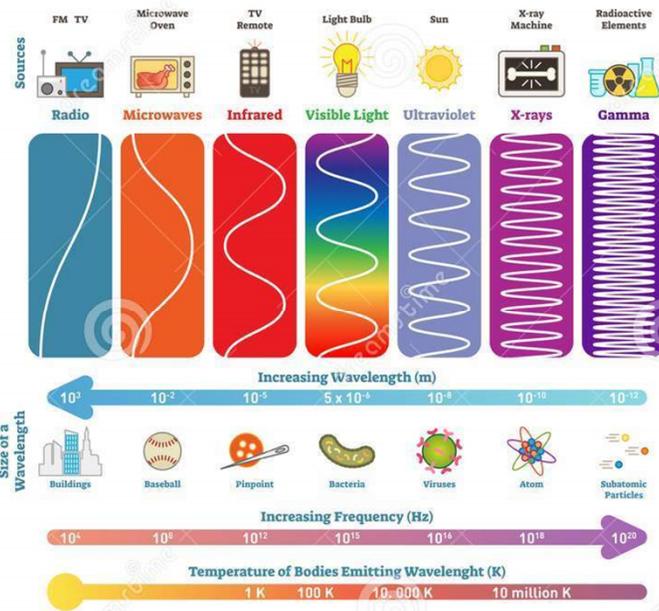
EM Spectrum



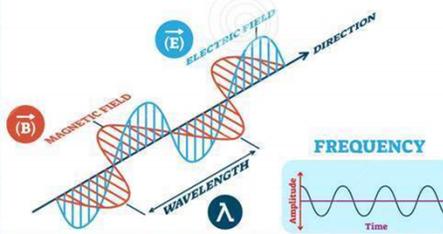
https://www.chemistryviews.org/details/ezone/5283841/The_Electromagnetic_Spectrum/



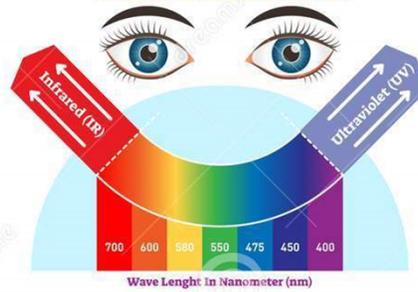
ELECTROMAGNETIC SPECTRUM



ELECTROMAGNETIC WAVES



VISIBLE SPECTRUM



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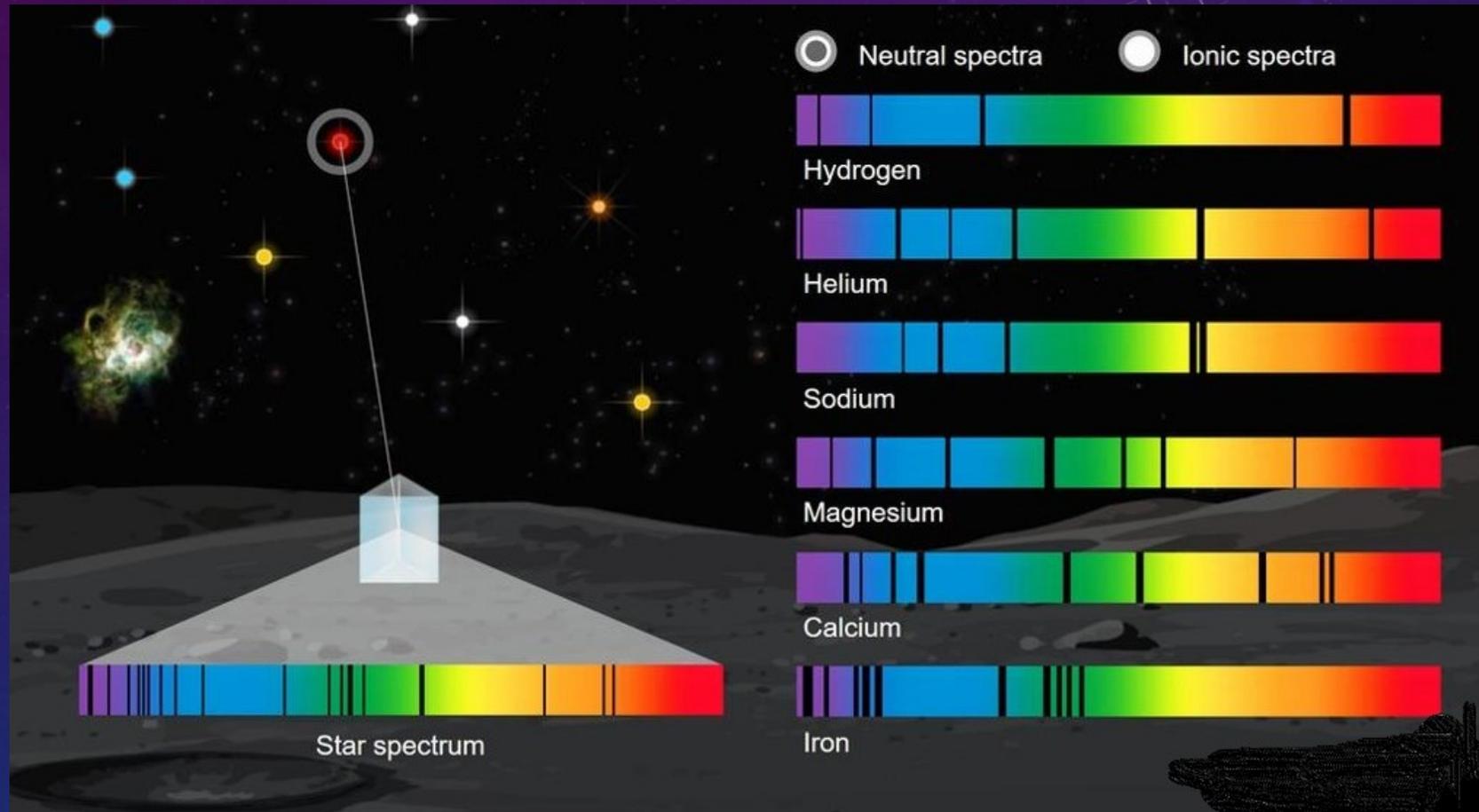
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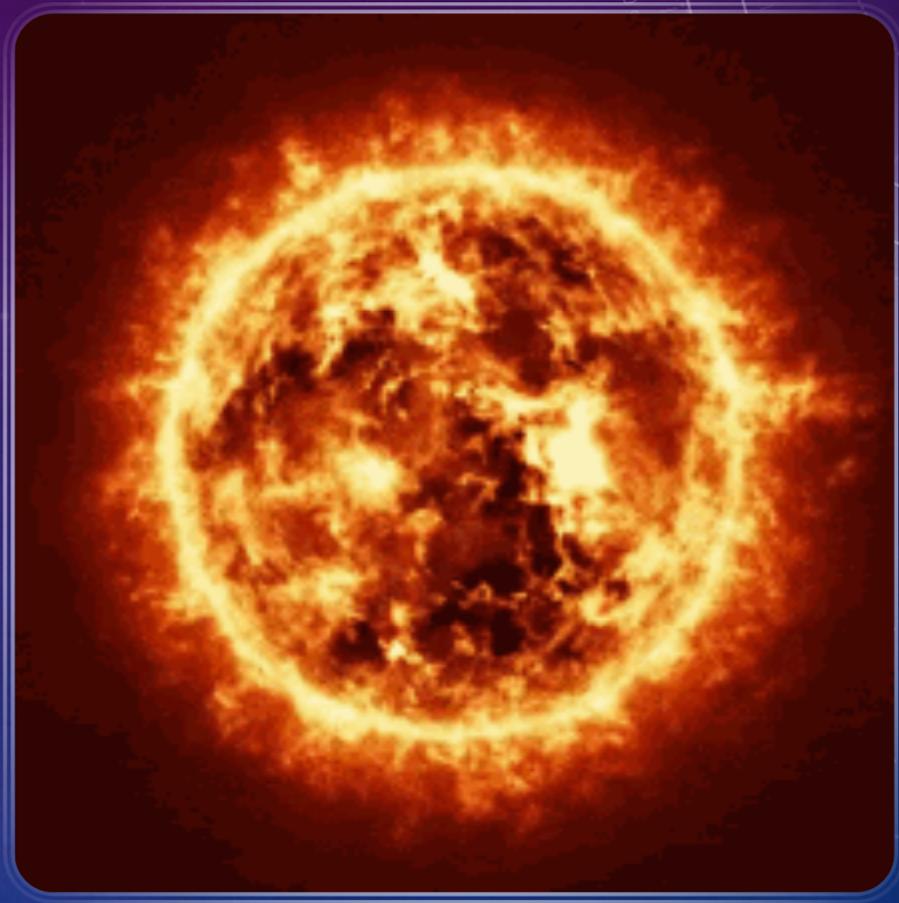
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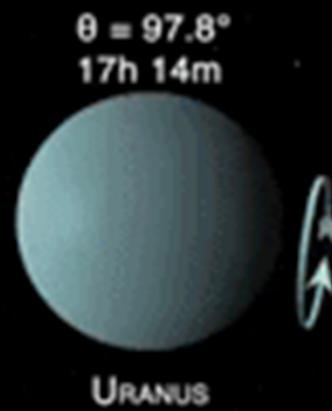
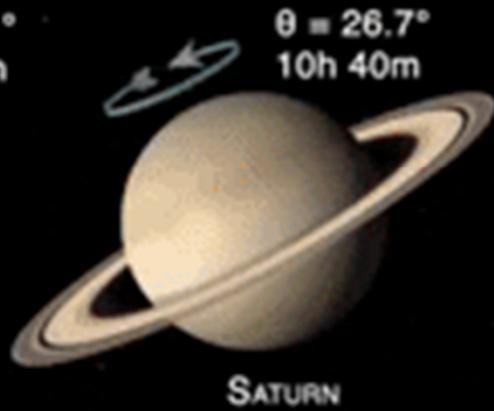
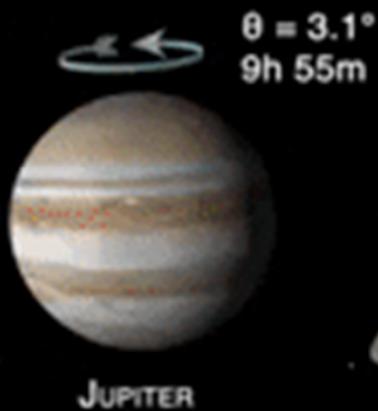
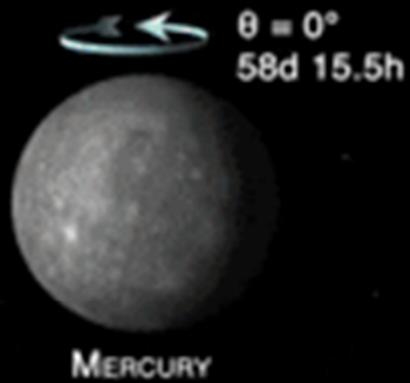
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Stellar Spectral Analysis

The elements contained within stars can be determined by observation and measurement of its spectral absorption.







James O'Donoghue / NASA -- T: @physicsJ IG: jameslikesspace

Big Bang Final thoughts

- Sources:
http://www.physicsoftheuniverse.com/topics_bigbang_timeline.html;
https://en.wikipedia.org/wiki/Chronology_of_the_universe
- At this point, we have reached about 9 BYA after the BB and about 4.6 BYA from the present
- Next we will look at some theological implications of this evidence
- Later we will examine the cosmological evidence about how the solar system was created
- We will also examine some of the features required of earth to sustain complex life over the long term

Big bang and the Bible – How do they relate?

How does the theory of big bang cosmology fit with biblical scripture?

The more I study science, the more I believe in God.

- Albert Einstein

THEOLOGICAL CLAIMS OF THE BIBLE 1. Space-Time has a beginning...

Genesis 1:1 - In the beginning God created the heavens and the earth.

Genesis 2:4 - This is the account of the heavens and the earth when they were created, when the LORD God made the earth and the heavens.

Psalms 148:5 - Let them praise the name of the LORD, for at his command they were created... Also see **Isaiah 45:18** and **Isaiah 40:26**

Isaiah 42:5 - This is what God the LORD says— the Creator of the heavens, who stretches them out, who spreads out the earth with all that springs from it, who gives breath to its people, and life to those who walk on it:

John 1:3 - Through Him all things were made; without Him nothing was made that has been made

Colossians 1:15-17 - ¹⁵ The Son is the image of the invisible God, the firstborn over all creation. ¹⁶ For in Him all things were created: things in heaven and on earth, visible and invisible, whether thrones or powers or rulers or authorities; all things have been created through Him and for Him. ¹⁷ He is before all things, and in Him all things hold together.

Hebrews 11:3 - By faith we understand that the universe was formed at God's command, so that what is seen was not made out of what was visible.

THEOLOGICAL CLAIMS OF THE BIBLE

2. The universe is expanding
from a beginning...

Job 9:8 - He alone stretches out the heavens and treads on the waves of the sea

Isaiah 40:22 - ...He stretches out the heavens like a canopy, and spreads them out like a tent to live in.

Isaiah 42:5 - This is what God the LORD says—the Creator of the heavens, who stretches them out, who spreads out the earth with all that springs from it, who gives breath to its people, and life to those who walk on it

Isaiah 44:24 - “This is what the LORD says—
your Redeemer, who formed you in the womb:

I am the LORD, the Maker of all things, who stretches out the heavens, who spreads out the earth by myself...

Psalms 104:2 - The LORD wraps himself in light as with a garment; He stretches out the heavens like a tent

Isaiah 45:12 - It is I who made the earth and created mankind on it. My own hands stretched out the heavens;
I marshaled their starry hosts

Isaiah 48:13 -My own hand laid the foundations of the earth,
and My right hand spread out the heavens;
when I summon them, they all stand up together.

