Ettinger Journals

Timelines Utilized by Ettinger Journals

The Moon Enigma By Douglas B. Ettinger

Douglas B. Ettinger
8/14/2012

Timelines Utilized by Ettinger Journals

I. Table of Contents

A. Table of Tables

II. Introduction

The concept of time is relative. Time can be based on many different periodic and repetitive events such as the Earth orbiting the Sun, the Moon orbiting the Earth, the rotation of the Earth, and even electrons orbiting around different atomic nuclei. Timelines are based on a large amount of data that must agree and fit within other developed timelines. A good example is the agreement for determining long range climatic changes in which tree rings studied are compatible with seafloor sediments studies. For astrophysics the model for the time spans of a star's core burning phases must agree reasonably well with expected galactic evolution and the measured ages of the universe, the Milky Way galaxy, and the solar system.

Any concept that causes a conundrum with timelines must be re-evaluated. A study of timelines can reveal unexpected causes and effects. The following compendium of timelines is utilized in these journals. Much of the data which has been re-arranged comes from Wikipedia subjects that are listed below:

1. Timeline of the Big Bang
2. Galaxy formation and evolution
3. Geologic time scale
4. Description of each of the ancient super-continents
5. Continental drift
6. Timeline of glaciation
7. Marine isotope stage
8. Phanerozoic climate change
9. CO_2 glacial cycles
10. Radiometric dating
11. Geomagnetic reversals
12. List of largest volcanic eruptions
13. List of impact craters on Earth
14. Descriptions of various large impacts
15. Tectonic Global Reconstruction
16. Genus extinction intensity
17. Biodiversity during the Phanerozoic
18. Dating data for the solar system, Earth, Moon and meteorites.

Some of the timeline constructions are completely original such as the "Evolution of Star Masses for Elliptical and Spiral Galaxies", "Archetypical Phases of an Evolving Super-massive Star", and the "Genus Extinction Intensity Relation of Earth's Catastrophic Events". Seeing the entire swath of important timelines together helps to form a video in your mind about our ever-changing universe and how they can definitely affect mankind.

III. Timelines

A. Listing of Celestial Timelines

1. The Creation of the Largest Structures in the Universe from the Big Bang Primordial Elements to Planet Earth

The following table reveals the major milestones of our Universe starting from the nucleosynthesis of hydrogen and helium after the Big Bang coming forward to the time that Earth's continents were created after a major collision. These major milestones are the forming of primitive globular clusters, elliptical galaxies, groups/clusters of galaxies, spiral galaxies, and closer to home – our very own Milky Way Galaxy, our Sun, Earth, and the Moon. These times are revealed by the study of isotope ages and radiometric studies of the solidification of rocks in our solar system. The accuracies are in billions or millions of years, but are certainly adequate to reveal the sequence of events and the relative spans between events.

Table A – Listing of Celestial Timelines

Event	BYA
Best current estimate for the age of the universe	13.75 $\pm$ 0.11
Primordial nucleosynthesis of H and He begins 10 seconds to 380,000 years later	13.7496
First stars form from primordial elements between 150 million to 1 billion years later	13.74-12.75
Primitive globular clusters of stars begin forming	13.00-12.75
First stars explode to create less massive, more stable stars every 6 to 10 million years during a span of about 1 billion years	12.75-11.75
Most globular clusters join to form elliptical galaxies that gather more primordial elements	12.75-9.75
Galaxies form into groups, clusters, and super-clusters caused by gravitational attractions	11.00 to present
Formation of spiral and irregular galaxies including the Milky Way begins with the collisions of elliptical galaxies	10.00 to present
The galactic disk of the Milky Way forms over a span of 2 billion years	8.80 $\pm$ 1.7
The mixing of primordial material surrounding the galaxies after collisions continues to create Population III stars that in turn create active starburst regions. Spiral galaxies eventually evolve into system of mostly Pop. I and Pop. II stars	10.00 to present
Either a super-massive Pop. II star inside an H II region or a Pop. III star inside a cluster of Pop. II stars is born and dies	7.00-4.5684
A supernova remnant is created that provides seeds for the Sun, a Pop. I star, and its planets	4.5683-4.5682
A proto-star disk is formed that creates a proto-star, captures planets, and is evacuated by the solar winds of the new hydrogen-burning star	4.5682-4.5681
The Sun joins the main sequence with a pristine planetary system	4.5680
The Earth forms a solid crust	4.540 $\pm$ 0.05
The Moon forms a solid crust	4.527 $\pm$ 0.01
Gaia (Earth) collides with a planet-size impactor and knocks Earth inward to share the Moon's orbit	4.1-4.0
The Late Heavy Bombardment (LHB) occurs within the inner solar system	4.1-3.9

1. Estimated Star Lifetimes

The lifetime (τ_{ms}) of a star on the main sequence is highly dependent on its mass. The amount of time it takes a star to die in each of the stages of a red giant, luminous blue variable, Wolf-Rayet phase, and supernova are insignificant. The equation for a star's lifetime for masses less than 50 solar masses is given by:

$$\tau_{ms} = 10^{10} \text{ years } (M/M_{\odot})\,(L_{\odot}/L) = 10^{10}\,(M/M_{\odot})^{-2.5}$$

The table below lists the $M/M_{\odot}$ ratio verses the lifetime, τ_{ms} . The lifetimes for very super-massive stars above 50 to 60 solar masses are estimated to be 6 to 10 million years.

