

Quarks, Chaos, and Christianity

What's Been Going On?

Sunday, January 13, 2008
10 to 10:50 am, in the Parlor
Presenter: David Monyak

St. John in the Wilderness

- ¹ The heavens declare the glory of God; the skies proclaim the work of his hands.
- ² Day after day they pour forth speech; night after night they display knowledge.
- ³ There is no speech or language where their voice is not heard.
- ⁴ Their voice goes out into all the earth, their words to the ends of the world. In the heavens he has pitched a tent for the sun,
- ⁵ which is like a bridegroom coming forth from his pavilion, like a champion rejoicing to run his course.
- ⁶ It rises at one end of the heavens and makes its circuit to the other; nothing is hidden from its heat.
- ⁷ The law of the LORD is perfect, reviving the soul. The statutes of the LORD are trustworthy, making wise the simple.
- ⁸ The precepts of the LORD are right, giving joy to the heart. The commands of the LORD are radiant, giving light to the eyes.
- ¹⁴ May the words of my mouth and the meditation of my heart be pleasing in your sight, O LORD, my Rock and my Redeemer.

- Psalm 19:1-8, 14 (NIV)

REVISED AND UPDATED EDITION

JOHN POLKINGHORNE

Templeton Prize Winner and author of Science and Providence

**QUARKS, CHAOS
& CHRISTIANITY**

Questions to
Science and Religion



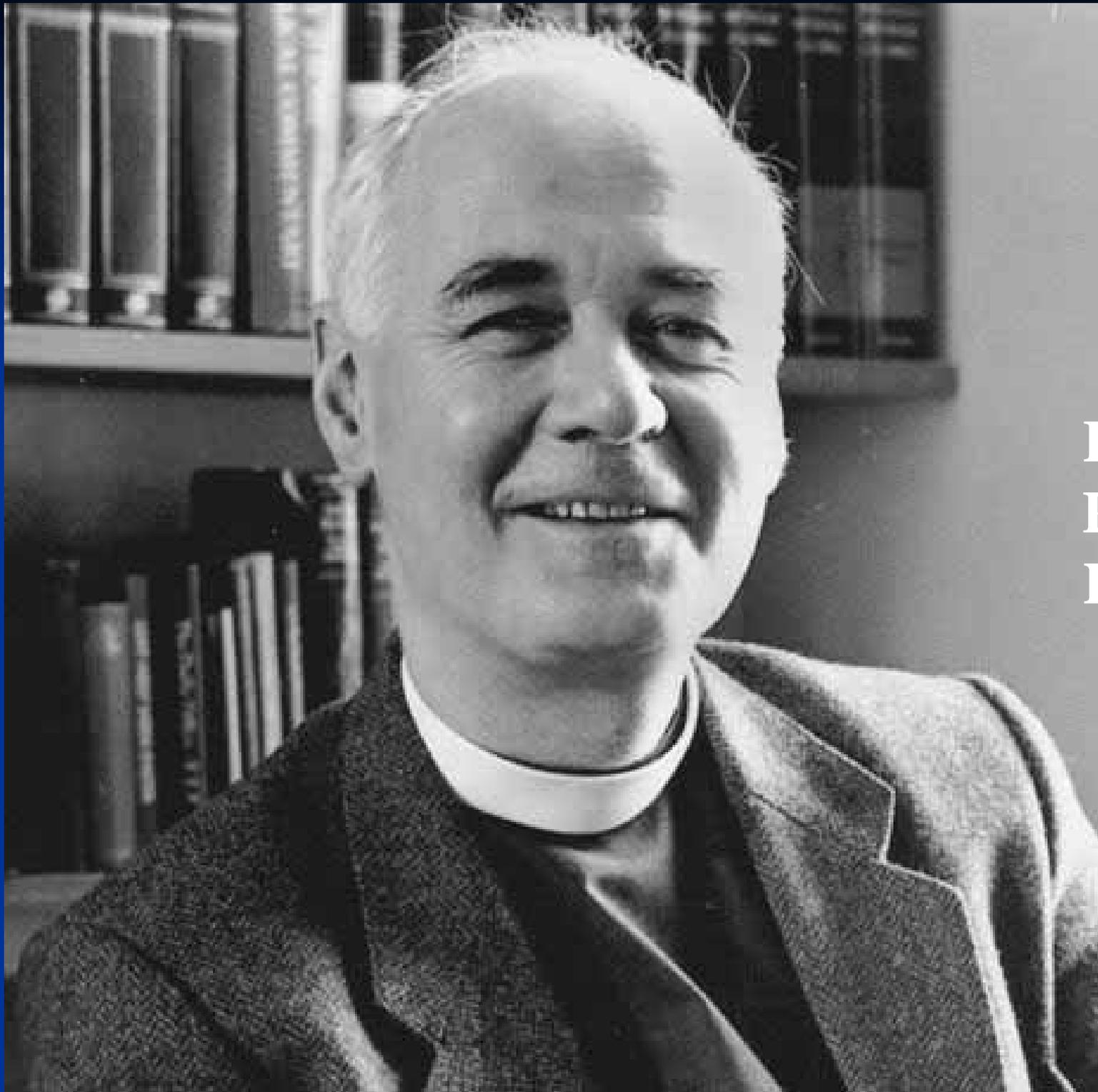
A CROSSROAD BOOK

Primary Reference

- **Quarks, Chaos, & Christianity. Questions to Science and Religion, Revised Edition**, John Polkinghorne, Crossroad, 2005

■ **The Rev. Dr. John Polkinghorne KBE, FRS:**

- **1955:** PhD physics from Cambridge University
- **1968:** full Professor of Mathematical Physics at Cambridge University
- published numerous papers on theoretical elementary particle physics
- **1974:** Fellow of the Royal Society
- **1979:** resigned his professorship in order to train for the Anglican priesthood
- **1981 to 1986:** served as a deacon, curate and vicar
- began writing numerous papers and books on interface between science and religion
- **1986:** Dean & Chaplain of Trinity College, Cambridge
- **1989-1996:** President of Queens College, Cambridge
- **1994-2005:** Canon Theologian of Liverpool Cathedral



