

# **Science, Religion and Spirituality**

## **Scientific Progress**

# Science, Religion and Spirituality

---

## Scientific Progress

- Modern science is < 500 years' old (1500 AD)
- Rapid advances in engineering, medicine, exploration, mining, buildings, machinery, transportation, printing, arts, music
- Steam engine, Industrial revolution

# Science, Religion and Spirituality

---

## Science in 1900

- Much progress, yet many aspects not well-known
- Many physicists did not believe that atoms existed!
- They didn't believe that any other galaxy other than Milky Way existed!
- By 1950, atoms were accepted as the smallest particles (nothing 'smaller than atoms' exists!)
- Yet we know today all of the above are wrong!
- As 'new ideas' emerge, 'old' gets discarded! (this is how science progresses)

# Science, Religion and Spirituality

---

## Presence of Ether in Universe

- Aristotle (384-322 B.C.) explained that 'ether' is present in universe, in fact 80 to 90% of universe is ether.
- This allowed science to proceed with electromagnetic waves, as waves cannot travel in 'empty space' but can in 'ether'
- Morley-Michelson experiments in 1887 shocked scientists by claiming 'no ether'! – 'new replaces old'
- Einstein used the 'no ether' theory' to develop 'special theory of relativity'

# Science, Religion and Spirituality

---

## Origin of Universe Theories:

- There are “several” origin of Universe Theories!
- We ask, ‘How is this possible?’
- We believe (or have believed) almost always that science has a theory, well validated and well accepted by all scientists. However, facts state otherwise!
- Difficult questions have ‘no single answer’ & if there is, it is ‘not yet discovered’!

# Science, Religion and Spirituality

---

- String Theory, considered by many as a leading candidate for a quantum theory of gravity, has many opponents!
- Some scientists are led to theories of ‘many universes’ (or ‘many regions’ in a universe where, in each region, a different theory operates!)
- There are two kinds of many-universe theories!

# Science, Religion and Spirituality

---

## **New theories needed:**

- We need a theory that combines Einstein's theory of relativity and quantum theory (which governs the micro world of sub-atomic particles).
- In other words, while there are various theories of origin of universe, none of these theories are accepted by all scientists.
- Big Bang theory has largest followers

# Science, Religion and Spirituality

---

## Planck Length

- The Planck length is the scale at which classical ideas about gravity and space-time cease to be valid, and quantum effects dominate. This is the ‘quantum of length’, the smallest measurement of length with any meaning.

And roughly equal to  $1.6 \times 10^{-35}$  m or about 10-20 times the size of a proton.



# Science, Religion and Spirituality

---

## Planck Time

- The Planck time is the time it would take a photon traveling at the speed of light to across a distance equal to the Planck length. This is the 'quantum of time', the smallest measurement of time that has any meaning, and is equal to  $10^{-43}$  seconds. No smaller division of time has any meaning.
- Within the framework of the laws of physics as we understand them today, we can say only that the universe came into existence when it already had an age of  $10^{-43}$  seconds.

# Science, Religion and Spirituality

---

- Estimated age of Universe – 13.6 billion yrs ( $8 \times 10^{60}$  Planck units of time). This is also equal to  $4.3 \times 10^{17}$  seconds.
- Some other estimates vary from 8 to 14 billion years!

# Science, Religion and Spirituality

---

- Planck Time and Inflationary Epoch (of Guth) form basis of the Expanding Universe Theory
- Hertle-Hawking 'wave-function of the universe' predict (or assume) that Big Bang was really the origin of time.
- Others predict that there was a Universe before the Big Bang and what happened then determined the properties of the universe that emerged from the Big Bang.

# Science, Religion and Spirituality

---

- Science - Origin of Universe – The ‘inflationary model’ by Alan Guth of Stanford (1979)
  - ‘inflationary epoch’ which lasted only from about  $10^{(-37)}$  sec. to  $10^{(-34)}$  sec. after the ‘big bang’, cosmos expanded by a factor of  $10^{(+50)}$ . - enormous expansion indeed!