Table B - $M/M_{\odot}$ Ratio vs. Star Lifetimes

$M/M_{\odot}$	Star Type	τ_{ms} (Years)
< 250 to 130	Have true pair-instability supernovae	≈ 10 x 10^6
< 130 to 100	Have partial pair-instability collapsing to normal SN	≈ 10 x 10^6
<100 to 60	SN Type-Ibc preceded by LBV and WR star	≈ 10 x 10^6
60	O-type (spectral type)	2.0 billion
40	O-type	2.3 billion
<25	No longer has a WR star phase; O-type	2.7 billion
18	B-type (spectral)	3.0 billion
9	Minimum for Type II SN	4.0 billion
3	A-type (spectral)	6.0 billion
1.0	G-type (spectral)	10 billion
0.8	K-type (spectral)	11 billion
0.5	M-type (spectral)	13 billion

The table above and information from the next table are used to generate the evolution of star masses. This evolutionary process is dependent on the initial distribution and initial size of stars and a possible scenario for how galaxies interacted and evolved themselves. This very speculative table attempts to show how stars both keep decreasing in size and increasing their lifetimes since smaller masses greatly slow down nuclear reactions inside the star. The estimated sizes and distributions of new stars after supernovae occur is guesswork, but probable within a reasonable error range based on the sizes of the first stars and the size distribution of stars today.

2. Core Burning Process for a 25 Solar Mass Star

Much useful information is provided by a model of star evolution and its nucleosynthesis for a 25 solar mass star. A table shows the various fusion phases, fuel, main products and duration for burning. The table reveals how the onion-like layers of a massive star are created. This table also indicates the layering of the different radially outward-moving clouds or shock fronts created from the stellar winds and/or the subsequent eruptions.

Table C - Core Burning Process for a 25 Solar Mass Star

Process	Main fuel	Main products	Duration
Hydrogen burning (via CNO cycle)	Hydrogen	Helium	10^7 years
Triple-alpha process	Helium	Carbon, oxygen	10^6 years
Carbon burning process	Carbon	Ne, Na, Mg, Al	1000 years
Neon burning process	Neon	O, Mg	3 years
Oxygen burning process	Oxygen	Si, S, Ar, Ca	0.3 years
Silicon burning process	Silicon	Nickel (decays into iron)	5 days

For each succeeding fusion process the amount of material produced is appreciably lessened. Nevertheless, the table indicates from where the major constituents of the solar system came. The gas giants are composed mostly of hydrogen and helium. The cores of planets and most satellites are composed of iron, nickel, and sulfur. Nitrogen came from either the CNO cycle or the burning of carbon with hydrogen. Oxygen mostly bonded either with Si, Al, Mg, and Ca forming rocky materials, or with hydrogen to form water, or with carbon to form CO_2. Other major volatiles or ices besides water and carbon dioxide were created by producing the molecules of CH_4, methane, and NH_3, ammonia. These more common volatiles became the major constituents of the ice giants, the satellites of the outer planets, and the atmospheres of the terrestrial planets. The SNS Hypothesis explains how these materials became unusually distributed within the proto-star disk and within the existing individual celestial bodies.

3. The Evolution of Star Masses for Elliptical Galaxies

This timeline is determined by the SNS hypothesis and is based on the present distribution of star masses and star ages within elliptical galaxies. The starting point for star masses after the Big Bang is postulated in the range of 250 to 25 solar masses. Then utilizing the theoretical core burning processes for a 25 solar-mass star and the estimated star lifetimes for all mass sizes, a table of evolving star masses is generated. The table reveals that eventually undisturbed elliptical galaxies become inactive with long-lived, older, smaller stars.

Table D - The Evolution of Star Masses $(M/M_{\odot})$ for Elliptical Galaxies

Mass Variation Creates Different Types of Supernova	Death via Pair Instability Supernova (SN)		Death via Red Giant into Planetary Nebula	Death via Core Collapse SN	Death via Core Collapse SN	Death via Ib and Ic SNs	Death via Red Giant Into Planetary Nebula	
First Stars		**2nd Star Generation**	**3rd Star Generation**				**4th Star Generation**	
≤ 250 to 130 formed 150 my to 1 by after the Big Bang	---------------↓ 1 by (several recombinations from star mergers occurred)	40 to 3 ↓						
1 by later	Elliptical Galaxies formed 13 bya	↓						
2 by later	Galactic groups formed 11 - 5 bya	↓						
2 to 3 by later	Spiral/Irregular galaxies formed from collisions 10 bya to present	↓						
3.3 by later		40 to 25	-----------→	----------→	-----------→	--------↓ 2.3 by		
3.7 to 4.0 by later		25 to 18	-----------→	-----------→	--------↓ 2.7 to 3.0 by	↓		
4.0 to 5.0 by later		18 to 9	-----------→	--------↓ 3.0 to 4.0 by	↓	9.0 to 3.0	---------↓ 6.0 by	≤0.5 or continue to burn for ≤ 9.3 by = (1+2.3+6).