**Rev. Dr John
Polkinghorne
KBE FRS**

Introduction

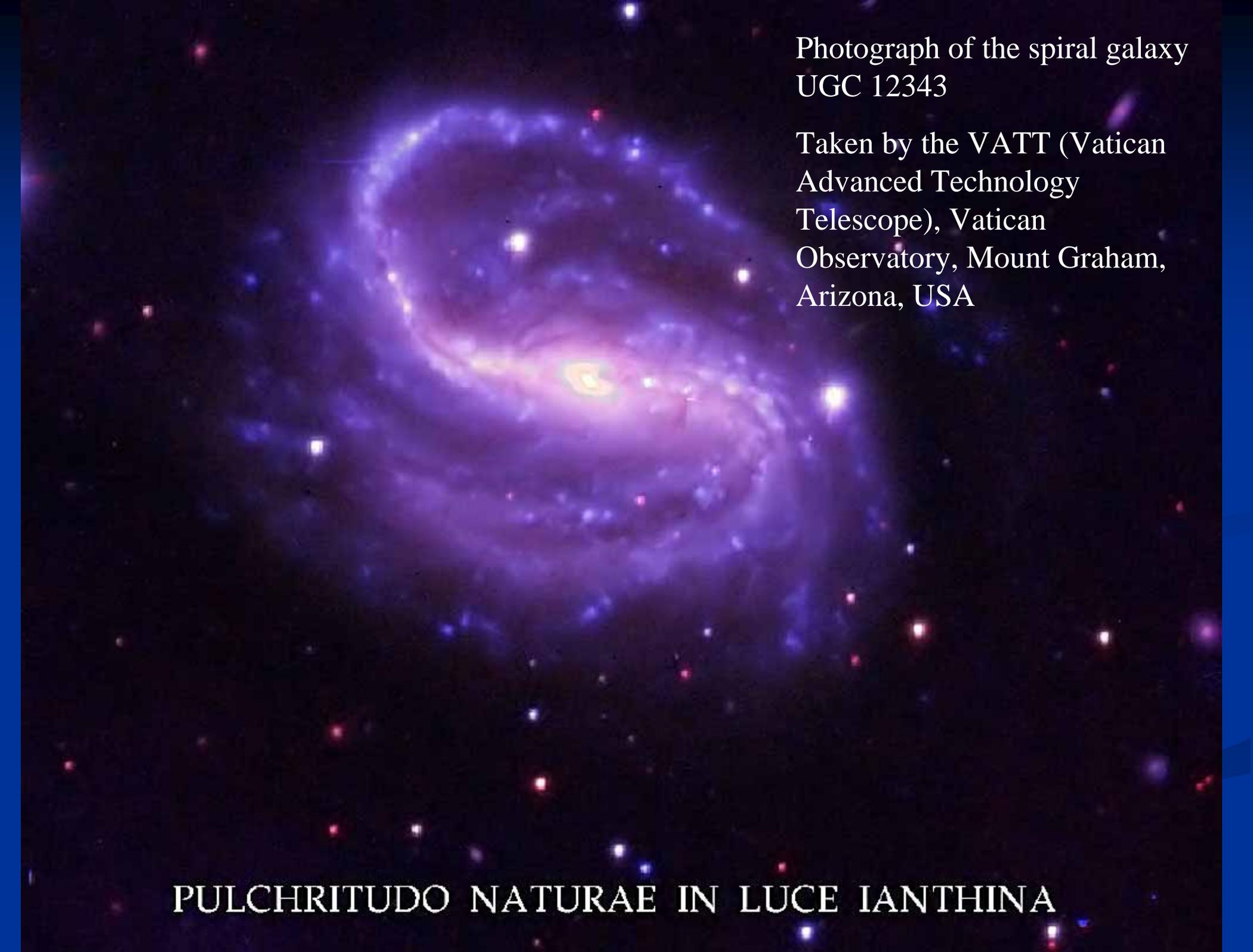
Science and Faith

Introduction

The Book of Nature

- Psalm 19:2: **The heavens speak of the Creator's glory and the sky proclaims God's handiwork**
- St. Paul (Romans 1:20 NRSV): **Ever since the creation of the world his eternal power and divine nature, invisible though they are, have been understood and seen through the things he has made.**
- The “Book of Nature” as well as the “Book of Scripture” can tell us about God.

PULCHRITUDO NATURAE IN LUCE IANTHINA



Photograph of the spiral galaxy
UGC 12343

Taken by the VATT (Vatican
Advanced Technology
Telescope), Vatican
Observatory, Mount Graham,
Arizona, USA

PULCHRITUDO NATURAE IN LUCE IANTHINA

Introduction

Is Anyone There?

- Last week we also discussed two questions about “the whole show” that arise out of science, but which science itself cannot answer.
 - 1. Why can we do science at all? Why are we capable of comprehending and appreciating the rationale beauty of the laws that govern the universe, when such knowledge goes far beyond what we need to survive?
 - 2. Why do we live in a universe whose laws are incredibly fine-tuned to produce life? (the **Anthropic Principle**)

Introduction

1. Why Can We Do Science At All?

- The rational beauty and transparency of the universe (the “reason without”) can be comprehended by us (the “reason within”) because they have a common origin in the reason of the Creator, who is the ground of all that is.
 - That is: humanity is made “in the image of God,” and this is why we can comprehend and appreciate the rationale beauty of God’s creation; this is why we can “do science.”

Introduction

2. Why Do We Live in a Universe Fine-Tuned for Life?

- There are two rational answers, *both* of which are “metaphysical” (*beyond* physics):
 - 1. There is a vast number of other universes, each with its own natural laws and circumstances. They are nearly all sterile and lifeless, but we happen to be in one that by sheer chance had the laws and circumstances to produce life.
 - 2. There is only one universe. It is fine tuned for life because it is the creation of a Creator who desires it to be fruitful of life.

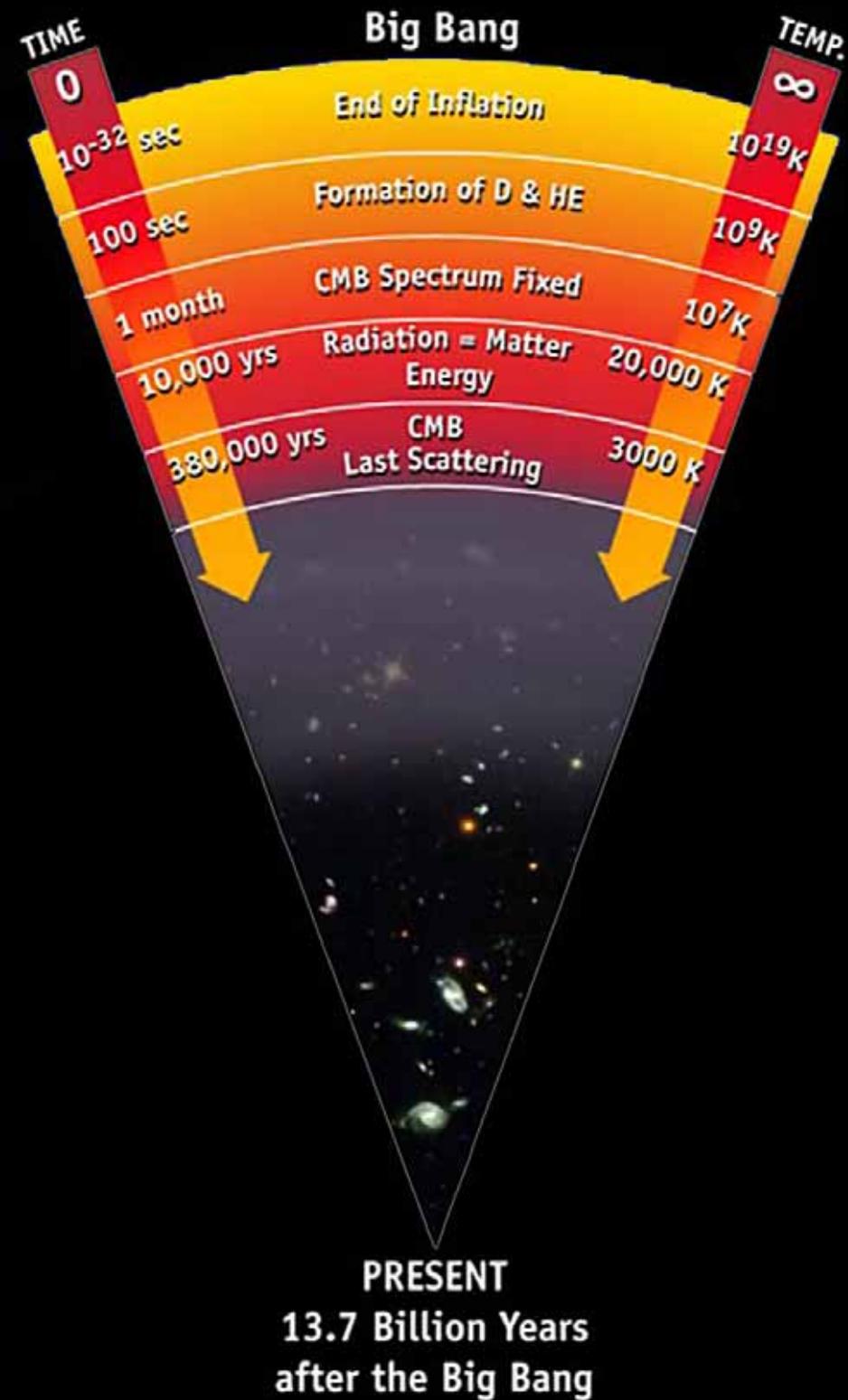
Introduction

Today's Topic

- What's Been Going On?