Isaiah 51:13 – ...that you forget the LORD your Maker, who stretches out the heavens and who lays the foundations of the earth...

THEOLOGICAL CLAIMS OF THE BIBLE

2. The universe is expanding
from a beginning... continued

Jeremiah 10:12 - But God made the earth by his power; He founded the world by his wisdom
and stretched out the heavens by His understanding

Jeremiah 51:15 - He made the earth by his power;
he founded the world by his wisdom
and stretched out the heavens by His understanding

Zechariah 12:1 - The LORD, who stretches out the heavens, who lays the foundation of the earth, and who forms the human spirit within a person, declares:

THEOLOGICAL CLAIMS OF THE BIBLE 3. The physical laws are constant...

Jeremiah 33:25 - This is what the LORD says: 'If I have not made My covenant with day and night **and established the laws of heaven and earth...**

From Physics, Biology and Chemistry, the universe the universe is described by finely tuned, fixed laws

THEOLOGICAL CLAIMS OF THE BIBLE 4. The universe is undergoing pervasive decay...

Romans 8:20-22 - ²⁰For the creation was subjected to frustration, not by its own choice, but by the will of the one who subjected it, in hope ²¹that the creation itself will be liberated from its bondage to decay and brought into the freedom and glory of the children of God.

²²We know that the whole creation has been groaning as in the pains of childbirth right up to the present time.

FINAL THOUGHTS

Do these biblical claims, written by numerous authors over many centuries, of

1. Having a beginning to the universe
2. Stretching out the heavens like a tent
3. Having natural laws that are constant repeatable
4. The universe undergoing loss and decay

Sound familiar to the story about big bang cosmology?

No other religious text ever conceived has the accurate science the bible has...

While science is not the intent of the bible, if it is written there, it should be accurate... and it is...

Terminology Review

- Science – Is man's interpretation and attempts to understand of the metaphorical book of nature (General Revelation)
- Theology – Is man's interpretation and attempts to understand the literal book of scripture (Special Revelation)
- Question – If we perceive a conflict between special and general revelation where do you think the problem lies?
 - We always need to remember that our knowledge of both science and theology is inadequate and incomplete.
 - We all have biases that cause our understanding to be imperfect and we lack complete information.
 - These allow for *apparent* conflicts between science and theology to occur.
- I Thessalonians 5:21 – But examine everything carefully; hold fast to that which is good.
- Acts 17... be like the Bereans

EIGHT RULES OF INTERPRETATION-

Creation

DEFINING TERMS– Are the terms consistent with the authors intent?

USEAGE – Who was the intended audience?

CONTEXT – places boundaries on the interpretation

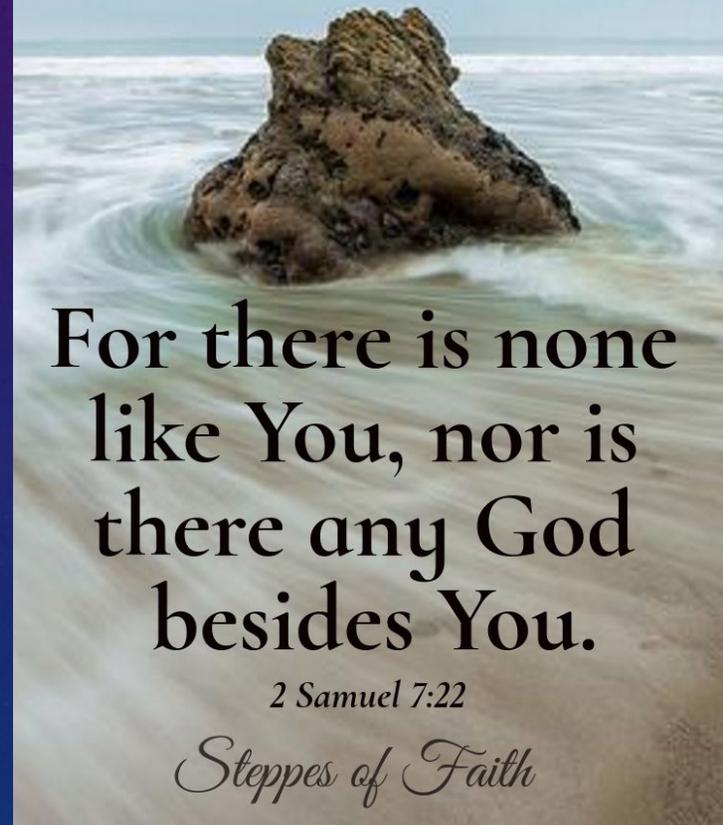
HISTORICAL & CULTURAL BACKGROUND – significance of and influences on the writing

LOGIC – Is the interpretation reasonable and consistent?

PRESCEDENT – Is the interpretation consistent with previous interpretations or does it significantly depart from them?

CONSISTENCY – Is the interpretation

**You are great,
O Lord God.**



**For there is none
like You, nor is
there any God
besides You.**

2 Samuel 7:22

Steppes of Faith

Select Scriptures on Creation

Of old You laid the foundation of the earth, and the heavens are the work of your hands (Psalms 102:25).

On the glorious splendor of your majesty, and on your wondrous works, I will meditate (Psalm 145:5).

You are the LORD, You alone. You have made heaven, the heaven of heavens, with all their host, the earth and all that is on it, the seas and all that is in them; and you preserve all of them; and the host of heaven worships you (Nehemiah 9:6).

But ask the beasts, and they will teach you; the birds of the heavens, and they will tell you; or the bushes of the earth, and they will teach you; and the fish of the sea will declare to you. Who among all these does not know that the hand of the LORD has done this? In his hand is the life of every living thing and the breath of all mankind (Job 12:7-10).

When I look at your heavens, the work of your fingers, the moon and the stars, which you have set in place, what is man that you are mindful of him, and the son of man that you care for him (Psalms 8:3-4)?

The heavens declare the glory of God, and the sky above proclaims his handiwork. Day to day pours out speech, and night to night reveals knowledge (Psalms 19:1-2).

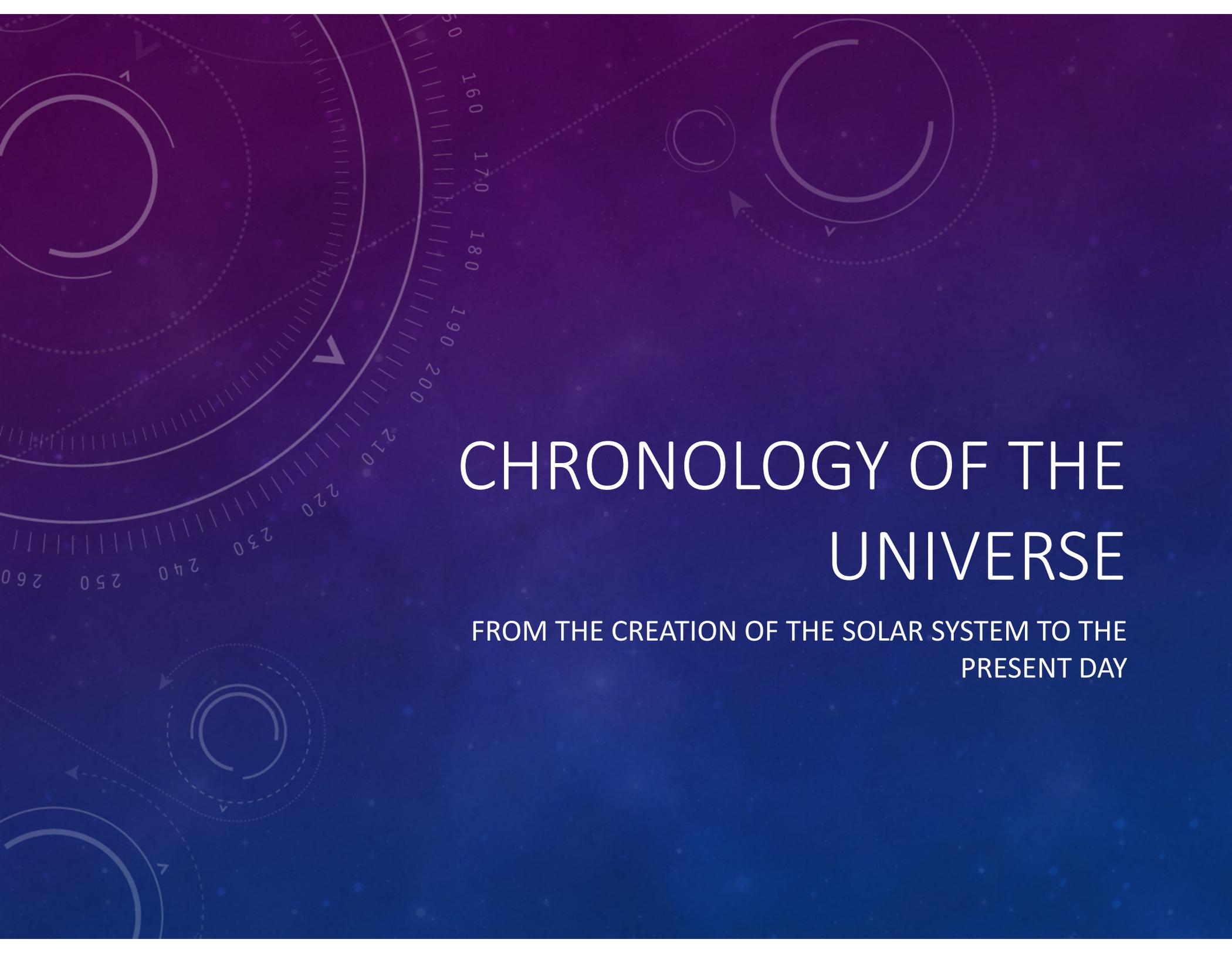
In the beginning, God created the heavens and the earth (Genesis 1:1).

The background is a dark blue gradient with a starry texture. On the left side, there are several overlapping circular patterns. One prominent circle has a scale around its perimeter with numerical labels: 160, 170, 180, 190, 200, 210, 220, 230, 240, 250, and 260. Other circles are partially visible, some with arrows indicating a clockwise direction. The overall aesthetic is technical and scientific.

CHRISTIAN APOLOGETICS

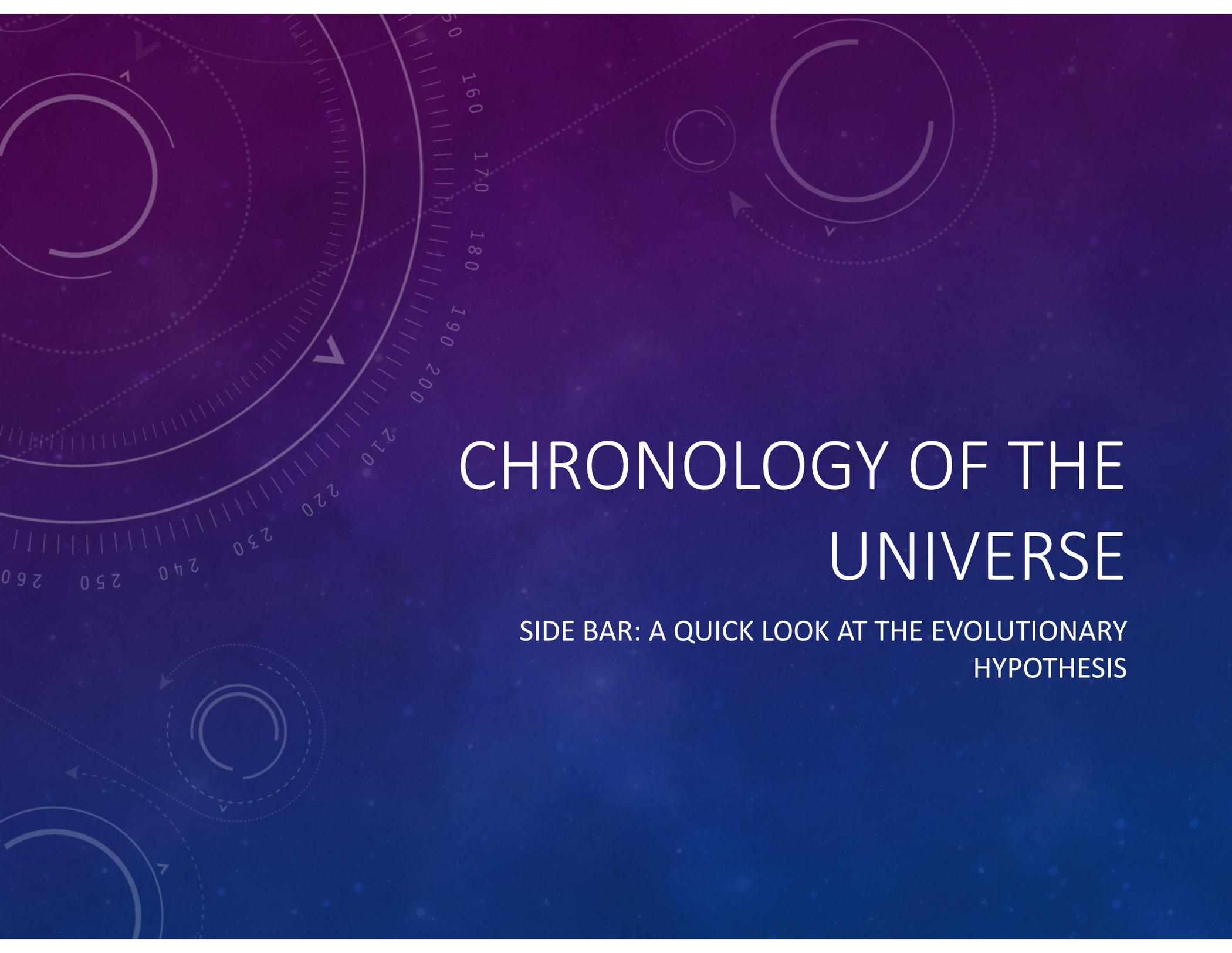
END OF SECTION

(FROM BIG BANG TO THE SOLAR SYSTEM)



CHRONOLOGY OF THE UNIVERSE

FROM THE CREATION OF THE SOLAR SYSTEM TO THE
PRESENT DAY

The background features a dark blue gradient with faint, glowing circular patterns and a scale. The scale is a large arc on the left side, with numbers ranging from 160 to 260 in increments of 10. There are also several smaller circular diagrams with arrows, suggesting a cycle or process. The overall aesthetic is scientific and futuristic.