Mass Variation Creates Different Types of Supernova	Death via Pair Instability Supernova (SN)		Death via Red Giant into Planetary Nebula	Death via Core Collapse SN	Death via Core Collapse SN	Death via Ib and Ic SNs	Death via Red Giant Into Planetary Nebula	
First Stars		**2nd Star Generation**	**3rd Star Generation**				**4th Star Generation**	
5.0 to 7.0 by later		9 to 3	-------↓ 6.0 by	↓	↓	↓	↓	
7.0 to 11.0 by later	Milky Way Galaxy began 8.8 bya		↓	↓	3.0 to 1.0	3.0 to 1.0	-----------→ 10.0 by	Either expelled to IMC after 13.3 by = (1+2.3+6) or continue to burn for ≤ 14.0 by = (1+3+10).
11.0 to 12.0 by later	LMC and SMC collided with Milky Way 2.5 bya		↓	↓	1.0 to 0.8	1.0 to 0.8	-----------→ 11.0 by	Stars continue to burn for 14.3 by = (1+2.3+11) to 16.0 by = (1+4+11).
12 or more by later			↓	0.8 to ≤ 0.5	0.8 to 0.5	0.8 to 0.5	-----------→ 13.0 by	Stars continue to burn for 16.3 = (1+2.3+13) to 18.0 by = (1+4+13)
Stars still burning			≤ 0.5	----------→	----------→	-----------→	----------→ > 13.0 by	Stars continue to burn for > 16.3 by = (1+2.3+>13) to > 19.0 by = (1+6+>13) or for the life of the universe.
This same logic for star mass evolution is repeated for the next range of star sizes: ≤ 130 to 100 solar masses since it is presumed that this second range is part of the first stars.								

D-2	Death via Partial Pair Instability Supernova (SN)		Death via Red Giant into Planetary Nebula	Death via Red Giant into Planetary Nebula	Death via Core Collapse SN	Death via Core Collapse SN	Death via Red Giant Into Planetary Nebula	
First Stars		**2nd Star Generation**	**3rd Star Generation**				**4th Star Generation**	
≤ 130 to 100 formed 150 my to 1 by after the Big Bang	---------------↓ 1 by (several recombinations from star mergers occurred)	25 to 1 ↓ ↓						
3.7 to 4.0 by later		25-18	-----------→	-----------→	-----------→	--------↓ 2.7 to 3.0 by		
4.0 to 5.0 by later		18 to 9	-----------→	-----------→	--------↓ 3.0 to 4.0 by	↓		
5.0 to 7.0 by later		9 to 3	-----------→	--------↓ 4.0 to 6.0 by	↓	↓		
7.0 to 11.0 by later		3 to 1	-------↓ 6.0 to 10.0 by	↓	↓	3.0 to 1.0	-----------→ 10.0 by	Either expelled to IMC after 13.7 by = (1+2.7+10) or continue to burn for ≤ 14.0 by = (1+3.0+10).
11.0 to 12.0 by later			↓	↓	↓	1.0 to 0.8	-----------→ 11.0 by	Stars continue to burn for 14.7 by = (1+2.7+11) to 15.0 by = (1+3+11).
12 or more by later			↓		0.8 to 0.5	0.8 to 0.5	-----------→ 13.0 by	Stars continue to burn for 16.7 by = (1+2.7+13) to 18.0 by = (1+4+13).
Stars still burning			MS	≤ 0.5		≤ 0.5	----------→ > 13.0 by	Stars continue to burn for >20 by = (1+6+ >13) or for the life of the universe.
This same logic for star mass evolution is repeated a second time for the next and last range of star sizes: ≤ 100 to 60 solar masses since it is presumed that this range is part of the first stars.								