# Science, Religion and Spirituality

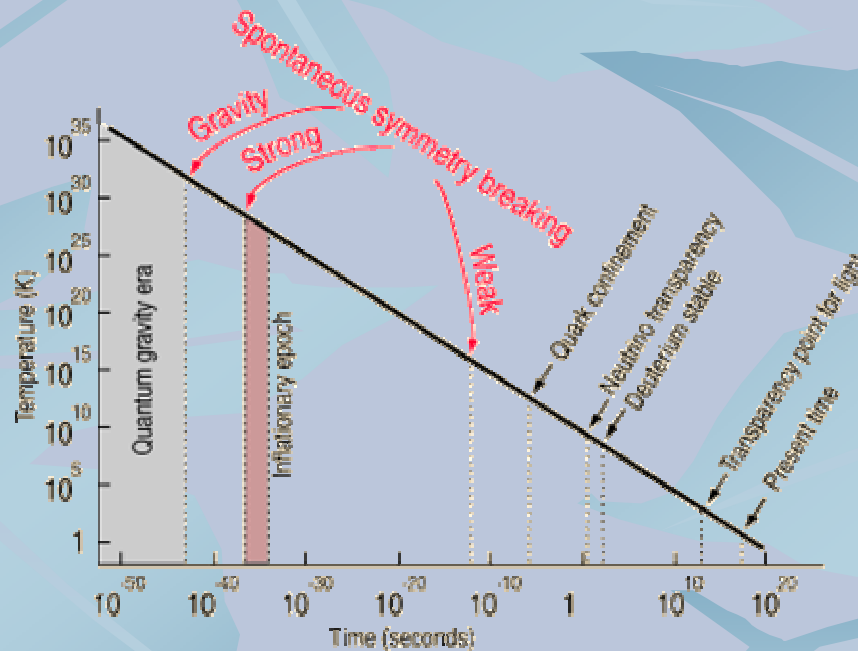
---

## Big Bang Time Line

- Cosmological models of the "Big Bang" expansion of the universe have converged on a general framework in time, energy, and temperature. Below is an attempt to show some of the features of the models on a time line.
- The later parts of this time line follow the chronology suggested by Steven Weinberg in "The First Three Minutes". The models are extended to earlier times back to the Planck time when the unification of all the fundamental forces is presumed. In order to deal with some problems with the standard big bang model, Guth introduced the idea of an extraordinarily rapid inflationary epoch. Along the time line there are three spontaneous symmetry breaks which separate the unified force into the four fundamental forces operating in today's universe.

# Science, Religion and Spirituality

- Relationship between temperature and expansion time.



# Science, Religion and Spirituality

---

- Early universe chronology - Unification of the fundamental forces
- **Inflationary Period**
- Triggered by the symmetry breaking that separates off the strong force, models suggest an extraordinary inflationary phase in the era  $10^{-36}$  seconds to  $10^{-32}$  seconds. More expansion is presumed to have occurred in this instant than in the entire period ( 14 billion years?) since. The inflationary epoch may have expanded the universe by  $10^{20}$  or  $10^{30}$  in this incredibly brief time. The inflationary hypothesis offers a way to deal with the horizon problem and the flatness problem of cosmological models.

# Science, Religion and Spirituality

---

- Lemonick and Nash in a popular article for Time describe inflation as an "amendment to the original Big Bang" as follows: "when the universe was less than a billionth of a billionth of a billionth of a second old, it briefly went through a period of supercharged expansion, ballooning from the size of a proton to the size of a grapefruit (and thus expanding at many, many times the speed of light). Then the expansion slowed to a much more stately pace. Improbable as the theory sounds, it has held up in every observation astronomers have managed to make."



# Science, Religion and Spirituality

---

## Quark-antiquark Period

- As the inflationary period ends, the universe consists mostly of energy in the form of photon, and those particles which exist cannot bind into larger stable particles because of the enormous energy density. They would exist as a collection of quarks and antiquarks along with their exchange particles, a state which has been described as a "sizzling sea of quarks". This time period is estimated at  $10^{-32}$  seconds to  $10^{-5}$  seconds. During this period the electromagnetic and weak forces undergo the final symmetry break, ending the electroweak unification at about  $10^{-12}$  seconds.

# Science, Religion and Spirituality

---

## Quark Confinement

- When the expansion of the "primordial fireball" had cooled it to  $10^{13}$  Kelvin, a time modeled to be about  $10^{-6}$  seconds, the collision energies had dropped to about 1 GeV and quarks could finally hang onto each other to form individual protons and neutrons (and presumably other baryons.) At this time, all the kinds of particles which are a part of the present universe were in existence, even though the temperature was still much too high for the formation of nuclei. At this point we can join the standard "big bang" model as outlined by Steven Weinberg in *The First Three Minutes*.

# Science, Religion and Spirituality

---

- Standard cosmology: from about 0.01 sec after Big Bang to present day. Excellent observational tests to confirm various postulates in this epoch.
- Particle cosmology:  $10^{11}$  to  $10^2$  period after Big Bang. Speculative than previous period
- Quantum cosmology: From Planck time  $10^{-43}$  to  $10^{-11}$  time period. Very speculative.