CHRONOLOGY OF THE UNIVERSE

SIDE BAR: A QUICK LOOK AT THE EVOLUTIONARY
HYPOTHESIS

5 DEFINITIONS FOR EVOLUTION

Macro-Evolution or Darwinian evolution – descent from a common ancestor with modification by completely mechanistic, naturalistic means... (undirected and unguided)

originally articulated by Charles Darwin in 1859 when he originally published his “origin of the species”

Causes of skepticism for Darwinian Evolution -

- Multi-regionalism – human origins arise in many locations around the world at once (out of Africa model is currently widely held as more accurate) human origins from single location
- Evidence shows All humanity can be genetically traced back to a mitochondrial Eve and Y chromosome Adam



5 DEFINITIONS FOR EVOLUTION

Macro-Evolution or Darwinian evolution – descent from a common ancestor with modification by completely mechanistic, naturalistic means... (undirected and unguided)

- Evidence shows All humanity can be genetically traced back to a mitochondrial Eve and Y chromosome Adam
- Transitional forms of hominids in the archeological record do not appear to exist – no known mechanism to allow a quadrupeds to morph into a biped
- Neanderthals should be related to humans and have been shown genetically to be a distinct species
- No explanation for the Cambrian explosion nor the rapid appearance of completely new creatures after all the extinction events
- Predicts "junk DNA" in the genomes of species
- Requires unguided and undirected abiogenesis (chemical evolution)



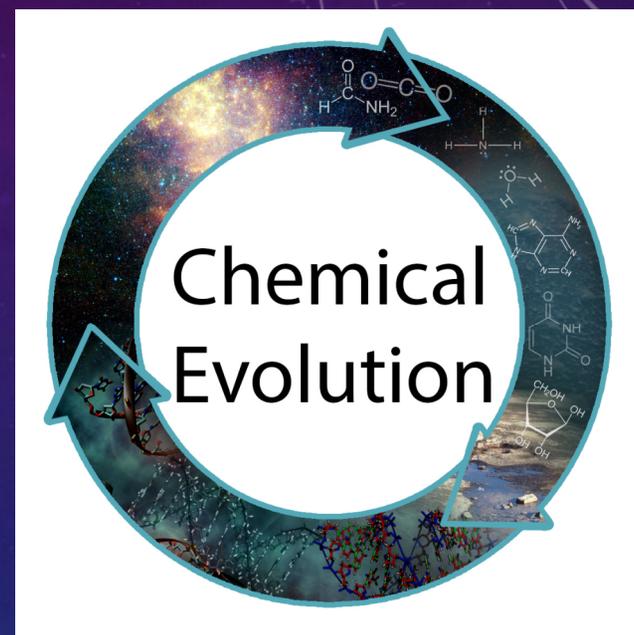
CHRONOLOGICAL VS MORPHOLOGICAL PHYLOGENY

- **Phylogeny** is the study of relationships among different groups of organisms and their evolutionary development. Phylogeny attempts to trace the evolutionary history of all life on the planet (source: <https://www.britannica.com/science/phylogeny>).
- **Morphology** is the study of the size, shape, and structure of animals, plants, and microorganisms and of the relationships of their constituent parts. The term refers to the general aspects of biological form and arrangement of the parts of a plant or an animal (source: <https://www.britannica.com/science/morphology-biology>).
- Archaeopteryx (ah-kee-op-tuh-riks) is (was) considered a transitional form from dinosaurs to modern birds. It has feathers & was believed could fly. The fossil is dated to about 150-148 MYA.
- Xiaotingia zhengi (zhow-tin-gee-ah zen-gi) is an example of a feathered bird found some 5 MY earlier in the fossil record.



5 DEFINITIONS FOR EVOLUTION (CONT)

- **Chemical Evolution** - small molecules within the model inventory of prebiotic chemistry can self-assemble into polymers that resemble RNA and proteins (www.centerforchemicalevolution.com) and ultimately DNA
 - Self-directed assembly appears as evidence for directed assembly. Complex assembly of Polymers in the lab only occur at the direction of a mind(s) (the researchers)
- Distinct lack of evidence for this type of evolution in the fossil record
- No evidence has been found in the fossil record of a “primordial soup”
- UV/O₂ paradox is still a problem for the assembly of a very delicate nucleic acids like DNA and RNA; no explanation



[Dr. James Tour](#)

[James Tour Group - Rice University](#)

5 DEFINITIONS FOR EVOLUTION

- **Micro – Evolution** or Adaptation – ability of an organism to adapt to new pressures and conditions within its environment. These would include new sources of food, climate / habitat changes and changes occurring as a result of predation.
- **Speciation** – is a process by which a species diverges into new genetically diverse species to the point where they can no longer mate and produce fertile offspring.
 - Examples include finches on the Galapagos islands (5 species), felines, canines, and equidae.
- Sometimes an organisms ability to adapt to a new environment really backfires....



5 DEFINITIONS FOR EVOLUTION (CONT)

- **Microbiological Evolution** – The adaptation of microbiological organisms.
- These organisms can adapt to new environments very quickly as evidenced by bacteria developing resistance to new antibiotics
- Michigan State University Long Term Evolution Experiment has been running since 1988, under the direction of Dr. Richard Lenski
<http://myxo.css.msu.edu/ecoli/> studying e coli generations. Near the 90,000 generation... interesting results
 - Follow on generations of e-coli have become larger and adapted to new sources of food and environmental conditions... but they are still e-coli....



5 DEFINITIONS FOR EVOLUTION – THE EVIDENCE

- The evidence in nature supports the concepts of micro evolution, speciation and microbiological “evolution” as these are species **adapting** to their environments...
- A better explanation of this evidence however would be a **Designer who is good enough to build an adaptation features** to help insure survival of that species
- **The evidence from nature does not support chemical evolution or macro evolution.** It is quite probable that Darwin (and Neo-Darwinists today) observed adaptation taking place and extrapolated (inferred / assumed) macro evolution.
- With the assumption of macro evolution, then chemical evolution must also be assumed to explain the first organism from which all other organisms have “descended with modification”
- What about intelligent design or ID?

A BRIEF ON INTELLIGENT DESIGN

Intelligent Design (ID): Intelligent design refers to a scientific research program as well as a community of scientists, philosophers and other scholars who seek evidence of design in nature. The theory of intelligent design holds that certain features of the universe and of living things are best explained by an intelligent cause, not an undirected process such as natural selection (source: <https://biologos.org/series/science-and-the-bible/articles/intelligent-design-history-and-beliefs>)

Secular progressives like the ACLU define ID like this:

Q: What is intelligent design?

A: Intelligent design (ID) is a pseudoscientific set of beliefs based on the notion that life on earth is so complex that it cannot be explained by the scientific theory of evolution and therefore must have been designed by a supernatural entity (source: <https://www.aclu.org/other/frequently-asked-questions-about-intelligent-design>).

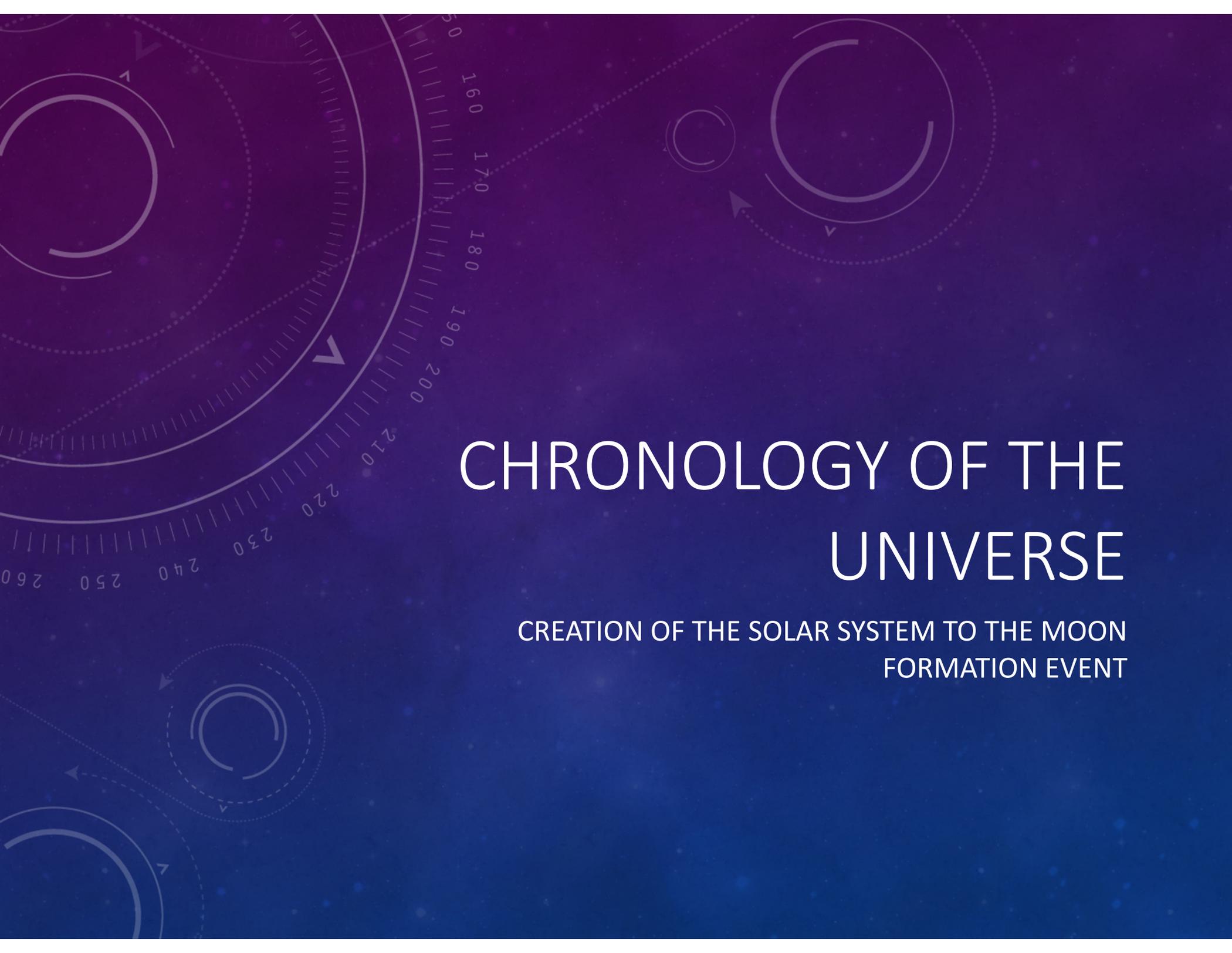
Antagonists and critics resist ID for the same reasons BB Cosmology was resisted by the scientific community in the 20th century.... It opens the door for the God of the Bible, which our adversary fights against with all his might... In the time we have left, you can decide for yourselves...

The background is a dark blue gradient with a starry texture. On the left side, there are several circular elements: a large scale with numbers from 160 to 260, and several smaller circles with arrows indicating rotation. On the right side, there are more circles, some with arrows, and a dotted line.

CHRISTIAN APOLOGETICS

END OF SECTION

(A QUICK LOOK AT THE EVOLUTIONARY HYPOTHESIS)



CHRONOLOGY OF THE UNIVERSE

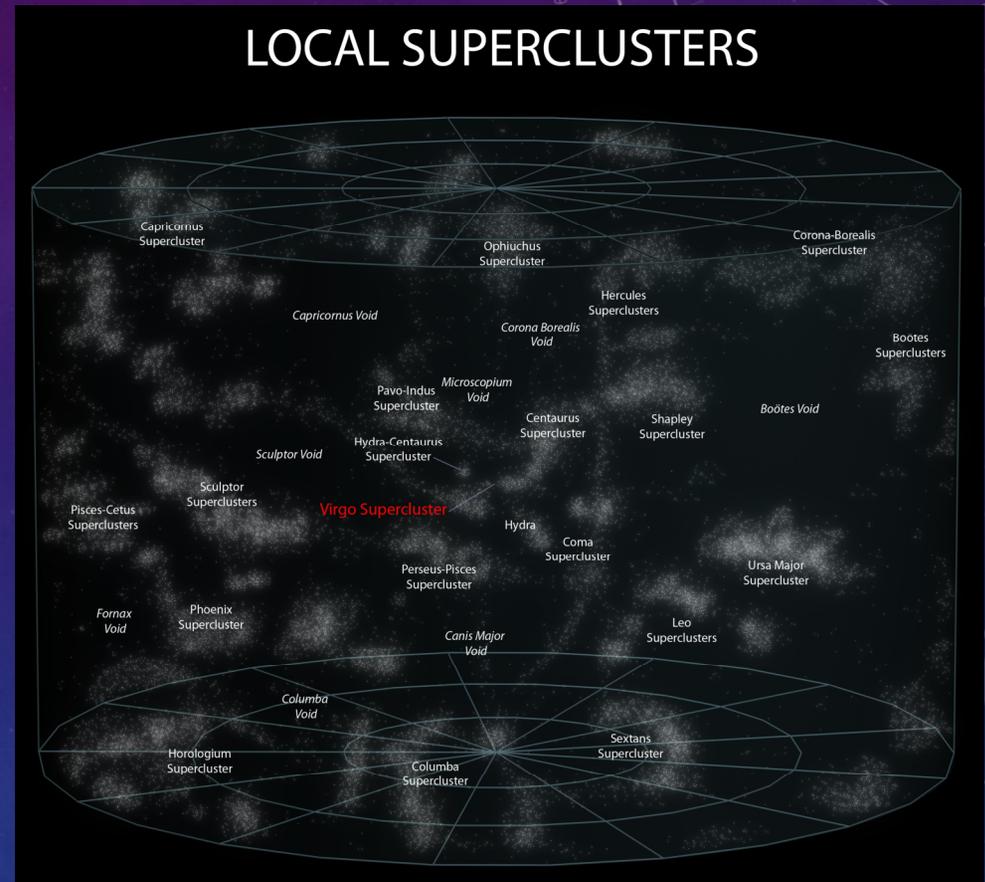
CREATION OF THE SOLAR SYSTEM TO THE MOON
FORMATION EVENT