D-3	Death via Ib and Ic Type Supernova		Death via Red Giant Into Planetary Nebula	Death via Red Giant Into Planetary Nebula	Death via Red Giant Into Planetary Nebula	Death via Red Giant Into Planetary Nebula	Death via Core Collapse SN	Death via Red Giant Into Planetary Nebula	
First Stars		**2nd Star Generation**	**3rd Star Generation**					**4th Star Generation**	
≤ 100 to 60 formed 150 my to 1 by after the Big Bang	-----------------↓ 1 by (several recombinations from star mergers occurred)	18 to 0.5 ↓ ↓ ↓							
4.0 to 5.0 by later		18 to 9	---------→	---------→	---------→	---------→	--------↓ 3.0 to 4.0 by		
5.0 to 7.0 by later		9 to 3	---------→	---------→	---------→	-------↓ 4.0 to 6.0 by	↓		
7.0 to 11.0 by later		3 to 1	---------→	---------→	--------↓ 6.0 to 10 by	↓	↓		
11.0 to 12.0 by later		1 to 0.8	---------→	--------↓ 10 to 11 by	↓	↓	↓		
12 to 14 by later		0.8 to 0.5	-------↓ 11 to 13 by	↓	↓	↓	0.8 to 0.5	------↓ 11 to 13 by	Stars continue to burn from 17 by = (1+3+13) to 18 by = (1+4+13)
> 14 by later and still burning			≤ 0.5	≤ 0.5	≤ 0.5	≤ 0.5	≤ 0.5	≤ 0.5	Stars continue to burn from 18 by = (1+4+13) to >27 by = (1+13+>13) or for the life of theuniverse.

Table Codes:
MS means stars residing as Main Sequence stars;
IMC means Interstellar Molecular Clouds;
M/M$_\Theta$ means star mass to solar mass ratio;
(**bya)** means billions of years ago from the present;
(**by)** means span of time in billions of years;
(-----↓ xx by) refers to death of star and time span for star to expire from its birth to a supernova.

When galaxies collide the residual star dust that did not become stars becomes mixed and concentrated in forming spiral arms to create not only new, but larger stars of the O and B spectral types, but larger masses from 60 to 100 M/M$_\Theta$. Much primordial material from the Big Bang surrounds these galaxies and also aids in making massive stars because the CNO cycle of nucleosynthesis is avoided due to the lack of metals. Subsequent collisions may occur that keep generating larger stars at much later times such as the near miss or collision of the Milky Way Galaxy with the irregular galaxies, the Large and Small Magellanic Clouds.

Conclusions from table for "The Evolution of Star Masses for Elliptical Galaxies"

Stars in common elliptical galaxies that have yet to collide with other galaxies and mix their undetectable shells or halos of primordial materials have the following characteristics as shown by the above table.

1. Largest average stars are no more than 3.0 M/MΘ and, hence, the range of stars is from 3.0 to < 0.5 solar masses.
2. A large proportion of these stars have already expired leaving behind progenitors of black holes, neutron stars, and white dwarfs.
3. Planetary nebula remnants and most stars are at least 9.3 billion years old.
4. Primordial materials for making larger stars cease to exist or be created inside elliptical galaxies. Primordial materials do surround elliptical galaxies which is too widely dispersed and too cold to become star-forming regions.

These conclusions agree with current thinking which claims that most elliptical galaxies are composed of older, low-mass stars with a sparse interstellar medium and minimal star formation activity. These galaxies are less common in the early universe because the majority interacted or collided to form spiral and irregular galaxies about one billion years after the initial elliptical galaxies formed. Lacking this thought pattern, current astrophysicists disagree with Edwin Hubble's idea that elliptical galaxies evolved into spiral galaxies. The SNS hypothesis and this table agree with Hubble's original idea.

4. The Evolution of Star Masses for Spiral and Irregular Galaxies

This timeline table is a continuation of the previous table but includes the evolution of star masses inside the later-occurring spiral and irregular galaxies. Because elliptical galaxies collide to create other types of galaxies they also mix inactive, cold primordial materials that surround the elliptical galaxies. This mixing creates starburst activities and the forming of more super-massive stars that only occur in spiral and irregular galaxies in the later Universe. The evolution of star masses reveals a spectrum of sizes inside these galaxies. Super-massive stars will continue to be created as long as galaxies continue to cluster and collide.

Table E - The Evolution of Star Masses ($M/M_{\odot}$) for Spiral and Irregular Galaxies

The example chosen is for the Milky Way that began about 8.8 billion years ago and had a either close encounters or collisions with the Large and Small Magellanic Irregular Galaxies.

E-1	**Death via Partial Pair Instability Supernova (SN)**		**Death via Red Giant into Planetary Nebula**	**Death via Red Giant into Planetary Nebula**	**Death via Core Collapse SN**	**Death via Core Collapse SN**	**Death via Red Giant Into Planetary Nebula**	
First New Stars Inside Spiral / Irregular Galaxies		**2nd Star Generation**	**3rd Star Generation**				**4th Star Generation**	
Spiral and irregular galaxies began to form from elliptical galaxies about 3.7 by after the Big Bang								
≤ 130 to 100 $M/M_{\odot}$ formed 3.3 to 6.7 by (about 5.0 by) after the Big Bang inside the Milky Way created by a collision of two or more galaxies.	-------↓ 10 my	25 to 1 $M/M_{\odot}$ ↓ ↓						
2.7 to 3.0 by later after MWG birth or 7.7 to 8.0 by after the Big Bang.		25-18	------→	-------→	-------→	--------↓ 2.7 to 3.0 by		
3.0 to 4.0 by later after MWG birth or 8.0 to 9.0 by after the Big Bang.		18 to 9	-------→	-------→	--------↓ 3.0 to 4.0 by	↓		
4.0 to 6.0 by later		9 to 3	------→	--------↓	↓	↓		