What's Been Going On?

**Is God Only a God of
Beginnings?**



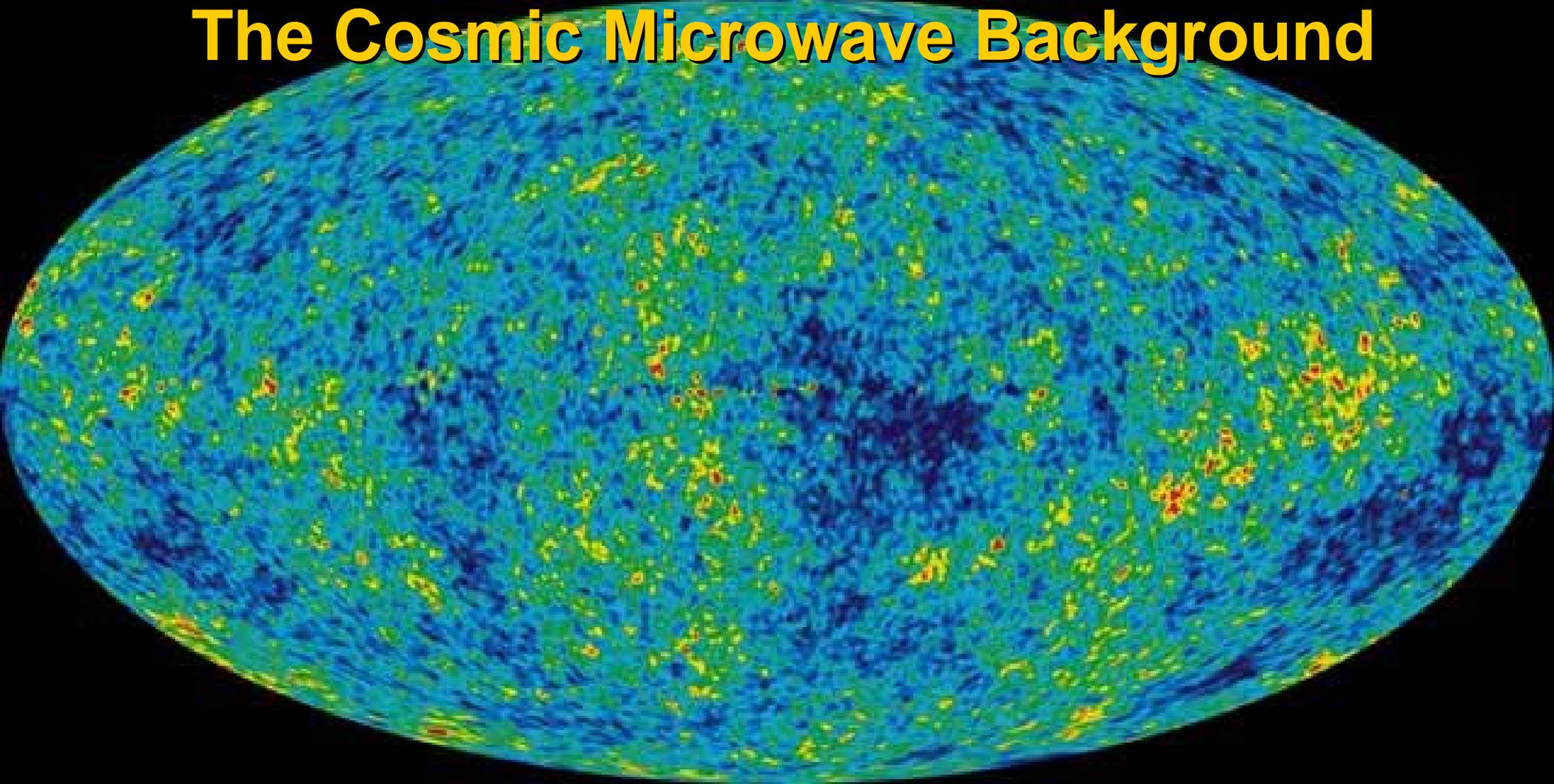
Only a God of Beginnings?

The Big Bang

- Science tells us the universe “began” 13.7 billion years ago

Only a God of Beginnings?