# Science, Religion and Spirituality

---

- Chronology of the Universe:
  - $1 \text{ GeV} = 10^{12}$  kelvin
  - 1. Planck epoch: The quantum gravity barrier  
 $t = 10^{-43}$  sec.  
Temp =  $10^{19}$  Gigaelectronvolts (GeV)
  - 2. Grand Unification transition  
 $t = 10^{-35}$  sec.  
Temp =  $10^{15}$  Gigaelectronvolts (GeV)

# Science, Religion and Spirituality

---

- 3. Electro Weak transition  
t =  $10^{**(-11)}$  sec.  
Temp =  $10^{**(3)}$  Gigaelectronvolts (GeV)
- 4. Quark-Hadron transition  
(Hadrons form protons and neutrons)  
t =  $10^{**(-6)}$  sec.  
Temp = 1 Gigaelectronvolts (GeV)

# Science, Religion and Spirituality

---

- 5. Nucleosynthesis  
(Light elements created)  
 $t = 1 \text{ sec. to } t = 3 \text{ minutes}$   
Temp = 1 MeV
  
- 6. Matter domination  
(Onset of gravitational instability)
- 7. Recombination  
(Relic radiation decouples)  
 $t = 400,000 \text{ years}$   
Temp = 3,000 K (1 eV)

# Science, Religion and Spirituality

---

- 8. Galaxy Formation  
(Epoch of gravitational collapse)

- 9. Today  
Life on earth  
Solar system  
Quasars  
 $t = 13$  Billion Years  
Temp = 3K ( 1 meV)

# Science, Religion and Spirituality

---

- Scientific exactness in ‘origin of universe’ or ‘many universes’ and other theories may be luxury!
- Science may have to yield ground to philosophers, and/or meta-physicists, on matters like “why anything exists, why there is a universe or multi-verse, rather than nothing”!
- In that sense, spirituality’s theories of ‘origin of universe’ must also be considered and not dismissed outright.
- Our Rishis’ conclusions may not thus be far off!!



# Science, Religion and Spirituality

---

## Our Rishi's Time Calculations and Present Time

- Three hundred and sixty-five days constitute one 'human' year.  
This constitutes 'one Deva day' or also known as "one Divya day'
- Three hundred and sixty 'Deva' or 'Divya' days constitute one "Deva year" or "Divya Year".  
(Thus, one "Deva Year" is equal to 360 'human years').

# Science, Religion and Spirituality

---

- There are four Yugas:
  - the Kritha Yuga,
  - the Thretha Yuga,
  - the Dwapara Yuga, and,
  - the Kali Yuga.

Together these constitute one “Chathur Yuga” (‘Chathur’ is a Sanskrit word that means four). The Kritha Yuga consists of 4,800 Deva years, the Thretha Yuga of 3,600 Deva years, the Dwapara Yuga of 2,400 Deva years and the Kali Yuga of 1,200 Deva years. Thus the Chathur Yuga has 12,000 deva years or 4,320,000 human years (4.32 Million human years), since each Deva Year is equal to 360 human years.

# Science, Religion and Spirituality

---

- 1,000 of these Chatur Yugas constitute a single day-time for Lord Brahma. Thus, Brahma's single day-time is equal to 4.32 Billion human years. At the end of his day-time, Lord Brahma starts to go to sleep (His night-time) which lasts another 1,000 Chatur Yugas (equal to another 4.32 Billion human years). The day time of Brahma and also His night time, each of 1000 chatur yuga, are known as 'Kalpam'. When Lord Brahma goes to sleep, the world is in a deluge of water that submerges the whole world or this is also known as "Pralayam" (which lasts for 1,000 chatur yugas).

# Science, Religion and Spirituality

---

- The daytime of Brahma of 4.32 Billion human years is the active period of life in universe!
- Beginning with the night time of Brahma (4.32 Billion years of darkness or no activity) followed by the next daytime of Braham of 4.32B years for a total of 8.64 B years is thus the lifetime of Universe (as against the science estimation of about 13 B years since origin of Universe with another 4 to 5 B years of life for Sun before it burns out – thus a total of nearly 18B years according to science!)

# Science, Religion and Spirituality

## ■ Comparison “Science” vs. “Vedic Rishis”

Origin	13 billion yrs *	5 to 6 b yrs
Time left	5 billion yrs	2.5 b yrs
Earth	4.6 b yrs ago	2.3 b yrs ago
Theory	Big bang	Projected out of Para Brahma

Before BigBang

?

Para Brahma  
alone existed always

\* 13.7 billion years (May 2009, Wendy Freeman, Director of Carnegie Observatories, Pasadena, CA, computed using the ‘accurate’ Hubble constant newly computed by her and her co-workers)

# Science, Religion and Spirituality

---

- Carl Sagan – Astro-physicist
- Hindu philosophy on the creation and dissolution of the Cosmos is the only philosophy that comes closest to the scientific idea that the Cosmos itself undergoes deaths and rebirths.
- Sagan also has stated that the Vedic Rishis are right, their computations of the time period of universe seem to be close to scientific ideas.