Location of earth in the universe

OBSERVABLE UNIVERSE



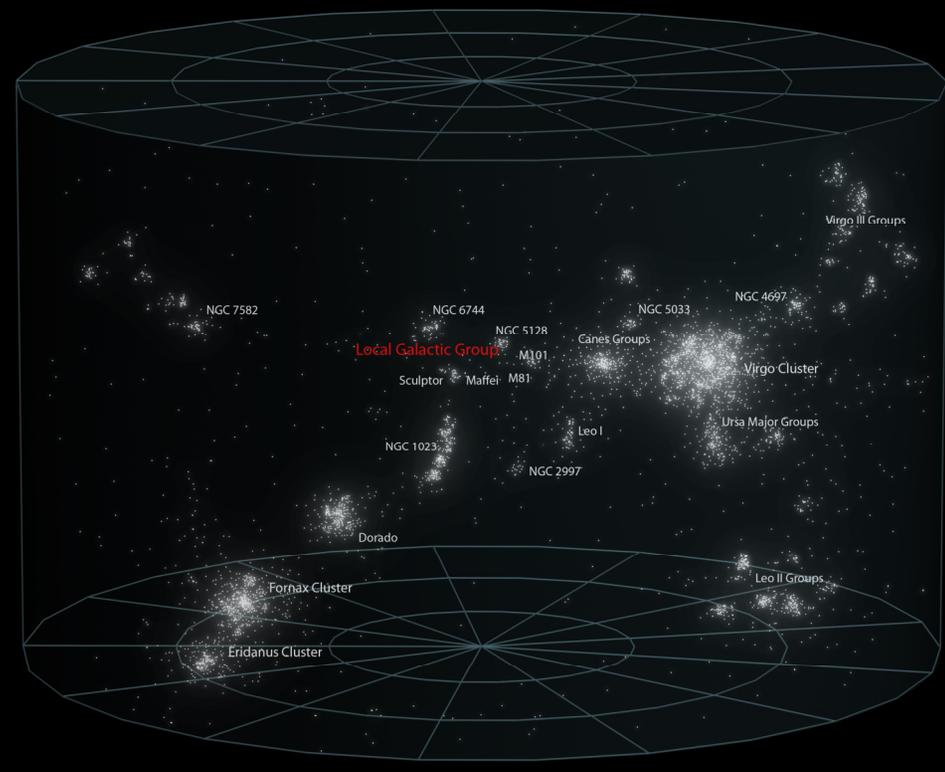
LOCAL SUPERCLUSTERS



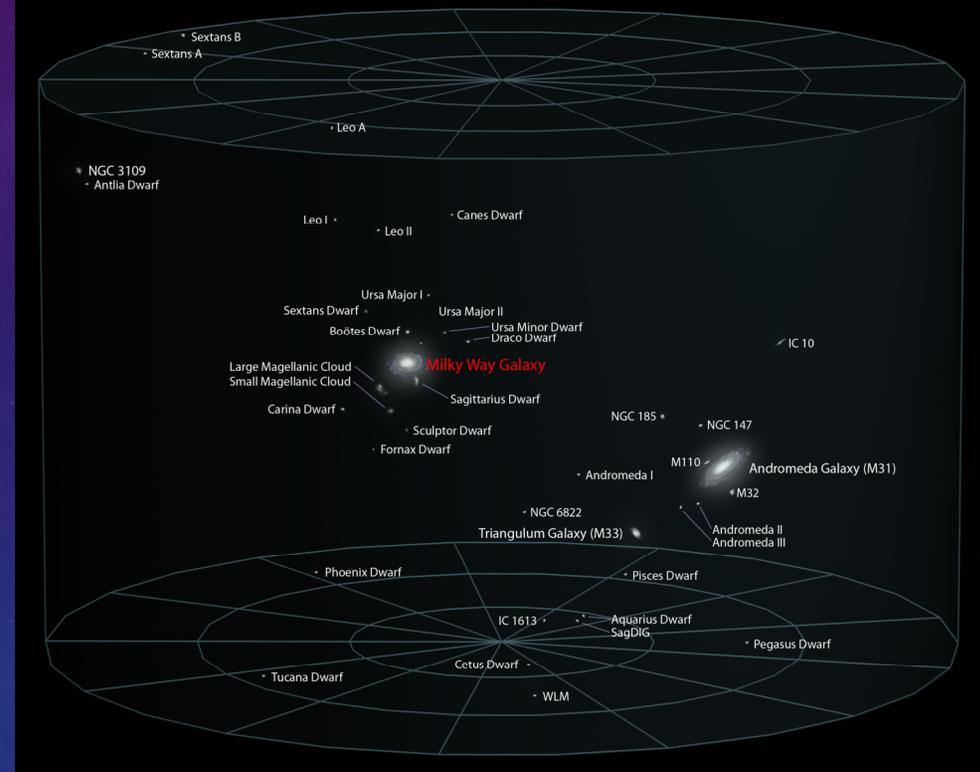
- By Andrew Z. Colvin - Own work, CC BY-SA 3.0, <https://commons.wikimedia.org/w/index.php?curid=14358437>

Location of earth in the universe

VIRGO SUPERCLUSTER



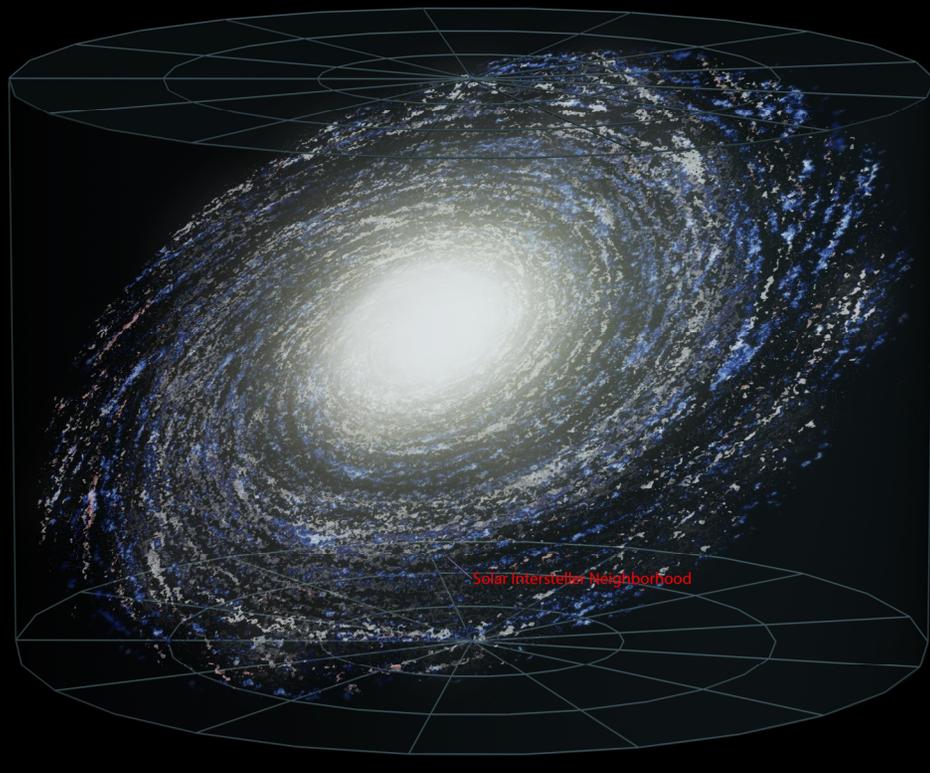
LOCAL GALACTIC GROUP



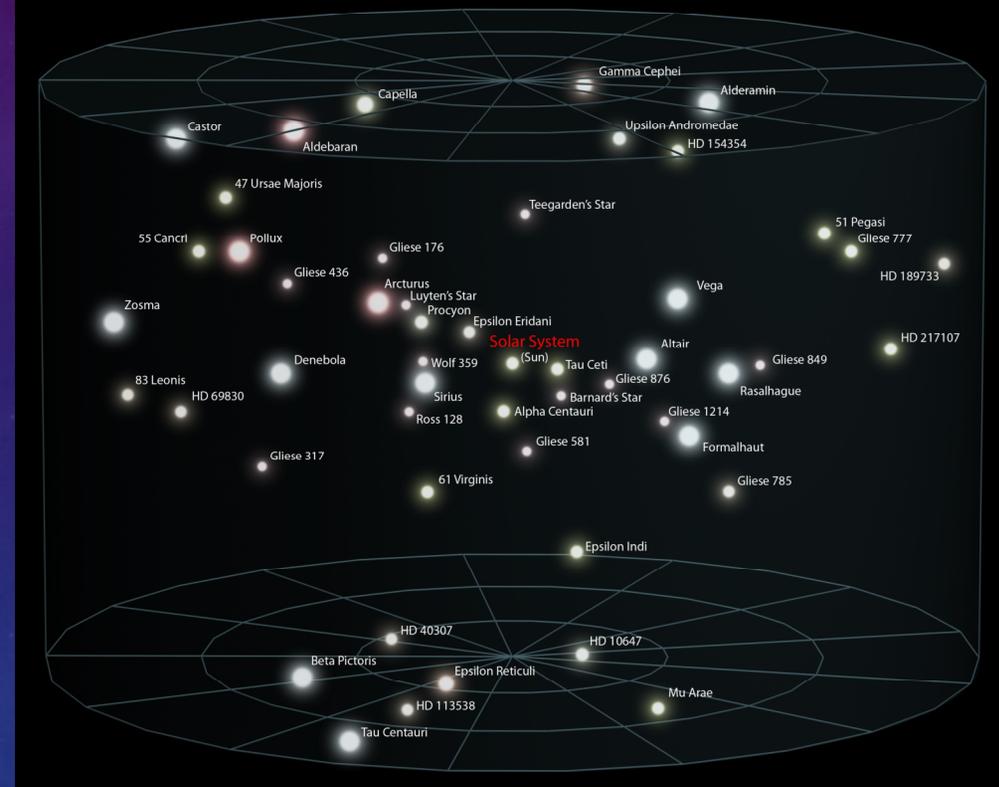
- By Andrew Z. Colvin - Own work, CC BY-SA 3.0, <https://commons.wikimedia.org/w/index.php?curid=14358437>