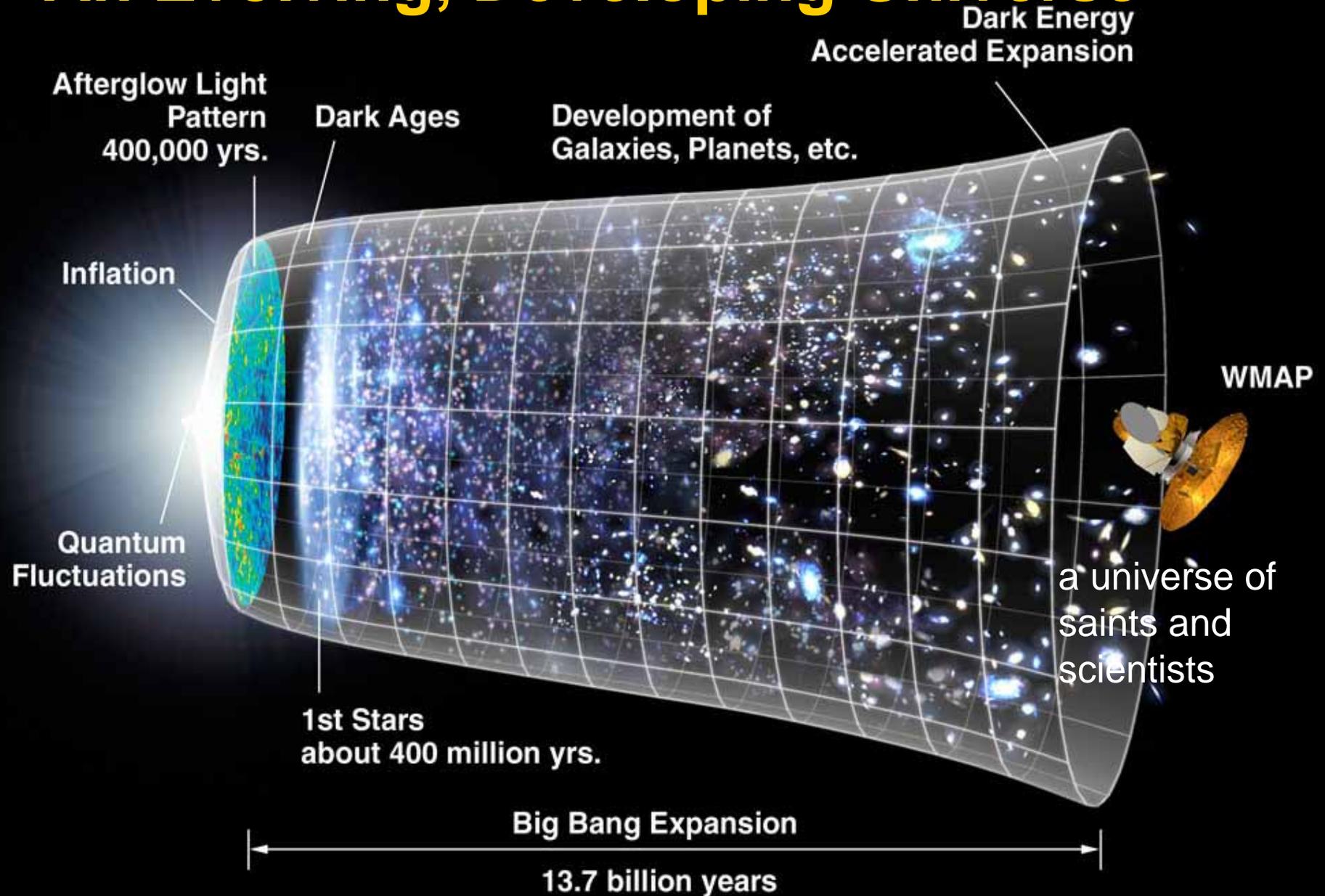
The Cosmic Microwave Background



The “Cosmic Microwave Background” = the red-shifted glow of the light that filled the universe 380,000 to 400,000 years after the “big bang,” as measured by the Wilkinson Microwave Anisotropy Probe (WMAP). The colors represent slight density fluctuations (variations of $< 0.001\%$) that would become the “seeds” for the formation of galaxies and clusters of galaxies.

Only a God of Beginnings?

An Evolving, Developing Universe



Only a God of Beginnings?

Creation = “Big Bang”?

- Genesis 1 and 2 are not a divinely guaranteed scientific textbook.
- They are theological writing, and their main purpose is to assert that all that exists does so because of the will of God (God said, “Let there be...”).
- Nonetheless, when science found the universe had a beginning with the “Big Bang”, many people of faith were quick to assert the Genesis account had been vindicated.



Only a God of Beginnings?

Creation = “Big Bang”?

- The “Big Bang” they asserted, was the moment God created the universe. God lit the “blue touch paper” of the Big Bang.

Only a God of Beginnings?

Creation = “Big Bang”?

- Polkinghorne suggests identifying creation with the “Big Bang” is a limited and ultimately *wrong* vision of “creation.”
- Consider:
 - St Augustine: The universe was made *with* time and not *in* time.
 - Einstein, in his Theory of Special Relativity, proved St. Augustine right by showing that time is a dimension intimately intertwined with the three dimensions of space, that the universe is best imagined as a single fabric of “space-time.”

Only a God of Beginnings?

Continuous Creation

- God is the creator and sustainer of the “whole show.”
 - Creator and sustainer = all that exists does so because of the will of God (God said, “Let there be...”)
 - The “whole show” = the entire space-time fabric of the universe.
- As long as time continues to be woven in the fabric of space-time, God’s **sustaining** of the universe is best considered another way of speaking of God’s **on-going creation** of the universe.

God’s sustaining of the universe = God’s continuous creation of the universe

Only a God of Beginnings?

Continuous Creation

- Polkinghorne:

“... creation isn't concerned with how things began, but with what's happening. God is as much the Creator today as God was fourteen billion years ago. The divine will holds the universe in being, and the divine mind and purpose are behind its evolving history. The Creator is the answer to the questions, “What's been going on?” and “What does it all mean?”

What's Been Going On?

Chance and Necessity

Chance and Necessity

An Evolving, Changing Universe

- What has been going on as the universe has evolved from an unimaginably hot plasma of quarks and gluons to a universe of galaxies, stars, planets, saints and scientists?
- The many processes involved in the evolution of this rich complexity have in common an interplay between what can be termed, in slogan form, “**chance and necessity**”.

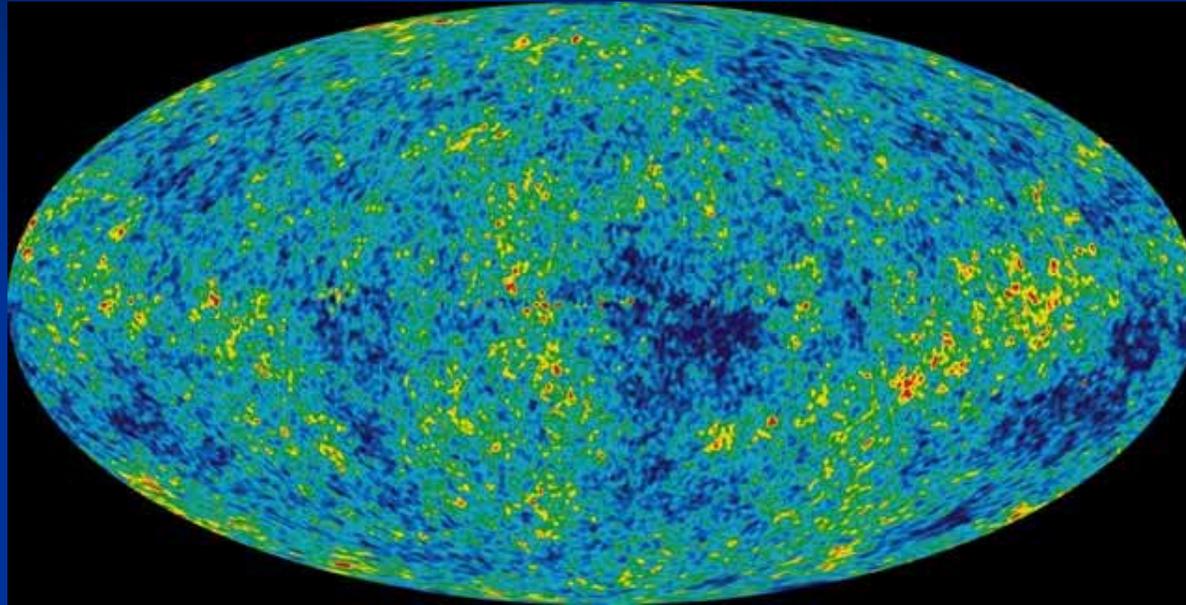
Chance and Necessity

An Evolving, Changing Universe

- **“chance”** = happenstance, the way things just happen to be, this way rather than that way
- **“necessity”** = the lawful regularity that governs how things develop