E-1	Death via Partial Pair Instability Supernova (SN)		Death via Red Giant into Planetary Nebula	Death via Red Giant into Planetary Nebula	Death via Core Collapse SN	Death via Core Collapse SN	Death via Red Giant Into Planetary Nebula	
First New Stars Inside Spiral / Irregular Galaxies		**2nd Star Generation**	**3rd Star Generation**				**4th Star Generation**	
after MWG birth 9.0 to 11.0 by after the Big Bang				4.0 to 6.0 by				
6.0 to 10.0 by later after MWG birth or 11.0 to 15.0 by after the Big Bang well into the future.	LMC and SMC collided with the Milky Way creating more super-massive stars about 2.5 bya.	3 to 1 $M/M_{\odot}$	-------↓ 6.0 to 10.0 by ↓ MS	↓ ↓ ≤ 0.5	↓ ↓ 0.8 to 0.5	3.0 to 1.0 1.0 to 0.8 0.8 to 0.5	------↓ 6.0 to 10.0 by ------↓ 10 to 11 by ------↓ 11 to 13 by	Either expelled to IMC after 13.7 by = (5.0+2.7+6) or continue to burn for ≤ 14.0 by = (5.0+3.0+6) on the Main Sequence (MS). ----→ MS ----→ MS
This same logic for star mass evolution is repeated for the next range of star sizes ≤ 100 to 60 solar masses since it is presumed that this range is part of the first super-massive stars produced inside a spiral or irregular galaxy.								

E-2	Death via Type Ib and Ic SNs		Death via Red Giant into Planetary Nebula	Death via Red Giant into Planetary Nebula	Death via Red Giant into Planetary Nebula	Death via Red Giant into Planetary Nebula	Death via Core Collapse SN	Death via Red Giant into Planetary Nebula
First New Stars Inside Spiral / Irregular Galaxies		**2nd Star Generation**			**3rd Star Generation**			**4th Star Generation**
≤ 100 to 60 $M/M_\odot$ formed 3.3 to 6.7 by (about 5.0 by) after the Big Bang inside the Milky Way created by a collision of two or more galaxies	-------↓ 10 my	18 to 0.5 $M/M_\odot$ ↓ ↓ ↓						
3.0 to 4.0 by later after MWG birth or 8.0 to 9.0 by after the Big Bang		18 to 9	---------→	---------→	---------→	---------→	--------↓ 3.0 to 4.0 by	
4.0 to 6.0 by later after MWG birth or 9.0 to 11.0 by after the Big Bang		9 to 3	---------→	---------→	---------→	-----↓ 4.0 to 6.0 by	↓	
6.0 to 10.0 by later after MWG birth or 11.0 to 15.0 by after the Big Bang well into the future.		3 to 1	---------→	--------→	--------↓ 6.0 to 10 by	↓	↓	
Beyond age of universe.		1 to 0.8	---------→	--------↓ 10 to 11 by	↓	↓	↓	
Beyond age of universe.		0.8 to 0.5	-------↓ 11 to 13 by	↓	↓	↓	0.8 to 0.5 $M/M_\odot$	------↓ 11 to 13 by ↓
Beyond age of universe.			Remain burning on the MS.	Remain burning on the MS.	Remain burning on the MS.	Remain burning on the MS.		Remain burning on the MS.
This same logic for star mass evolution is repeated for the next range of star sizes: ≤ 60 to 18 solar masses since it is presumed that this range is still part of the first super-massive stars produced inside a spiral or irregular galaxy.								

E-3	Death via Type Ib and Ic SNs		Death via Red Giant Into Planetary Nebula	Death via Red Giant Into Planetary Nebula	Death via Red Giant Into Planetary Nebula	Death via Red Giant Into Planetary Nebula
First New Stars Inside Spiral/Irregular Galaxies		**2^{nd} Star Generation**	**3^{rd} Star Generation**			
≤ 60 to 18 $M/M_{\odot}$ formed 3.3 to 6.7 by (about 5.0 by) after the Big Bang inside the Milky Way created by a collision of two or more galaxies	------↓ 2.0 to 2.7 by	→ 9.0 to 0.5 $M/M_{\odot}$ ↓ ↓ ↓				
4.0 to 6.0 by later after MWG birth or 9.0 to 11.0 by after the Big Bang		9.0 to 3.0	-------→	-------→	-------→	------↓ 4 to 6 by
6.0 to 10.0 by later after MWG birth or 11.0 to 15.0 by after the Big Bang well into the future		3.0 to 1.0	-------→	-------→	------↓ 6 to 10 by	↓ ↓ ↓
Beyond age of universe		1.0 to 0.8	-------→	------↓ 10 to 11 by	↓	↓
Beyond age of universe		0.8 to 0.5	------↓ 11 to 13 by ↓	↓	↓	↓
			Remain burning on the MS.	Remain burning on the MS.	Remain burning on the MS.	Remain burning on the MS.
Star masses below 18 solar masses will not be considered although they are produced during star bursts after galaxies collide. These smaller stars do not significantly contribute to producing more stars. The recent collision of the LMC and SMC irregular galaxies about 2.5 bya created another new round of super-massive stars.						