Location of earth in the universe

MILKY WAY GALAXY



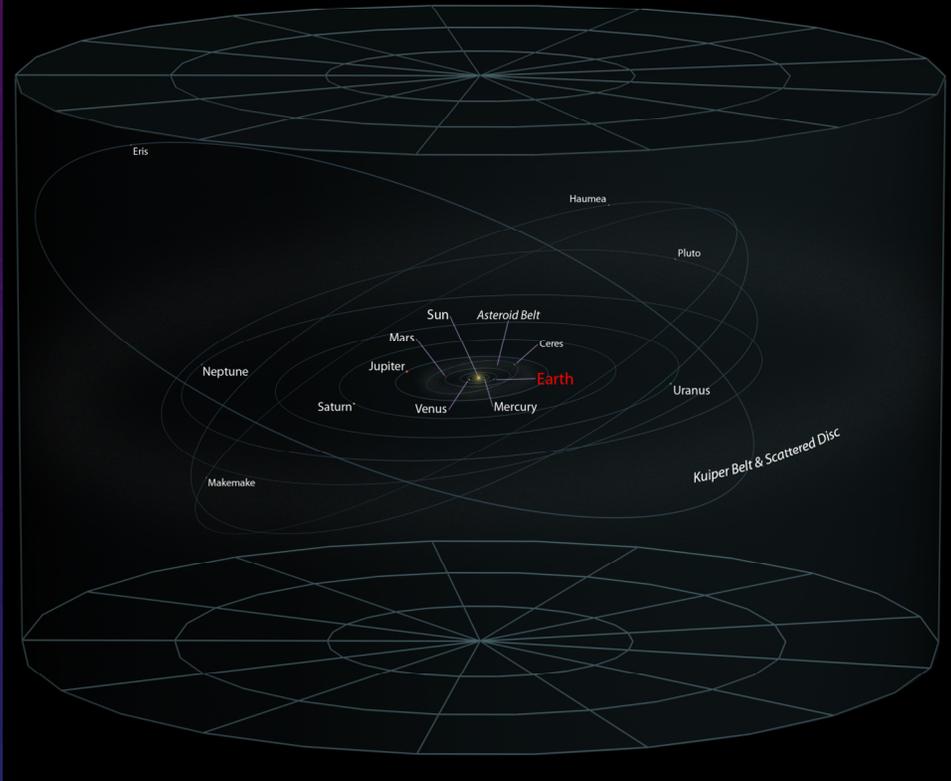
INTERSTELLAR NEIGHBORHOOD



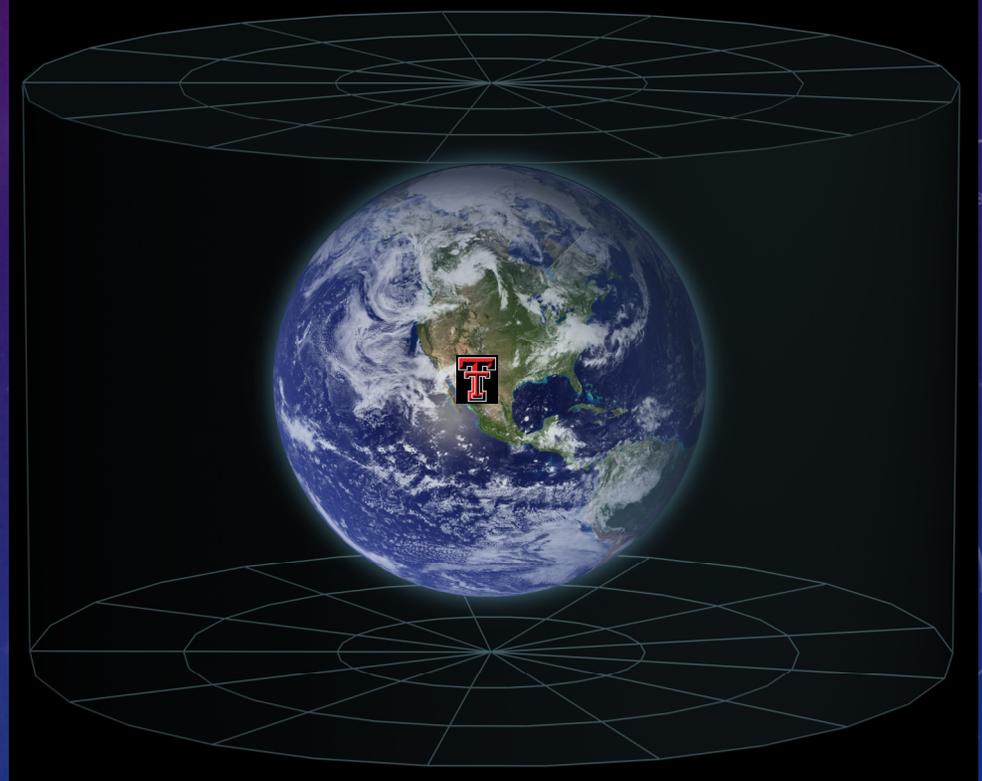
- By Andrew Z. Colvin - Own work, CC BY-SA 3.0, <https://commons.wikimedia.org/w/index.php?curid=14358437>

Location of earth in the universe

SOLAR SYSTEM



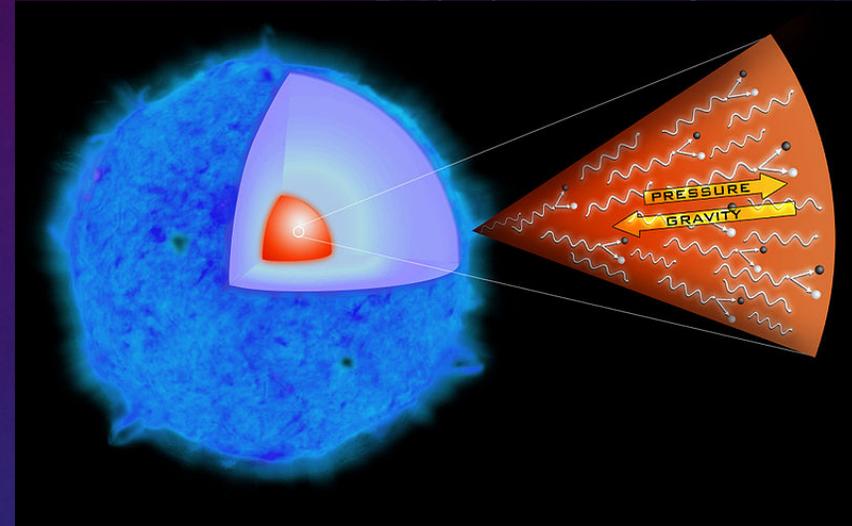
EARTH



- By Andrew Z. Colvin - Own work, CC BY-SA 3.0, <https://commons.wikimedia.org/w/index.php?curid=14358437>

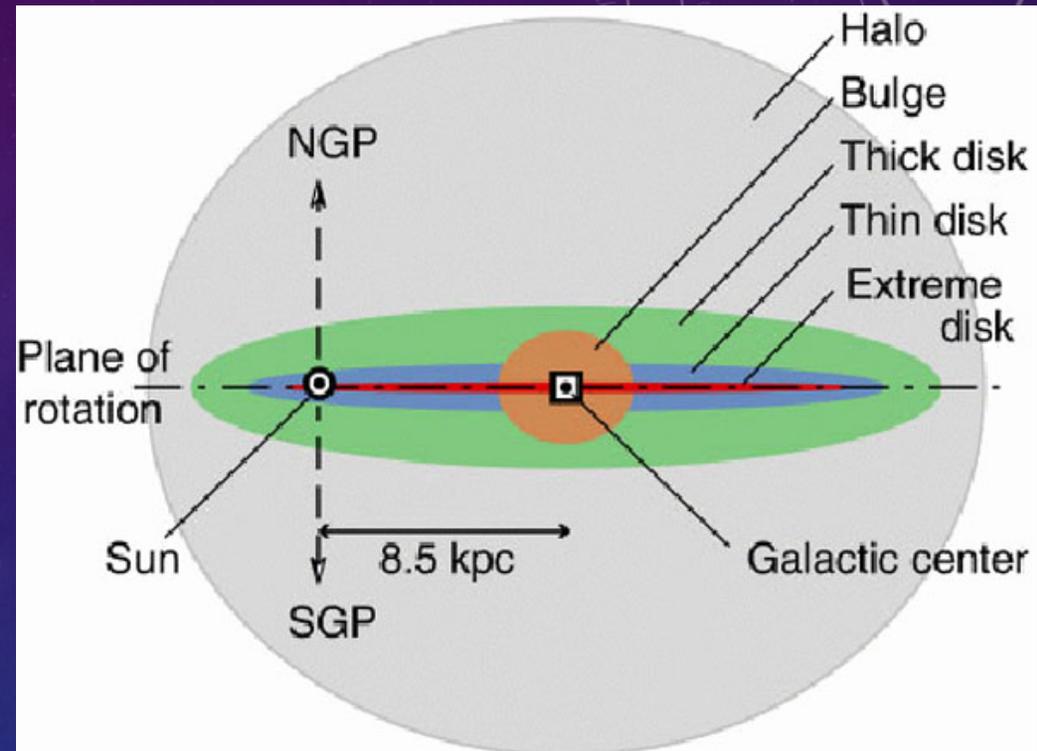
Population III Stars

- Population III Stars formed resulting from increased matter density due to gravitational force. As mass increases, it increases in temperature and pressure.
 - When the matter becomes hot enough, (around 10 million degrees F) hydrogen nuclear fusion reactions can begin and be sustained
- P III stars have no metals, are thought to be very large (100 to 400 times a solar mass)
 - As a consequence they burned through their fuel in only a few million years (very quickly by comparison to main sequence)
 - collapsed into supermassive black holes and forming (not the first) quasars; created elements heavier than Fe in supernovae



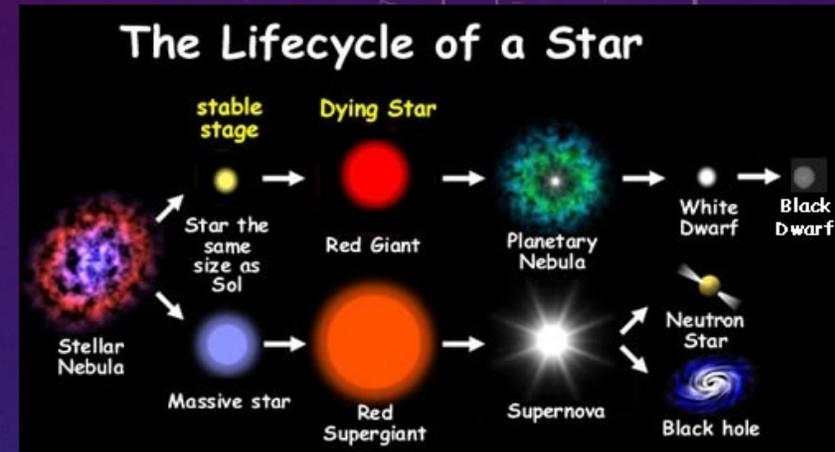
Population I and II Stars

- Population II Stars have lower metal content as compared to P I stars.
 - They are generally found around the outer rim of galaxies today (older stars); nebulae (stellar nurseries) are near the center
 - Unlike P III, they can be observed today
 - Theory and spectroscopic observations hold that all remaining elements in the periodic chart would be created by P II stars as they supernova.
 - In general, much longer lifespans than P III
- Population I Stars (youngest of all stars)
 - When formed in nebulae, pick up many metals (>Fe) created by previous generations of stars, hence metal rich
 - Our solar system begins to form about 9 BYA BB; more on this shortly...
 - In the meantime, generations of stars are creating heavy metals that are completely necessary for sustaining complex life and seeding nebulae with them.

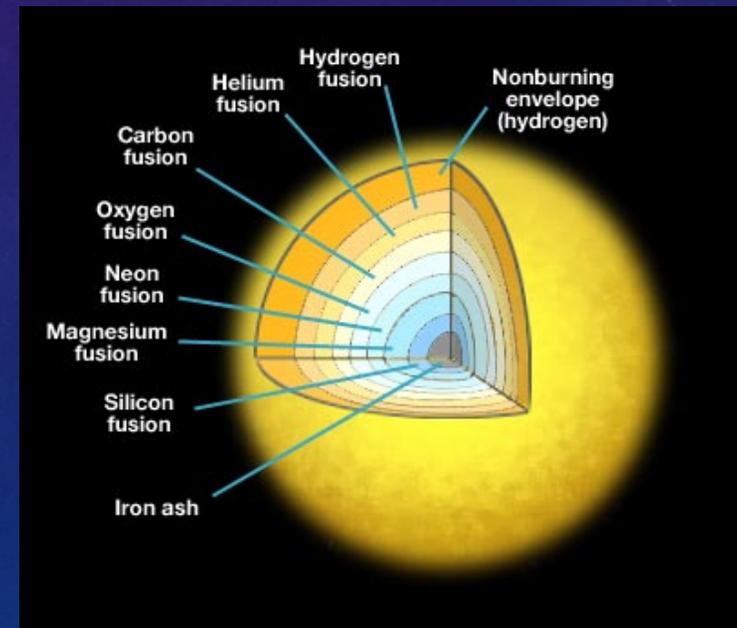


Life Cycle of Stars

- These supermassive stars produced the first metals (elements heavier than He) in the universe
 - during their fusion (up to iron, element 26) AND
 - subsequent supernovae (possibly up to uranium, element 92)
- As we shall see later, these heavy elements, especially thorium and uranium are absolutely necessary for sustaining complex life on earth.



H																		He								
B																		B								
Li	Be																	B	C	N	O	F	Ne			
C	C																	C	S	L	S	L	S	L	S	L
Na	Mg																	C	S	S	S	S	S	S	S	S
L	L																	L	L	L	L	L	L	L	L	
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr									
L	L	L	S	L	S	L	S	S	S	L	L	S	S	L	S	S	S									
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe									
S	L	L	L	L	S	L	S	S	S	S	S	S	S	S	S	S	S									
Cs	Ba	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn										
S	L	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S										
Fr	Ra	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu										
S	S	L	L	S	S	S	S	S	S	S	S	S	S	S	S	S										
		Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr										
		S	S	S	S	S	S	M	M	M	M	M	M	M	M	M										





Sol System
(our Sun)

Milky Way Galaxy

- Galaxies with spiral arms (SG) are very rare
 - Is the only type able to support complex life
 - Ellipsoidal and Spherical galaxies contain mostly older stars and formation is relatively rare causing a significant shortage and diversity of heavy metals
 - Stars are often in congested areas where stable, long term orbits are very rare.
 - Maintaining spiral structure is a complex topic, but it requires the presence of dwarf galaxies to accrete gas and the absence of nearby super large galaxies that may accrete from the spiral galaxy or perturb orbits gravitationally
 - MWG is the right size for life on earth
 - Co-rotation radius – distance from galactic center at which stars revolve around the galactic center at the same rate as the galactic arms
 - Larger SG (longer CRR) too far out to have sufficient abundance of essential heavy metals
 - Smaller SG (shorter CRR) places the planet too close to the galactic center with exposure to deadly gamma and cosmic radiation; gravitational interference with other spiral arms

Source: Ross, H. (2016). *Improbable Planet*. Grand Rapids, MI: Baker Books.