Chance and Necessity

Example: the Early Universe

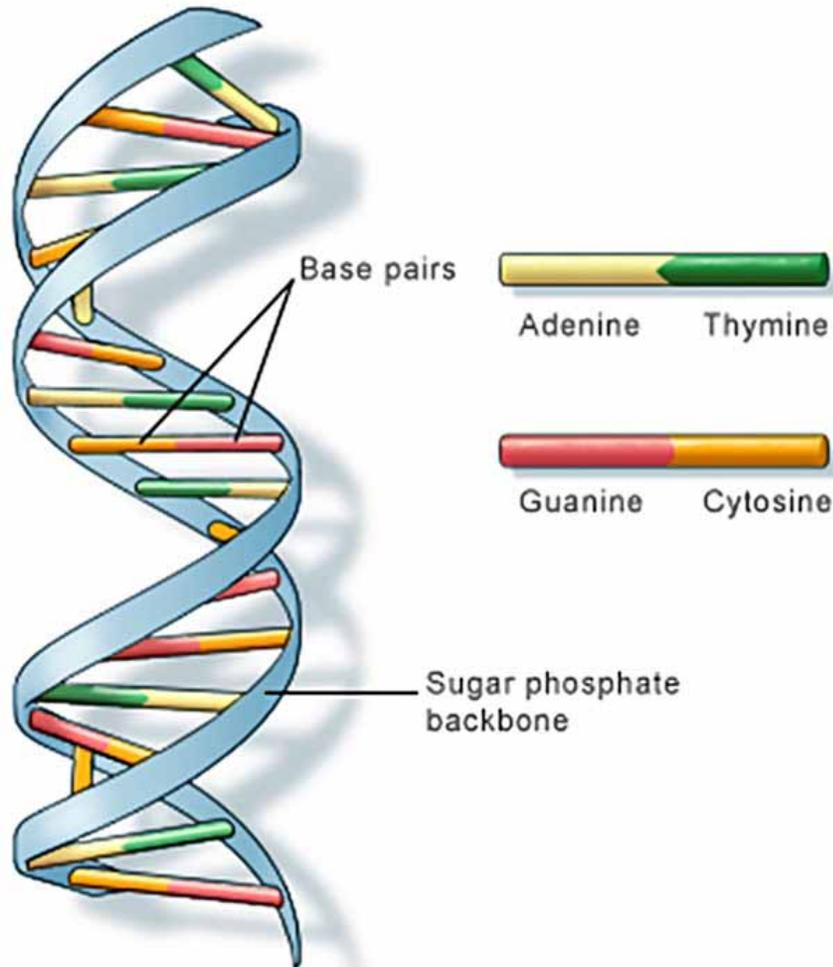


“Ripples” in the universe 380,000 years after the Big Bang

- The early universe wasn't completely smooth; there were ripples in which there was a bit more matter here than elsewhere. These fluctuations were **chance, happenstance**.
- They were augmented by **necessity**, the lawful force of gravity. A bit more matter exerted a bit more gravitational pull, which attracted a bit more matter in its turn.
- A snowballing process began by which the universe, after about a billion years, became lumpy with galaxies, and the galaxies became lumpy with stars.

Chance and Necessity

Example: Biological Evolution



U.S. National Library of Medicine

- In biological evolution, genetic mutations are **chance, happenstance**; they just occur from time to time.
- Through such chance mutations, new forms of life arise that are sifted and preserved by the **lawful necessity** of natural selection.

DNA molecule, carrier of genetic information

Chance and Necessity

Requirement for a Fertile World

- **Chance** is the engine of novelty. **Necessity** is the preserver of fruitfulness.
- A fertile world must be neither too rigid, nor too loose. It needs both **chance** and **necessity**.

Chance and Necessity

Chance versus Divine Purpose

- *Problem:* doesn't the role of chance deny the theological claim that universal history is the unfolding of a divine purpose?
- Nobel Prize-winning French biochemist Jacques Monod, in *Chance and Necessity* (1972), concluded **“man at last knows he is alone in the unfeeling immensity of the universe, out of which he has emerged by chance.”**
 - Monod concludes that because of the element of “chance” in the processes of the world, the universe's history must be a tale told by an idiot

Chance and Necessity

Chance versus Divine Purpose

- *An alternative interpretation:* when God came to create the world, the Creator faced a dilemma:
 - The natural gift of the **faithful** God would be **reliability** in the operation of creation
 - However, reliability by itself could lead to a clockwork world in which nothing really new ever happened.
 - God is also loving, and the natural gift of the **loving** God would be an **independence** granted to creation
 - “Letting-be” is an indispensable gift to give in the process of growing up
 - However independence on its own could degenerate into a world of disorderly chaos.

Chance and Necessity

Chance versus Divine Purpose

- The God who is both loving and faithful has given to creation the twin gifts of:
 - **independence**
 - **reliability,**reflected in the fruitful interplay of **chance** and **necessity** in evolving cosmic history.
- The shuffling operations of **happenstance** are thus a way of exploring and bringing to light the deep designed-in “anthropic” fruitfulness with which the physical world has been endowed.

Chance and Necessity

God's Relationship with Creation

- God's twin gifts of **independence** and **reliability**, reflected in the fruitful interplay of **chance** and **necessity** in the evolution of the cosmos:

What might this tell us about God's relationship with creation?

Chance and Necessity

God's Relationship with Creation

- Two extreme pictures of God's relationship to creation unacceptable to Christian theology:
 - 1. The universe is God's puppet theater, in which the Creator pulls every string and makes all creatures dance to the divine tune alone.
 - The God of love cannot be such a cosmic tyrant
 - 2. God is an indifferent spectator, who set it up and gave it a push and then left the universe to go on its own.

Chance and Necessity

God's Relationship with Creation

- An **evolutionary world** is understood theologically as a world allowed by the Creator to “make itself” to a significant degree.
- Cosmic history is *not* the unfolding of an inexorable divine plan.
- Yet Polkinghorne suggests, the universe's self-making takes place:
 - in a setting of finely tuned potentiality established by God, and
 - with God's continuous providential interaction with the universe through its history
 - How God might interact with the cosmos while maintaining God's twin gifts of reliability (reflected in “necessity”) and independence (reflected in “chance, happenstance”) is a topic we will explore in a couple weeks.

Chance and Necessity

God's Relationship with Creation

- God's general overall purpose, God's "vision" for creation are being fulfilled as the universe evolves.
- But God has given to the universe a range of potentiality, a range of options that it is free to choose from and "actualize" through the contingencies (the chance, happenstance) of history.
- The picture is of a world endowed with fruitfulness, guided by its Creator, but allowed an ability to realize this fruitfulness in its own particular ways.

What's Been Going On?

**The Problem of Evil and
Suffering**

Evil and Suffering

Evil in God's Creation

- A universe given the freedom to make itself through processes involving an interplay between **chance** and **necessity** will have rough edges:
 - The shuffling explorations of chance will lead to deterioration as well as fruitful novelty, to blind alleys as well as ways ahead.
- *We must ask:* Does a world with cancer and concentration camps really look like the creation of a powerful and loving God?

Evil and Suffering

Evil in God's Creation

- Two kinds of evil:
 - 1. **Moral Evil** = the chosen cruelties and neglects committed by human beings.
 - We generally explain this evil with the “**free will defense:**” the possibility of moral evil is the price that must be paid for the greater good of human freedom.
 - 2. **Physical Evil** = diseases and disasters that are our common lot.
 - The principal responsibility here is *not* ours.
 - To put it bluntly, surely the responsibility for physical evil rests with God, who created the world as it is.
 - What can we say in the Creator's defense?

Evil and Suffering

Free Will and Free Process

- The created order looks like a “package deal.”
 - *for example:* the same biochemical processes that enable cells to mutate, making evolution possible, are those that enable cells to become cancerous and generate tumors.
- God might have created a magic world in which there was divine intervention every time a cell looked like it was becoming malignant, or our hands got too near the dangerous fire.
- But such a magic world could not have been the home of morally responsible beings:
 - in such a world there would be no true consequences of our deeds.

Evil and Suffering

Free Will and Free Process

- But such a magic world could also not be the home of a universe allowed the freedom to make itself.
- On All Saints' Day in 1755 an earthquake in Lisbon caused the churches, filled to people, to collapse, killing fifty thousand people.
 - The Oxford theologian Austin Farrer once asked himself: what was God's will in the Lisbon earthquake?
 - His answer: God's will was that the elements of the Earth's crust should behave in accordance with their nature.
 - In other words, they are allowed to be in their own way, just as we are allowed to be in ours.
- This is the “**free process defense**” for physical evil.