Conclusions from table for "The Evolution of Star Masses for Spiral and Irregular Galaxies"

Spiral and irregular galaxies are the result of collisions of elliptical galaxies and then later collisions with each other. The smaller irregular galaxies may have been the result of collisions of globular clusters. Due to these collisions primordial material surrounding these galaxies that is cold, inactive, and undetectable becomes active again. Gravitation collapse of this material is caused by the increasing proximity and intermingling of existing stars. These primordial materials can also become mixed with and/or agitate the existing clouds of dust and gases with heavier metals to produce a mixture of Population I and II stars.

The table above for spiral and irregular galaxies indicates the following characteristics:

1. The range of star sizes because primordial materials are currently mixed into the spiral arms are primarily 100 to < 0.5 solar masses. Other stars in the range of 200 to 100 solar masses may be produced but extremely rarely. The universe has expanded immensely since the high density conditions when 200 solar-mass stars were made initially 150 million years after the Big Bang.
2. The age of second generation stars is between 3.0 to 5.0 billion years which is a great deal younger than the average star in an elliptical galaxy.
3. There are very few 4th generation of stars; most stars are 3rd generation.
4. Spiral galaxies continue to have mixing of both older gases and dust possibly drawing some primordial materials inward. The spiral arms are evidence of density waves that aid in this mixing to continuously produce new stars. But any spiral galaxy is a sign of a collision that brought a new supply of primordial materials for star-making.
5. Super-massive stars that were created during the Milky Way's first collision produced stars in the range of 25 to 1 solar masses. A large proportion of this range is currently dying or due to die thereby producing about one supernova every 100 years for each spiral galaxy of similar age to the Milky Way.

These results support the basic concept of spiral galaxies, especially their disks, have younger stars and that star-making activity is continuing within the disks. The mixing of materials set-up by galactic collisions produces more clouds and shock fronts of homogeneous metals from previous star deaths that then create more Population I stars than Population II.

The collision idea of two elliptical galaxies typically creating a spiral galaxy is supported by the following observational data. Spiral and irregular galaxies make up approximately 60% of galaxies in the local universe. They are found in low density regions and are rare in the centers of galaxy clusters. (Wikipedia; Spiral galaxy) Elliptical galaxies have already collided to form spiral galaxies and create a low density region. The high density regions or galaxy clusters have more elliptical galaxies because they have not yet collided. The collision of two galaxies is more than likely offset thereby setting the combination into a rotating motion. This motion then creates a flat, rotating disk of mostly new stars with older stars remaining near the center to create a bulge resembling of an elliptical galaxy. This bulge is either the central part of one or both of the colliding elliptical galaxies.

Further enhancing elliptical galaxy collisions are the difference in bulges using the Hubble classification. The bulges of Sa and SBa galaxies that are larger have primarily older, red Population II stars with low metal content. The bulges of Sc and SBc galaxies are much smaller and composed of young, blue Population I stars. (Wikipedia; Spiral galaxy-galactic bulge) The reason is that collisions of smaller galaxies produce more thorough mixing and more resulting star burst activity. The collisions of larger galaxies more than likely are offset to the degree that their centers are less affected leaving behind the characteristics of the original elliptical galaxies. The stripped outer regions create the disk for the new spiral galaxy.

The galactic halos surrounding spiral galaxies have older Population II stars with much lower metallacity than their Population I brethren in the disk. These halos also contain globular clusters similar to elliptical galaxies. (Wikipedia; Spiral galaxy – galactic spheroid) These halos are simply the residual halos of elliptical galaxies that were left behind after a collision. The stars in the halo came from the death of super-massive primordial stars that were too isolated to mix with other exploding star remnants to produce higher metal stars.