Sol System
(our Sun)

Milky Way Galaxy

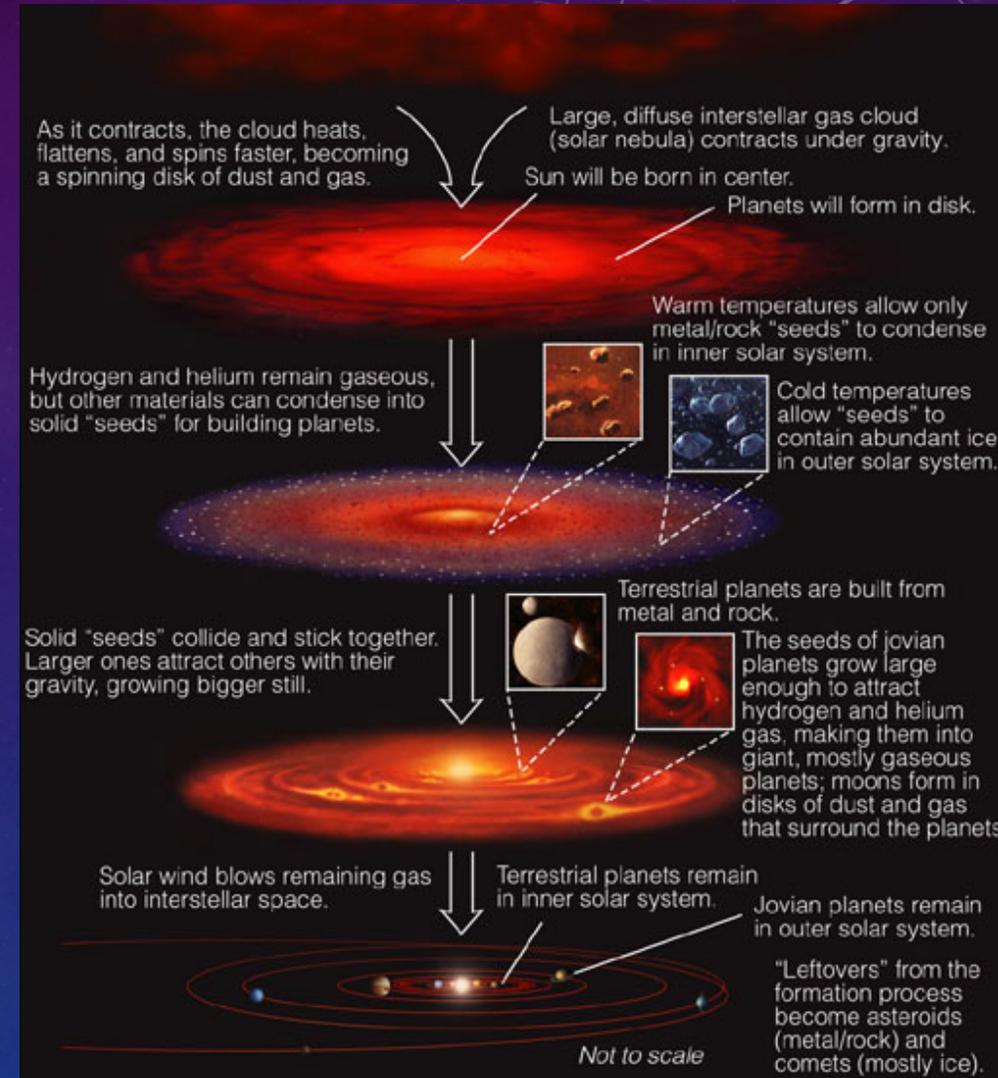
- Galaxies with spiral arms (SG) are very rare
 - Our solar system migrated outward after initial formation to
 - A location that within the Orion spiral
 - At this location, stars do not drift in and out of the spiral arms as the arms rotate about the center
 - Stars with their large gravitational wells would disturb the orbits of smaller objects (like earth) resulting in destruction of complex life
 - This location also affords us a view of the galactic center, neighborhood and universe at large, this is necessary for exploration

Source: Ross, H. (2016). *Improbable Planet*. Grand Rapids, MI: Baker Books.

Solar System Formation: 8.5 – 9B years after BB; 4.5 – 5 BYA

BYA

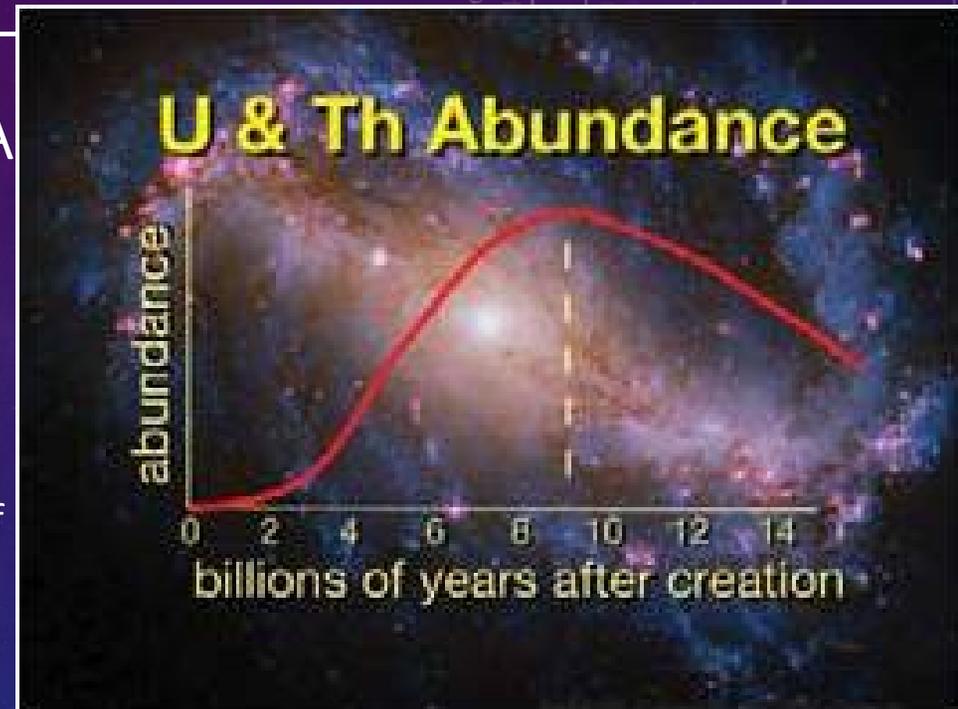
- Infographic shows the process currently understood for the development of our solar system...
- Today the solar system orbits just inside the CR distance in a stable part of the galaxy
- The solar system must have originated at a point much closer to the galactic center as evidenced by the abundance of metals in our solar system (specifically heavy radioisotopes) and earth.
- Early stars that were supernovae expelled large quantities of metal rich gases into surrounding void
 - later generation stars and nebulae formed with these materials
- Apparently, the solar system formed in the just right proximity to several large supernovae that provided heavy elements and drove off vast quantities of light elements



Copyright 2004 Pearson Education, publishing as Addison Wesley

Solar System Formation: 8.5 – 9B years after BB; 4.5 – 5 BYA

- With respect to other observations made in the milky way, earth's crust has greater relative abundances (by mass) of several metals and heavy metals compared to other solar systems observed (spectroscopic techniques)
- The solar system formed at a time in history when Thorium and Uranium would have been at their peak abundances (chart)
- The sun and the new planets could not stay in their place of creation, they had to move to a quieter place...
 - The trajectory had to take it away from the center of the galaxy with a very gentle nudge so as not to disturb orbits
 - Z-motion must be <500 LY, if greater, the solar system would be exposed to lethal levels of radiation from the core that would prevent complex life to exist later
 - Actual solar z-motion is about +/- 228 LY

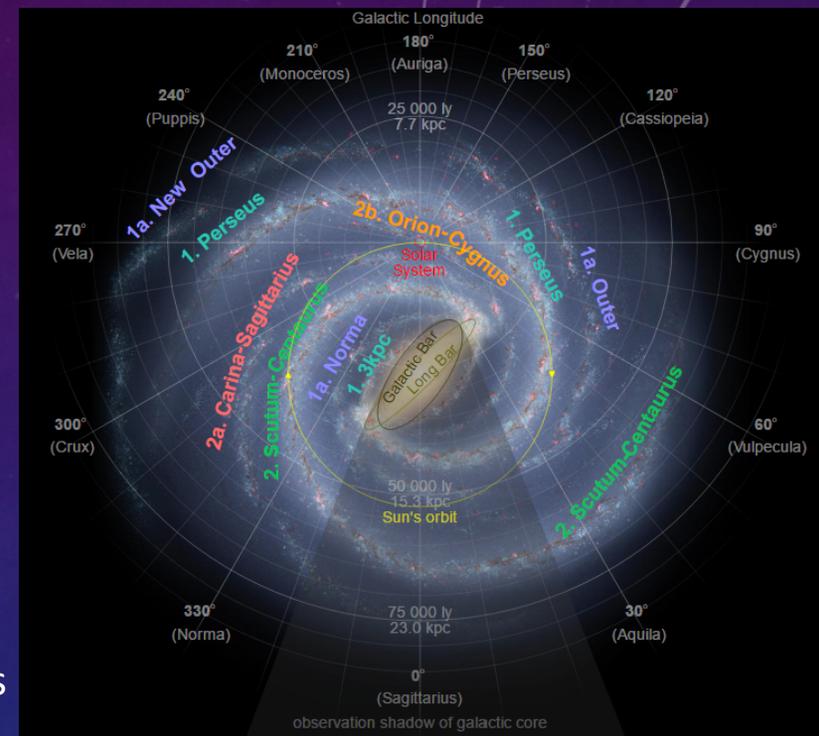


Source:

<http://www.reasons.org/articles/elemental-evidence-of-earths-divine-design>

Solar System Formation: 8.5 – 9B years after BB; 4.5 – 5 BYA

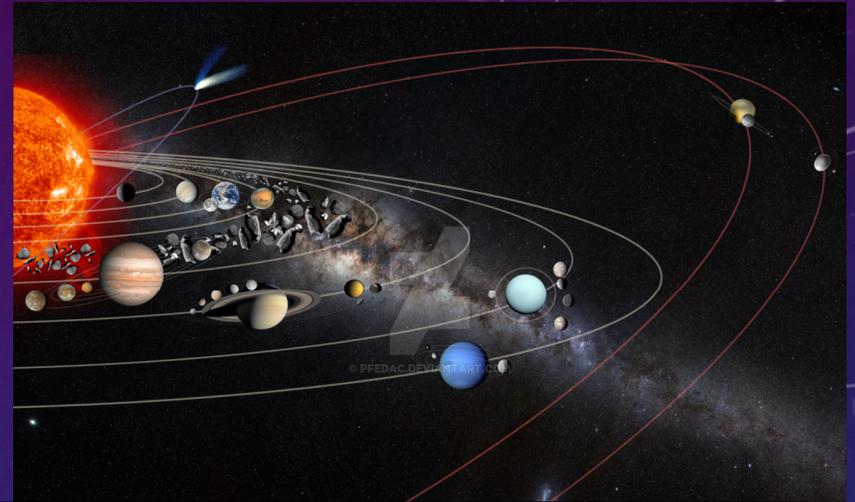
- The final radius and orbit of the solar system around the galactic center is not certain
- Radius does vary to some extent, though not certain of extent
- The new orbit is in a “quiet neighborhood”
 - No nearby objects to disturb planetary orbital trajectories
 - No nearby bright stellar objects to obscure observation of the galaxy and universe
 - Protected from the high intensity radiation from the galactic center
 - Just when things were looking pretty good...



Artists conception of galactic orbit
source
https://en.wikipedia.org/wiki/Galactic_year

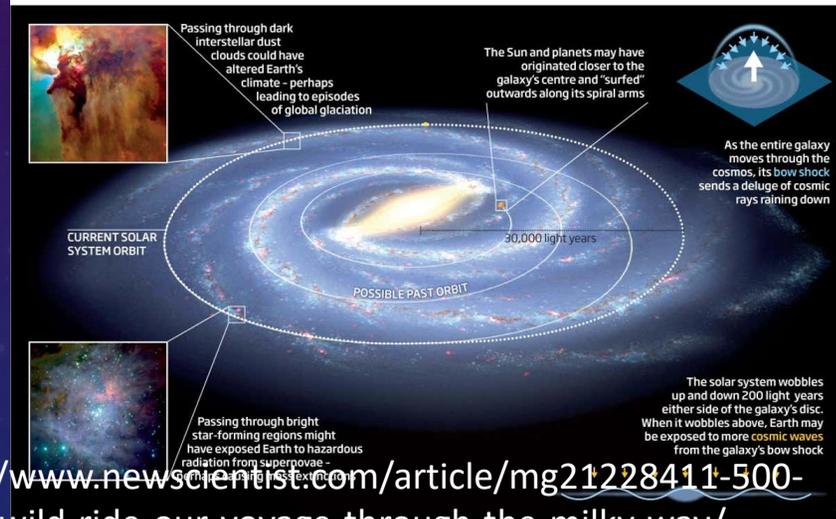
Solar System Dynamics - Gas Giants

- Provide effective protection for the inner rocky planets from objects outside the solar system or from Kuiper belt / Oort cloud



Our way through the Milky Way

The solar system is travelling at a steady 220 kilometres per second in a circular orbit around the centre of the galaxy - but it might not always have done so



<https://www.newscientist.com/article/mg21228411-500-earths-wild-ride-our-voyage-through-the-milky-way/>

Solar System Dynamics - Gas Giants

- Gas giant gravitational well will either accelerate and deflect incoming objects or draw them into a collision
- If gas giants are too small or too distant they will be ineffective
- If they are too large or too close they will disrupt the orbits of the inner planets where complex life must exist
- All four gas giants, Jupiter, Saturn, Uranus and Neptune have optimal sizes, orbits and distances from the sun to minimize the number of collisions from extra solar objects

Source: Ross, H. (2016). *Improbable Planet*. Grand Rapids, MI: Baker Books.

[Solar System Formation 6min](#)

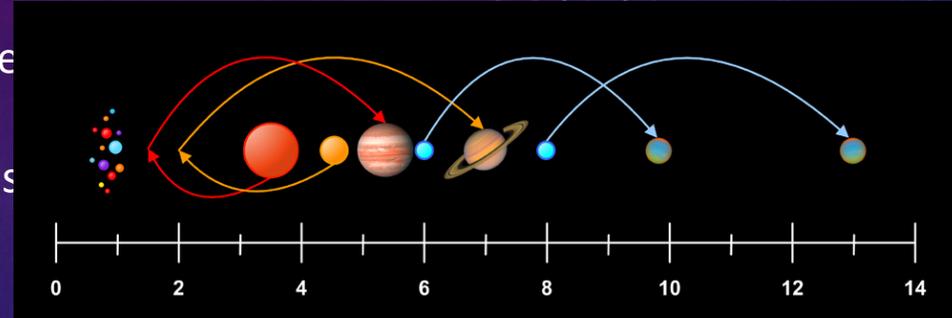
Source:

https://www.youtube.com/watch?v=M8AzsbtII_k



Solar System Dynamics - The Grand Tack

- In order to account for orbits of earth, mars and the size of the asteroid belt observed today, Jupiter and Saturn did something unique.
- Current observations of exoplanets show most gas giants are very close to their star as a result of inward migration
- Planetary models predict mars should be 50% more massive than earth and that the asteroid belt should be 2000 times more massive than observed
 - This results in many more asteroids being gravitationally slung towards earth causing many more catastrophic collisions on the surface
- All solar system models agree that Jupiter was the first GG to form and afterwards, enough mass persisted to cause an inward migration to begin



Source:

<http://backalleyastronomy.blogspot.com/2012/07/solar-system-archaeology-part-ii.html>



THE GRAND TACK

Jupiter's zigzagging path through the fledgling Solar System

APPROX 4.6 BILLION YEARS AGO: T=0

Jupiter forms near the 'ice line' in the protoplanetary disc, between its rocky inner parts and icy outer parts. The other large planets are also beginning to condense out.