Evil and Suffering

Free Will and Free Process

- But wait a minute – there may be some moral worth in allowing human beings freedom, but what’s the point in giving freedom for tectonic plates?
- *Polkinghorne*: “**We're characters in the cosmic play who have emerged from the scenery. Animate beings have evolved from inanimate matter, and our nature is tied to that of the physical world, which gave us birth. Once again, I suspect it is a package deal. Only a universe to which the free process defense applied could be expected to give rise to beings to whom the free will defense applies**”
- In other words, **moral and physical evil** are both the inescapable costs of a universe permitted by its Creator to be other than God, permitted to make itself and evolve fruitfully.

Evil and Suffering

The Mystery of Suffering

- When a young mother develops a terminal cancer, it is not a display of divine punishment, or of divine indifference.
- But the tragedy and suffering it causes is not alleviated by noting that the possibility of cancer is the price to be paid for the evolution of new life.
- The profound problem and mystery of suffering in God's creation remains.
- As Christians, we approach this mystery by noting that

Evil and Suffering

The Mystery of Suffering

- As Christians, we approach this mystery through the cross:
 - God is not just a compassionate spectator, looking down in pity on the bitterness of the world. God has been a fellow participant in the world's suffering
 - In the lonely figure hanging on the cross, we see God accepting suffering and embracing the bitterness of the world. God is not above us in our misery, but alongside us in its darkness.

Evil and Suffering

The Mystery of Suffering

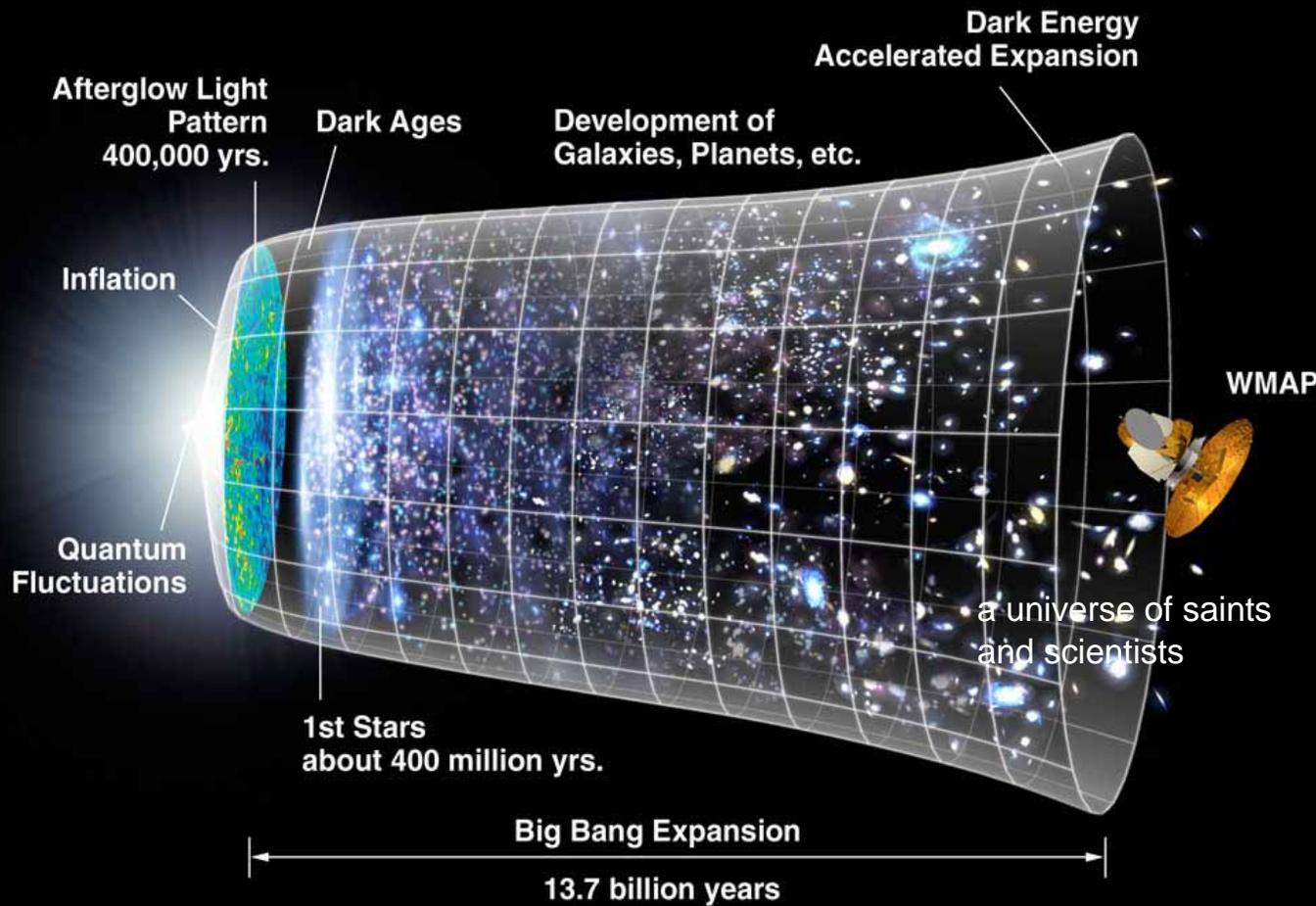
- In one of the concentration camps of World War II, a young Jewish boy hung, twisting and dying in a Gestapo noose.
- From the crowd of his fellow Jews, forced to witness the execution, came the cry, “Where is God now?”
- One of the crowd later wrote he felt inside him the answer, “He is here, hanging in the noose.”
- This insight of God as fellow sufferer is also the Christian insight to the mystery of suffering.

What's Been Going On?

Summary

What's Been Going On?