5. Archetypical Phases of an Evolving Super-Massive Star

The archetypical supernova remnant for a super massive progenitor star in the range of 200 M_Θ is difficult to find. So the meager SNR data from progenitor star masses in the neighborhood of 25 to 150 solar masses are utilized. The kinematics and physical characteristics are studied for various snapshots taken in time from zero time of the SN explosion to about 11,000 years later for the Vela SNR. Supernova imposters and Wolf-Rayet stars help supply information regarding pre-supernova winds and major eruptions. A table is developed to display the archetypical characteristics of a SNR for a super-massive star between 150 and 200 solar masses that would supply the necessary "supernova seeding" or "magnetic spinning orbs" (MSOs) that become future stars and planets. This evolving progenitor star is shedding material long before the final familiar supernova occurs. The data for this table comes from various sources: observations of SNRs, interstellar matter, LBV and Wolf-Rayet stars, solar wind data, some speculation, and a few calculations. The mass-losses at various stages are only projected predictions starting with a 200 M_Θ star that ends up becoming a typical Wolf-Rayet of 30 M_Θ shedding material at the end of each core-burning process. The final remnant of the progenitor star becomes a neutron star or black hole with a mass of 1.3 to 2.0 M_Θ.

The velocity of the SNR outer shell or shock front, the shell's rough diameter in parsecs, and the time it took the SNR envelop to expand indicate a consistent and congruent group of kinematic data. The state of the matter inside the shell is given by its temperature, density, and ionization. Some of the mean velocities are calculated by simply dividing the SNRs envelop radius by the estimated time since the SN occurred. The following table is believed to be representative of all the major phases of an archetypical evolving massive progenitor star. Various data of the table are footnoted to show its source. The sources are listed below.

	Supernova Remnants
(1)	Crab Nebula
(2)	Vela SNR
(3)	Cassiopeia A SNR
(4)	SNR RCW 103
(5)	SNR 1987a
(6)	SNR 1988s
(7)	SNR 1978k
(8)	Eta Carinae LBV star
(9)	SNR 2006jc
(10)	SNR 1998s
(11)	SNR RCW 86
	Interstellar Matter:
(12)	H II regions
(13)	Warm Neutral Medium (WNM)
(14)	Warm Ionized Medium (WIM)
(15)	Typical Wolf-Rayet star
(16)	Solar wind and eruptions
(17)	Calculated values
(18)	Projected values based on mass-loss of 1M_Θ/100,000 years and a lifetime for a 200 M_Θ being 6 to 10 million years.

Table F - Major Phases of an Archetypical Evolving Super Massive Star

		Velocity (km/sec)	Radius of Shell (parsecs)	Time (years)	Temperature of Shell (K^0)	Density (parts/m^3)	State of H	State of Iron	Projected mass-loss ($M_\odot$)
Phase 1	**Expulsion of the H layer**	215 or 300 to 1000 (16)	≈ 2.2	< 10 x 10^6; ≈ most ejecta over 1000.	6000 (13) or 10,000 (14)	0.2 to 0.5 (13) and (14)	Either neutral atom or ionized.	N/A	60 (18) (mostly H)
Phase 2	**Expulsion of the He layer**	avg. = 1000 to 1200 (17)	≈ 1.7	< 10,000 (5); ≈ most ejecta over next 1000.	≈ 4000 to 6000	1 x 10^2 (12)	Ionized (reheated by new shockfront - Hα emission)	N/A	15 (18) (mostly He w/ some H)
Phase 3	**Expulsion of C (O and N) layer**	avg. 5200 (17) or 2000 to 2400 (15)	0.612 (2 ly) (8)	1000 (8); ≈ 500 for largest stars.	4000 to 4500 (10)	1 x 10^4 (12)	Ionized (reheated again - Hα emission)	N/A	23 (spectrum indicates C, O and N)
Phase 4	**Fast core burning eruptions**	15,000 (5) or 17,000 (17)	0.026 to 0.077 (8)	2 (9) or 3 to 4	36,000 to 40,000 (8)	≈ 50 x 10^{12}	Ionized very energetically (Hα emission)	N/A	23 for neon; 23for oxygen; 23 for silicon
Phase 5	**Supernova (largest brightening)**	30,000	N/A	< 0.3 to 0.6 (from SN light curves)	1 x 10^6 to 1 x 10^7	N/A	Ionized (X-ray emission)	Created by either fusion / decay of Ni	31 (leaving behind 2 or less $M_\odot$)
Phase 6	**Iron plasma forming into MSOs**	≈ 15,000 to 20,000; 16,000 (5)	0.01 (6)	20 (5) (inner ring illuminated)	≈ 10,000 to 1 x 10^6	≥ 100 x 10^{12} (6)	Ionized (X-ray emission)	Ionized	(Spectrum also indicates Fe and S)
Phase 7	**Free expansion of ejecta**	10,000 (7)	2.0 (7)	200 to 500 (7)	≈ 10,000 to 1 x 10^6	≥ 100 x 10^{12} (6)	Ionized (Hα emission)	Ionized	(Spectrum also indicates Fe and S)
Phase 8	**Sweeping up CSM (strong X-rays)**	1200 (1) or 1500 (4)	> 1.7 (5.5 ly) (1)	1000 (1) and (4)	11,000 to 18,000 (1)	1300 x 10^6 (1) Flux is 1 x 10^{12} eV.	Ionized (Hα emission)	Ionized and compressed inside MSO	New stars and planets are 10% of ejecta
Phase 9	**Outer shell cooling (H recombining)**	≈ 1000	> 2.0 (6.5 ly)	2000 (11)	6000 to 10,000 (12)	10,000 (12) to 100 x 10^6	Ionized and re-combining)	Ionized and compressed but obscured	90% of the ejecta are tiny planetisimals or part of ISM that become GMCs
Phase 10	**Shell interior cooling and envelop edge dissipating**	300 to 500	20	11,000 (2) to 100,000	50 to 100 [cold neutral medium-CNM]	20 to 50 [cold neutral medium-CNM]	Neutral (H I 21 cm line emission)	Dust	