THE SUN



T=70,000 YEARS

The 'drag' of the protoplanetary material causes Jupiter to migrate inwards, pushing much of the rocky material into the Sun.



T=100,000 YEARS

Saturn follows Jupiter inwards, almost catching up with it and halting their inward movement. In the process, some icy asteroids are dragged into the inner Solar System.



T=300,000 YEARS

Jupiter and Saturn migrate back outwards, leaving behind a mixture of rocky and icy debris from which the inner planets will form.



T=500,000 YEARS

At the end of the Grand Tack, Jupiter is near its present position - but the outer planets are still much closer to the Sun than they are today.



APPROX 4.5 BILLION YEARS AGO

Now the inner planets have formed too, close to their present positions. After another half a billion years, Uranus and Neptune will migrate outwards to their final positions.



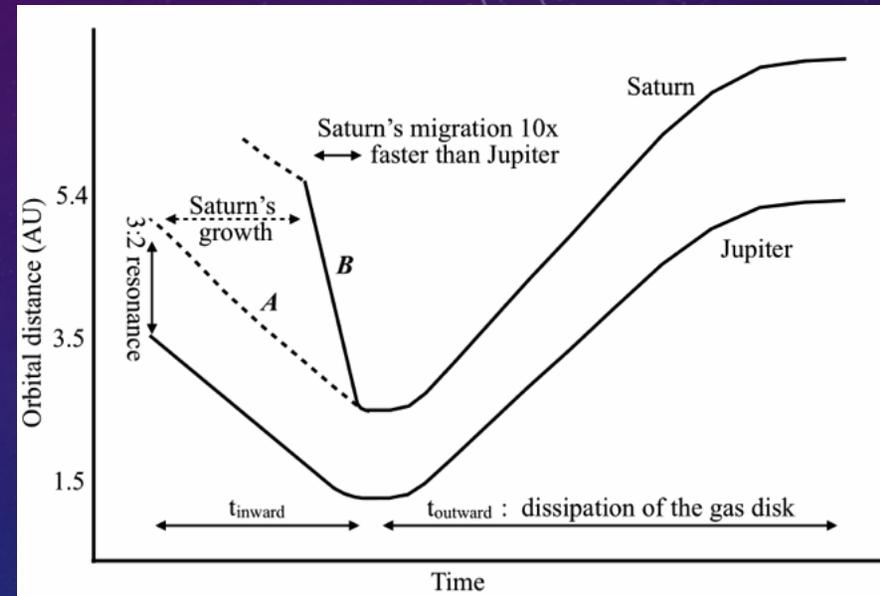
2 AU

4 AU

XXXXX

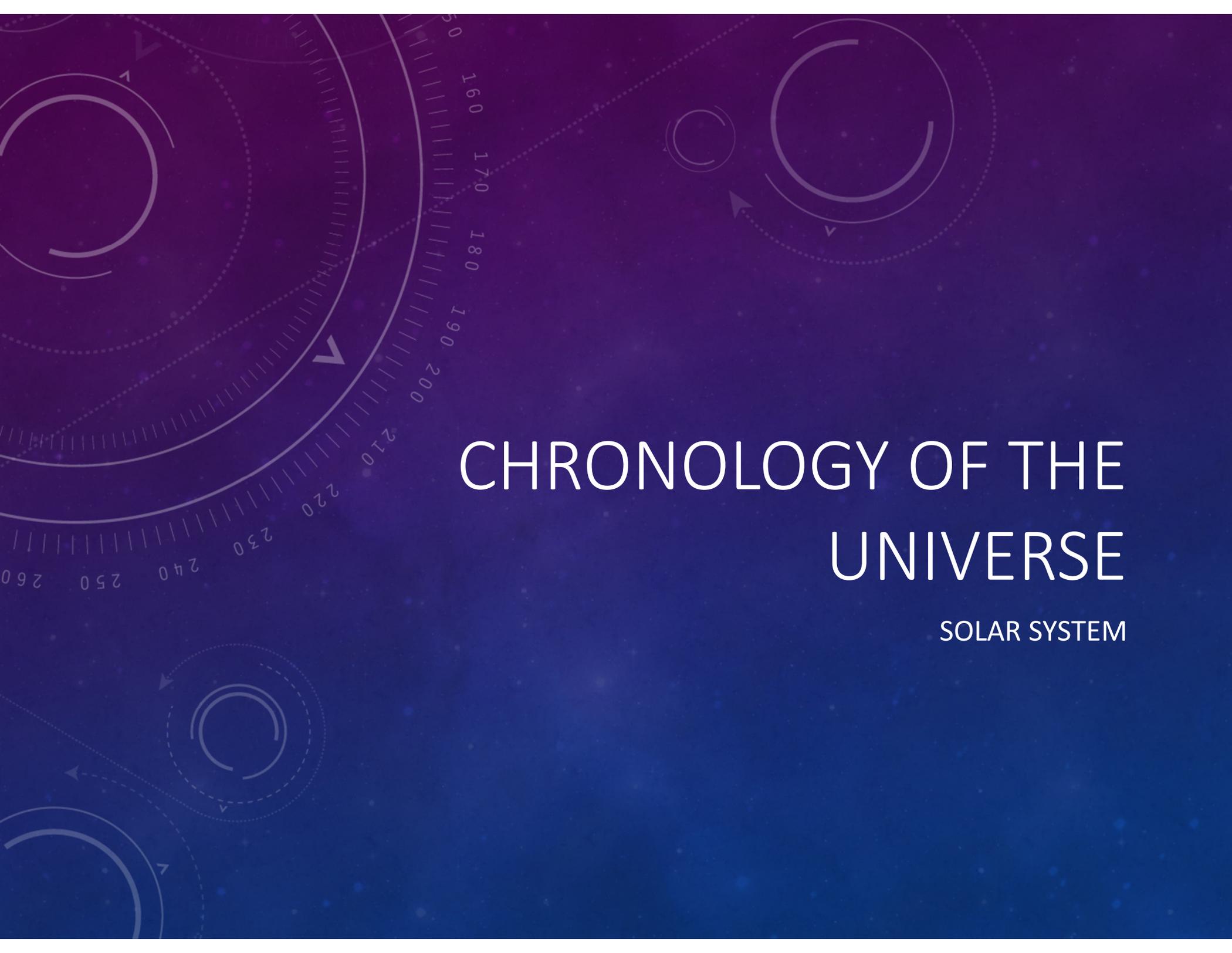
Solar System Dynamics - The Grand Tack

- As Saturn approached its final mass and position, it also began to migrate inward but at a faster rate
- Both planets continued their inward migration until they reached a 3:2 gravitational orbital (mean motion) resonance condition
 - From the perspective of the sun, the masses of Saturn and Jupiter add together to create a much more massive “virtual” planet that has enough angular momentum to recede from the sun
- The inward migration and recession results in a significant thinning of the asteroid belt and, removes material that Mars could have used to increase its mass
- Other models have corroborated the same results
- Long term complex life on earth is possible as a result of the gas giants and is not possible without them



Source: http://www.obs.u-bordeaux1.fr/e3arths/raymond/movies_grandtack.html

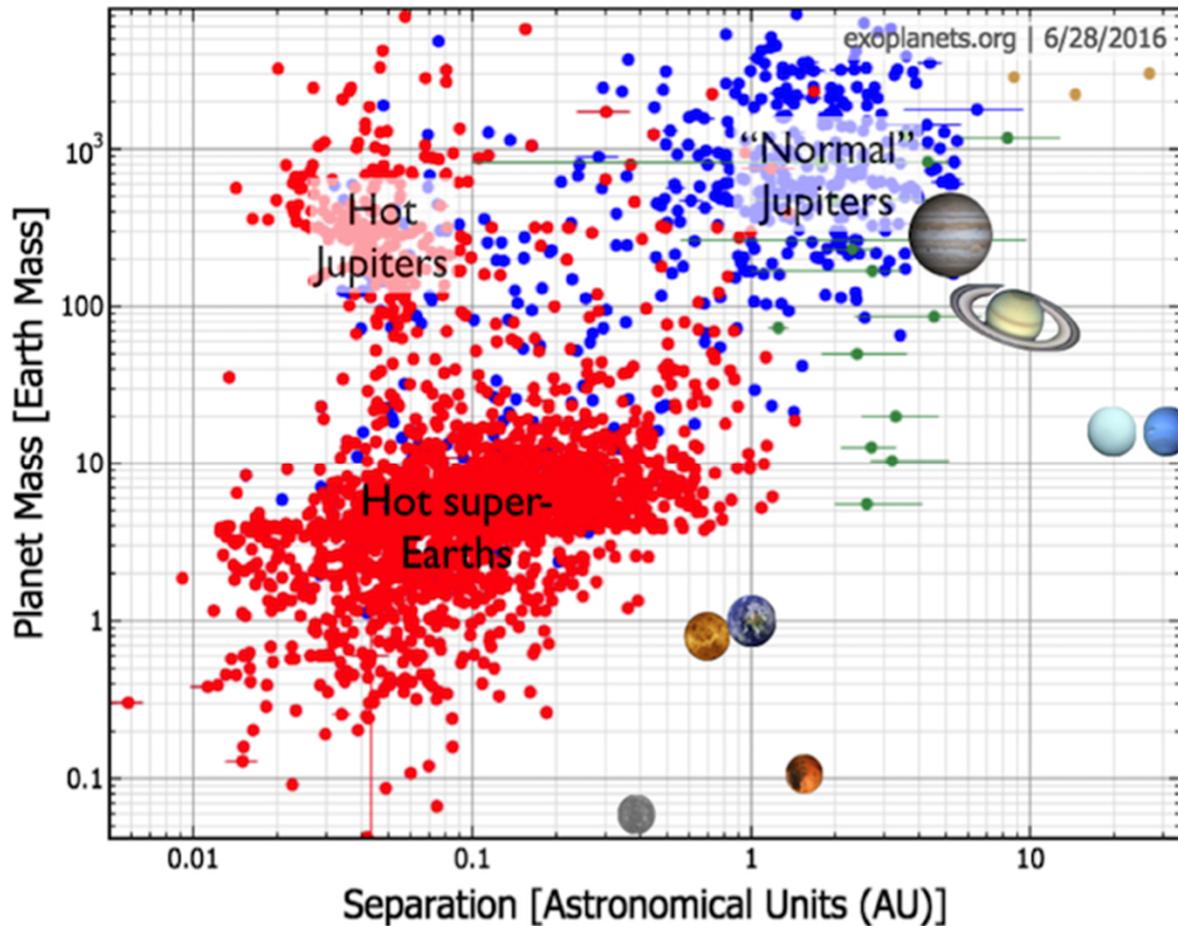
Ross, H. (2016). *Improbable Planet*. Grand Rapids, MI: Baker Books.



CHRONOLOGY OF THE UNIVERSE

SOLAR SYSTEM

Solar System Comparison to exoplanets discovered so far



- X axis shows distance from the sun and the Y axis show mass
- For reference earth is 1 AU and 1 earth mass
- In comparison to other solar systems, ours seems to be quite unique as ideally suited for complex life

Source:

<https://planetplanet.net/2016/07/12/exactly-how-unusual-is-our-solar-system/>

Solar System Dynamics - The Moon Forming Event

- About 4.5 BYA, Earth was hypothesized to be a molten world with a thick atmosphere similar to Venus today
- Most widely accepted explanation of how the moon formed is that a mars sized object (Theia, about 20% mass of earth) collided with earth
- Models show and the laws of physics allow a second planet to accrete and coalesce at a LaGrange point close to earths orbit and eventually overtake earth through gravitational interactions with Venus
 - Impact at about a 45° angle with a relative velocity of 12 km/sec
 - The light elements would have been blown into local space while the two heavy metal cores would have merged into one
- The lighter ejected products would have later coalesced into the moon while the heavier materials would have collected back to earth



Source:

<http://www.universetoday.com/19718/formation-of-the-moon/>

Ross, H. (2016). *Improbable Planet*. Grand Rapids, MI: Baker Books.