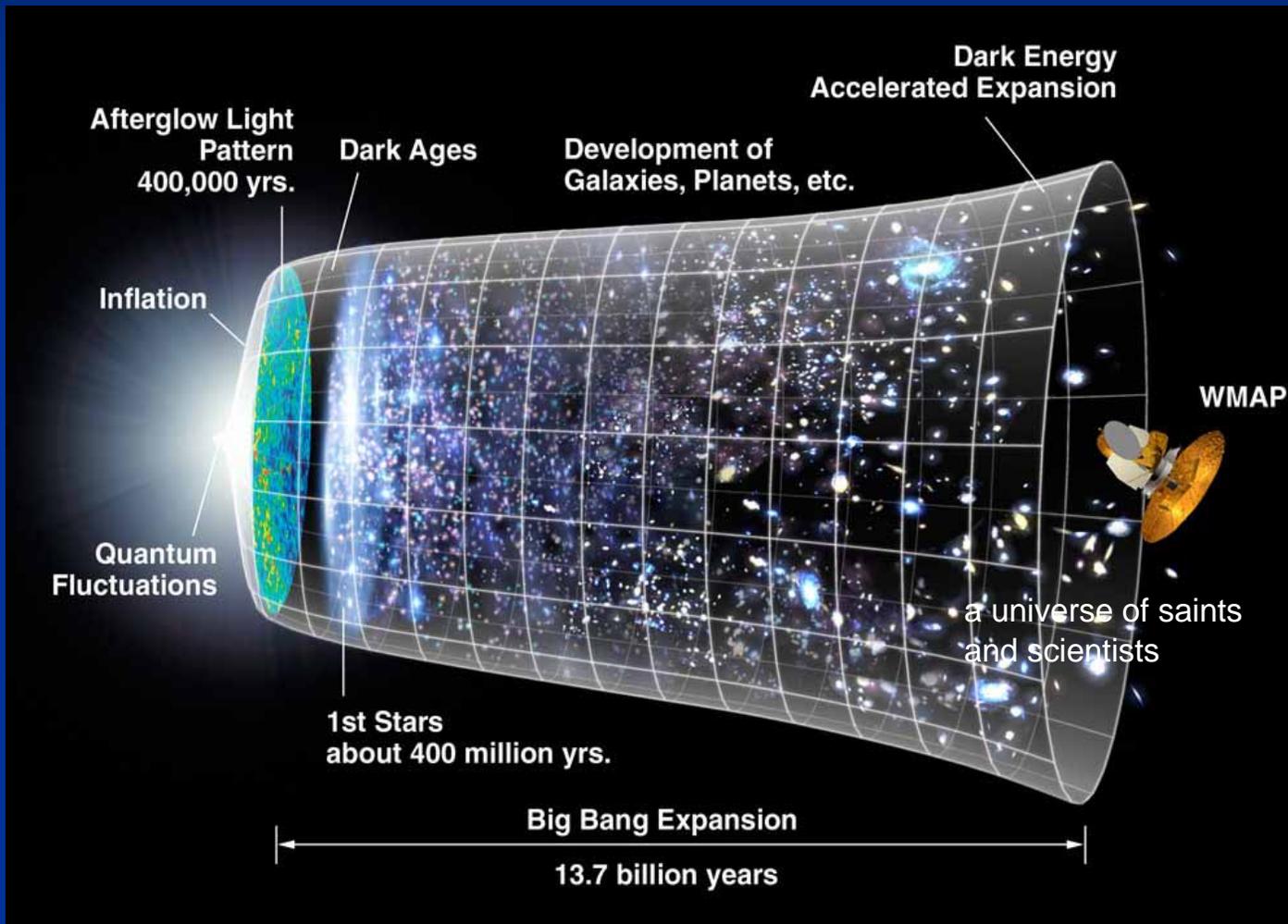
A Universe of Space and Time



13.7 billion years ago God began to create and sustain the universe of space and time

What's Been Going On?

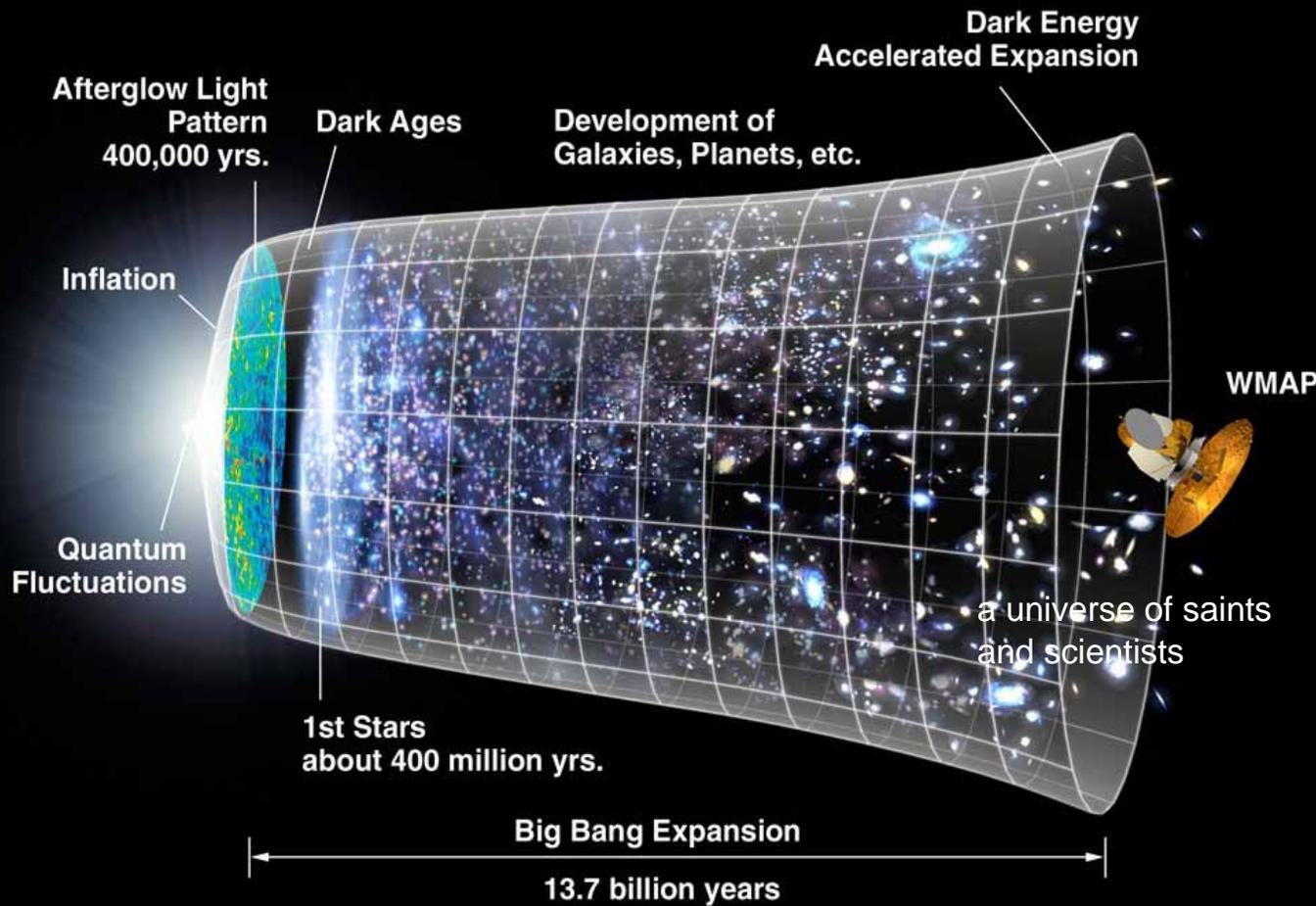
A Universe Other Than God



It is a developing, evolving universe, given by faithful and loving God the twin gifts of reliability and independence so it could be other than God, so it could make itself, be fruitful.

What's Been Going On?

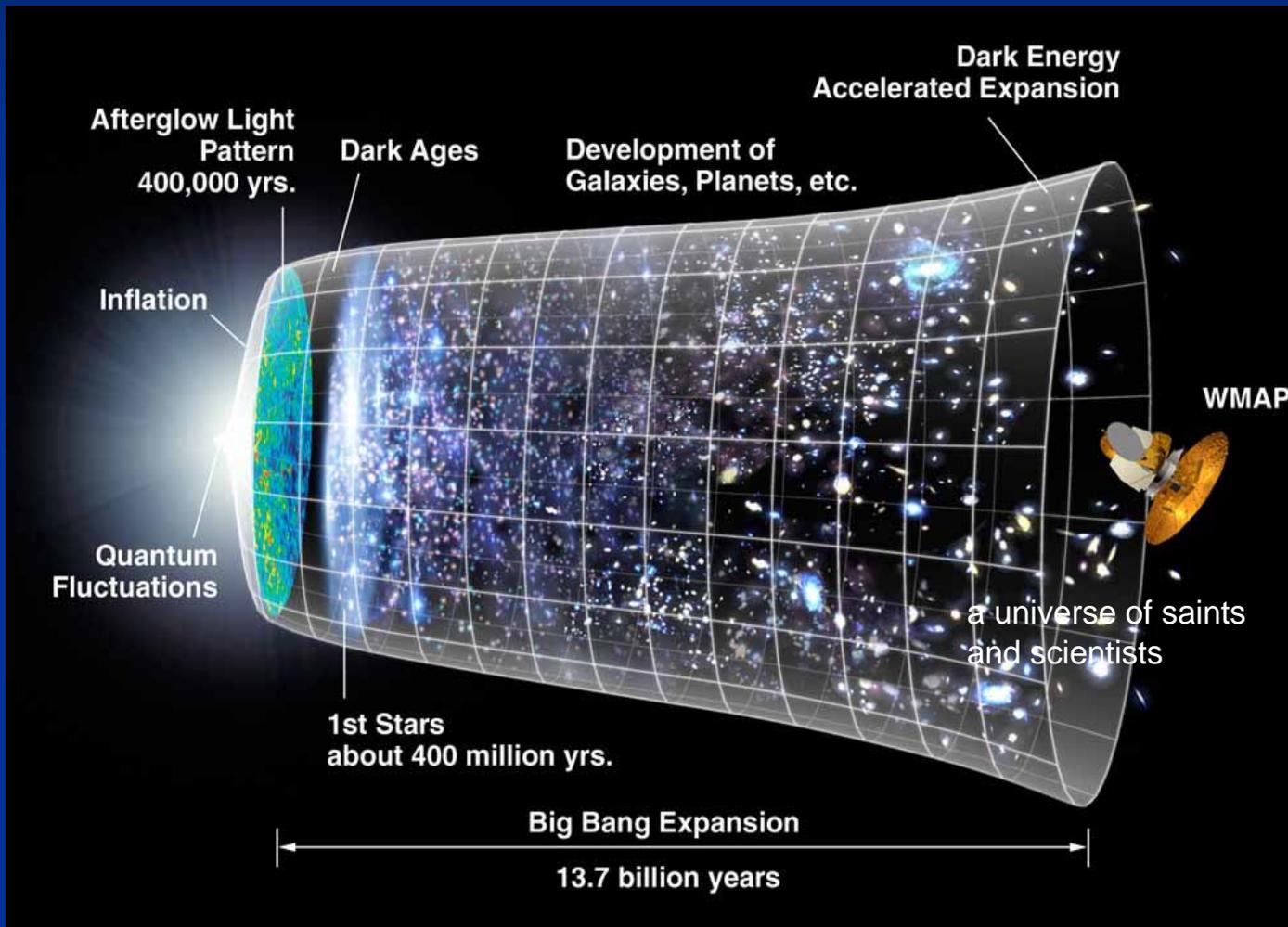
An Evolving, Fruitful Universe



In 13.7 billions years, it has evolved from an unimaginably hot plasma of quarks and gluons to a world of galaxies, stars, planets, saints and scientists.

What's Been Going On?

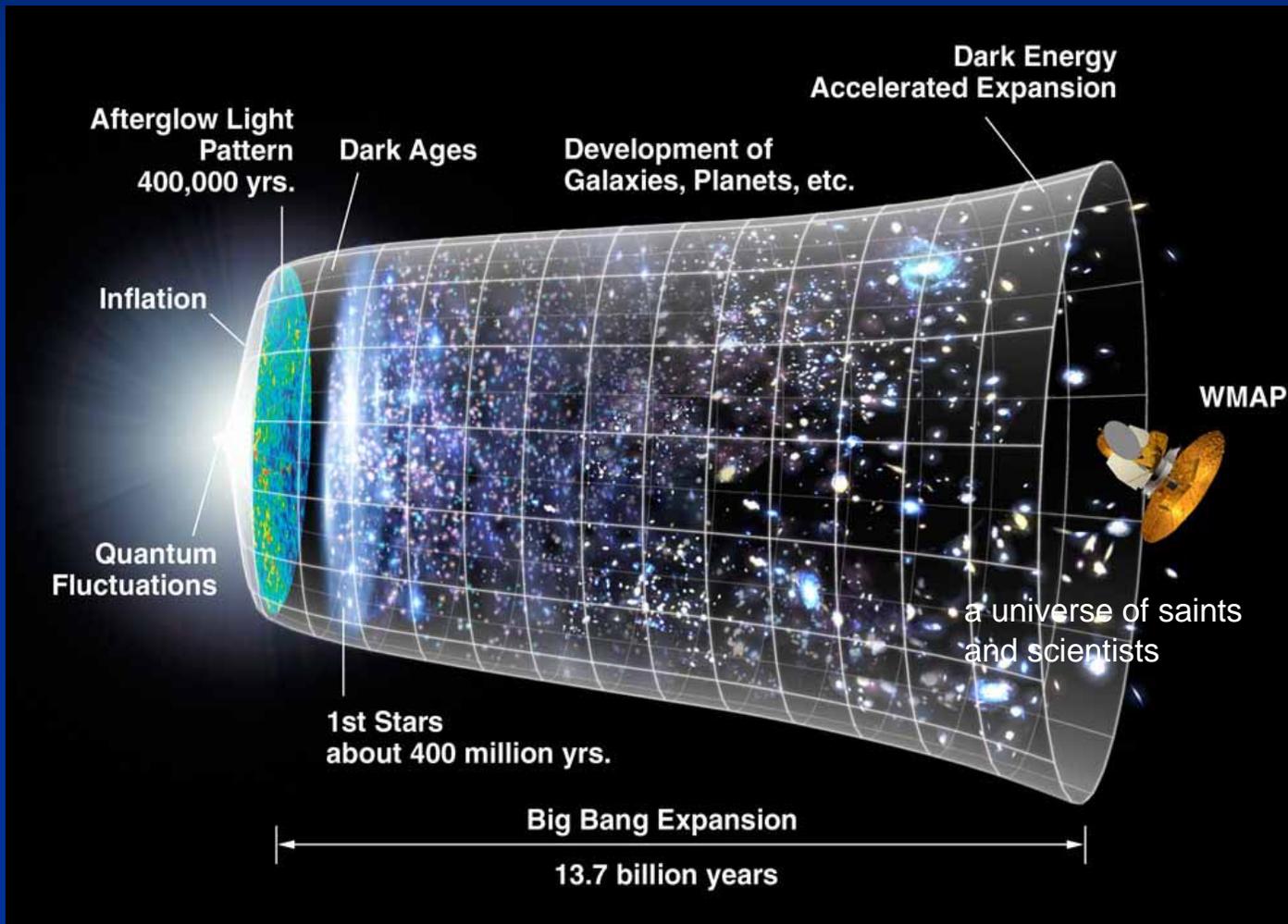
A Universe Making Itself



It has evolved through processes involving the fruitful interplay of **chance** and **necessity**, within a range of potentialities defined by its Creator, and with providential interactions of its Creator through history.

What's Been Going On?

A Universe of Rough Edges



Its freedom to make itself necessarily includes the rough edges of **moral and physical evil**, the prices that must be paid for the greater good of **free will** and **free process**

Topics

Quarks, Chaos, and Christianity

- **Jan 6:** Is Anyone There?
- **Jan 13:** What's Been Going On?
- **Jan 20:** *Annual Parish Meeting*
- **Jan 27:** Who are We?
- **Feb 3:** Prayer and Miracles
- **Feb 10:** How Will It End?