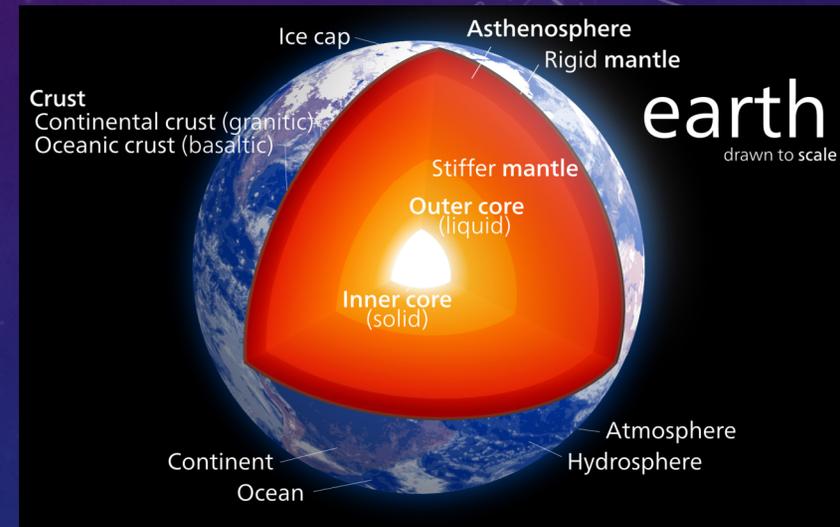
[Moon Forming Simulation 1:30](#)

Source:

<https://www.youtube.com/watch?v=PnhfLL7-I3I>

Solar System Dynamics - The Moon Forming Event

- The collision enveloped Theia and turned Earth into a molten ball; in this “liquefied” state, many of the heavy elements sank into the inner and outer cores of earth
- Implications of the collider event
 - Replacement of earth’s thick atmosphere with one more optimal for later complex life chemically
 - Earth’s atmosphere went from being opaque to translucent and later to transparent after O_2 was introduced in the atmosphere
 - Mass and density of earth were augmented to retain water vapor (MW 18), while allowing NH_3 (MW 17) and CH_4 (MW 16) to escape the atmosphere



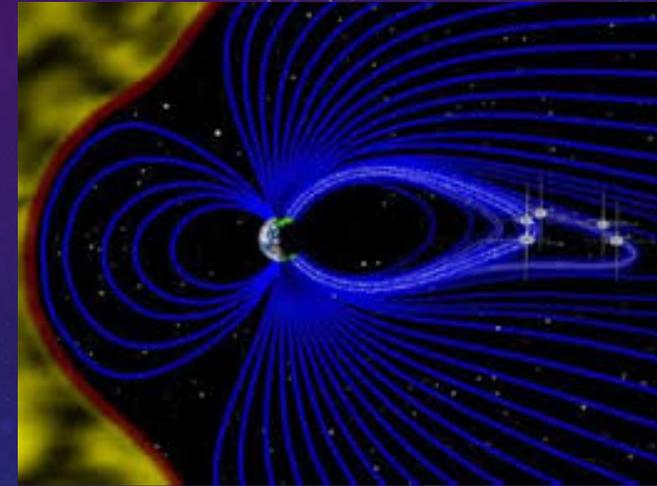
Source:

<http://www.universetoday.com/19718/formation-of-the-moon/>

Ross, H. (2016). *Improbable Planet*. Grand Rapids, MI: Baker Books.

Solar System Dynamics - The Moon Forming Event

- Implications of the collider event (cont)
 - The collision event likely provided the kinetic energy to kick start the dynamo in the core but heat from radioactive decay of heavy elements provides the heat energy required to maintain
 - Significant increases in Fe & Ni content in the core allowing liquefied metal dynamo to create a strong magnetic field around the earth
 - Shields the earth from solar winds (charged particles like protons, electrons thrown out from the sun)
 - Coronal Mass Ejections (CMEs - charged particles like protons, electrons thrown out from the sun)
 - Prevents atmospheric sputtering by solar winds (Mars)



Source: Ross, H. (2016).
Improbable Planet. Grand
Rapids, MI: Baker Books.

[Magnetosphere & Magnetopause 2 min](#)

Solar System Dynamics - The Moon Forming Event

- Implications of the collider event (cont)
 - Provided sufficient abundance of long lasting radioisotopes (U-238 HL 4.5 BY and Th-232 HL 14 BY) that provide the energy to drive volcanism and plate tectonics
 - The moon had enough mass, proximity, and angular velocity (momentum and gravity) to stabilize earth's tilt and slow earth's rotation rate
 - After the collision, earth nutated (wobbled) on its axis
 - Earth's rotation time was about 6 hours, far too fast to allow complex life; 500 mph surface winds
 - The moon's size and initial proximity provided nutation stabilization and reduced angular momentum (rotation speed) over time.



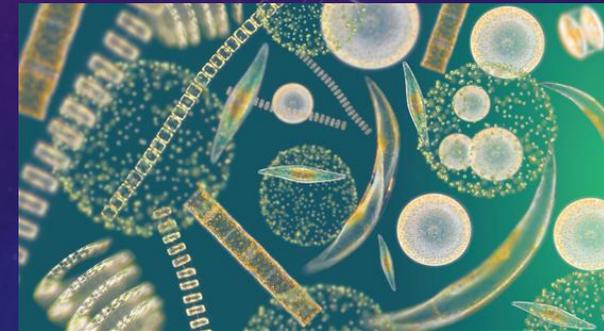
Source:

<https://images.newscientist.com/wp-content/uploads/2016/09/14151451/webresize-112717163.jpg?width=800>

Ross, H. (2016). *Improbable Planet*. Grand Rapids, MI: Baker Books.

Solar System Dynamics - The Moon Forming Event

- Implications of the collider event (cont)
 - Phytoplankton (created later) are ocean dwelling photosynthetic organisms that require Fe,
 - Form the basis of the aquatic food chain and require Fe and other metals in their metabolic processes
 - Are the largest source of atmospheric oxygen on the planet required for long term advanced life
 - Provided sufficient abundance of long lasting radioisotopes (U 238 HL 4.5 BY and Th HL 14 BY) that provide the energy to drive volcanism and plate tectonics.



Source:

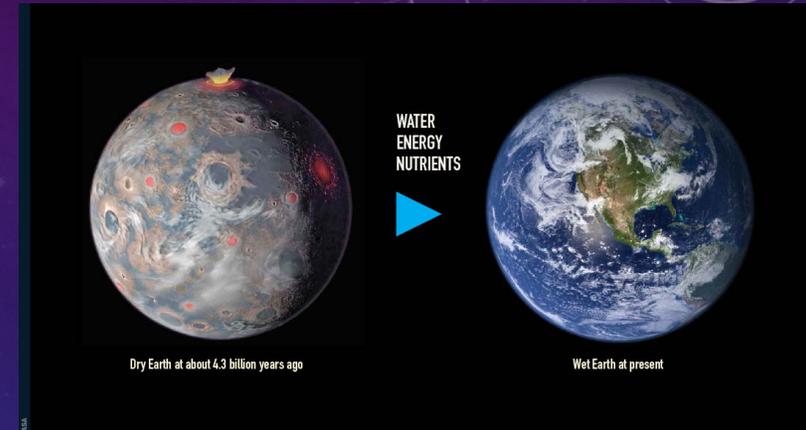
<http://sailorsforthesea.org/programs/ocean-watch/searching-phytoplankton>

Ross, H. (2016). *Improbable Planet*. Grand Rapids, MI: Baker Books.

Late Heavy Bombardment 4.2

– 3.8 BYA

- The image shows what the earth is believed to have looked like after the moon collider event; there was a thin atmosphere and no water
- It wasn't until after the merger event that earth had enough mass to retain water vapor in its atmosphere
- So where did our water come from?
- Going back to the gas giants for a moment....
 - Detailed solar computational models show that when Saturn and Jupiter reached its 2:1 gravitational resonance...
 - This condition created a gravitational disturbance that caused Uranus and Neptune to change places and move outward
 - These in addition with other possibilities caused LHB to begin



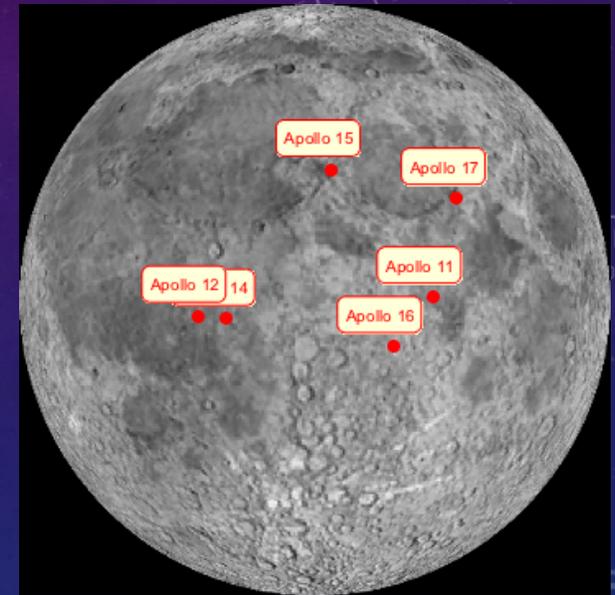
source

<http://astrobiowalk.gsfc.nasa.gov/5.html>

Late Heavy Bombardment 4.2

– 3.8 BYA

- Nice Models indicate that predominately Kuiper belt objects would have been hurled inward toward the rocky planets (lots of ice out there)
- Radiometric dating of lunar rocks returned from Apollo missions confirm the ranges
- From studies of the lunar craters and assuming a consistent probability, the following can be extrapolated for earth
 - Appx 22,000 impact craters > 12 miles
 - Appx 40 impact craters > 620 miles
 - Several (3) impact craters up to 3,100 miles
- The bombardment is necessary for bringing water to the planet



source

<http://astrobiowalk.gsfc.nasa.gov/5.html>
https://en.wikipedia.org/wiki/Late_Heavy_Bombardment

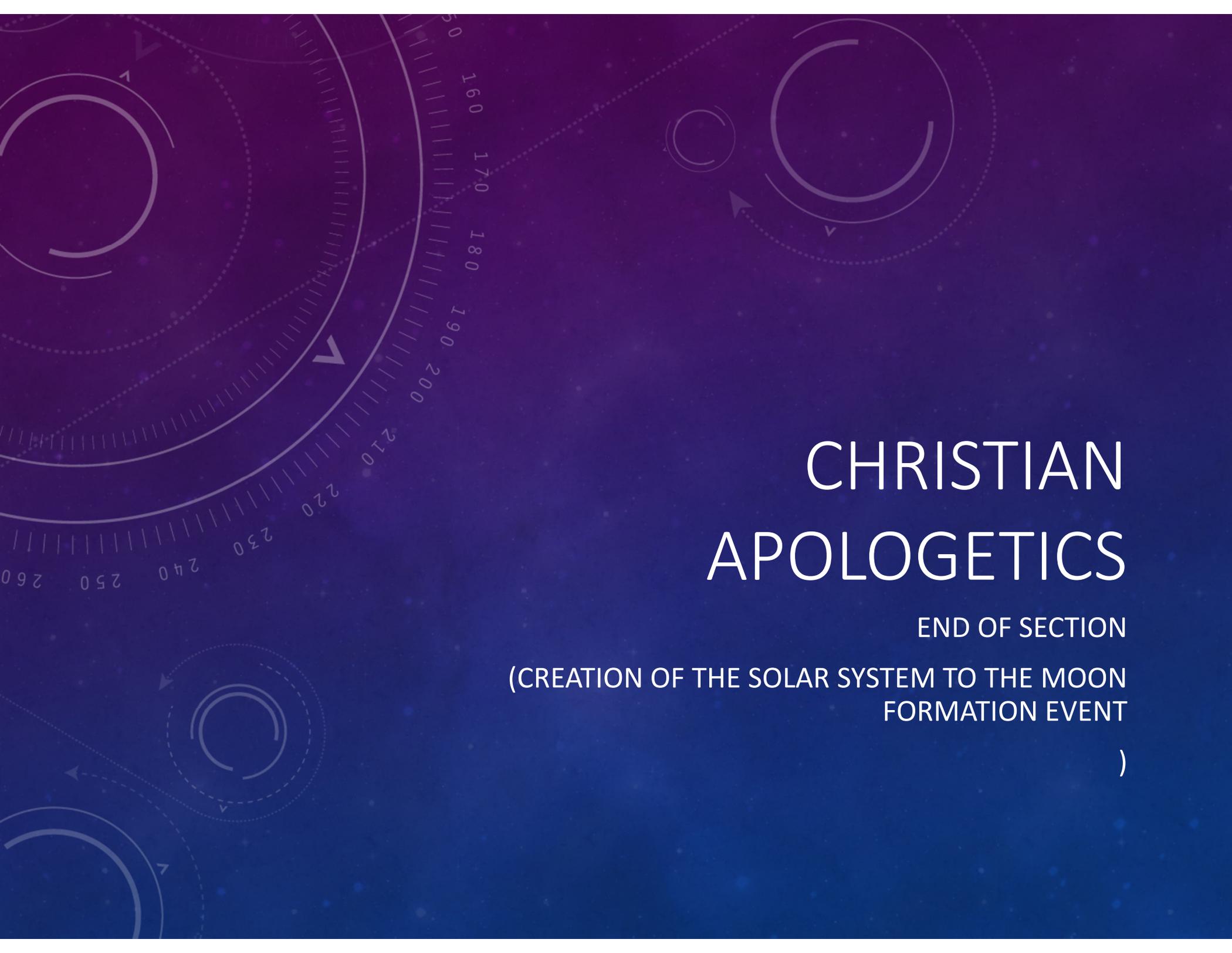
Late Heavy Bombardment 4.2

– 3.8 BYA

- Iridium enrichment levels found in metasedimentary rocks dated 3.8 BY is consistent with enrichment levels found in lunar samples of the same age...
 - On average 7.5x higher than in crustal levels
- Some have speculated hyperthermophile life (HTL) forms may have existed however there is no evidence to support this, for example
 - Ribose (5 carbon sugar base) of DNA/RNA, in a pH neutral solution
 - Concentrations would not be high enough spawn any reasonable abiogenesis scenario
 - Additionally, gamma radiation due to radioactive decay would have been 5 times its present value measured today
- Minimum conditions for even primitive life are not yet met



Source: Ross, H. (2016). *Improbable Planet*. Grand Rapids, MI: Baker Books.

The background features a dark blue gradient with faint, glowing circular patterns and a scale on the left side. The scale has markings from 160 to 260 in increments of 10. There are also several circular diagrams with arrows indicating rotation or movement.

CHRISTIAN APOLOGETICS

END OF SECTION

(CREATION OF THE SOLAR SYSTEM TO THE MOON
FORMATION EVENT

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