B. Listing of Earth's Timelines

1. Geologic Time Scale

Geologic times are time spans on Earth that are determined chiefly from dramatic changes in the fossil record. The fossil record is almost as old as the radiometric ages for rocks since life began soon after the Late Heavy Bombardment (LHB) period around 3800 million years ago (mya). This time scale is the main basis for defining continental drift and glacial periods.

Table G - Geologic Time Scale

Eon	Era	Period	Epoch	MYA
Pre-Archean				4000
Archean				3800
Proterozoic	Late, Middle, Early			2500
Phanerozoic	Paleozoic	Cambrian		570
		Ordovician		500
		Silurian		435
		Devonian		410
		Mississippian (Carboniferous)		360
		Pennsylvanian(Carboniferous)		330
		Permian		290
	Mesozoic	Triassic		240
		Jurassic		205
		Cretaceous		138
	Cenozoic	Tertiary (Paleogene)	Paleocene	66
		Tertiary (Paleogene)	Eocene	56
		Tertiary (Paleogene)	Oligocene	34
		Tertiary (Neogene)	Miocene	23
		Quaternary		1.6

2. Continental Drift and the Ancient Super Continents

The oldest rocks on Earth are about 3.8 billion years ago (bya); these rocks crystallized shortly after the LHB to become the cratons of Earth's granitic continental crusts. The original continent created by the Earth's major impact has broken apart and reformed several times. These continental drifts are confirmed by magnetic reversals, climatic record, fossil records, isolation record of flora and fauna, and the current matching of continental boundaries. This continental drift process and the resulting plate tectonics corroborate Earth's first major impact that created the LHB within the inner solar system. The unbalance of an uneven crustal surface created by uplift and eruption of volatile and mantle materials within the immense impact basin started continental drift which is still occurring to this day.

Table H - Continental Drift and the Ancient Super Continents

Continental Drift Events	BYA
The ancient continent Ur is the oldest continent known	3.0
Arctica develops	2.5
Atlantica develops	2.0
Nena develops	1.8
Columbia forms by joining Ur, Atlantica, and Nena	1.8-1.5
Columbia fragments	1.6-1.2
Rodinia forms by accreting Ur, Atlantica, Nena, and other minor continents which then contains most of Earth's present land mass	1.5-1.1
Rodinia breaks-up	1.1- 0.75
Snowball Earth, extreme cooling is believed to be triggered by Rodinia breaking up	0.700
Pangaea is formed by re-assembling Rodinia during the Permian Period	0.225
Pangaea breaks-up in three basic phases:	
1. Pangaea breaks apart to form Laurasia and Gondwana In the early Jurassic Period	0.175
2. Gondwana separates into Africa, South America, India, Antarctica, and Australia in the early Cretaceous	0.150
3. Laurasia splits to form North America and Greenland and Eurasia in the Cenozoic	0.060-0.055
Meanwhile, Australia and Antarctica split with India moving northward to collide with Asia	0.035

3. Glacial Periods and Climatic Changes

The first known ice age spanned 2.4 to 2.1 bya in the Proterozoic Eon. The second and most severe ice age, called the "Snowball Earth", befell the planet 800 mya. Other periods have occurred through the ages with the last severe glacial period occurring only about 11,000 years ago. These glacial periods occur rather periodically between more temperate conditions called inter-glacial periods. These glacial periods are believed to be caused by the combination of different positions of the ancient super-continents and the Milankovitch theory of climatic cycles determined by the Earth's orbital and rotational parameters.

Table I - Glacial Periods and Climatic Changes

Major Changes	MYA
First known ice age occurs in the Proterozoic Eon	2400-2100
Second and most severe cooling produced the "Snowball Earth" in which the planet iced over	800-635
End of second cold period is predicted to have caused the "Cambrian Explosion", a rapid rise in multi-celled animals	542-500
Minor periods of glaciation occurred in the:	
1. Ordovician - Silurian Period	460-430
2. Carboniferous - Permian Period	350-250
A relatively cold period occurred during the Jurassic-Cretaceous Periods without glaciation due to the configuration of the continents	175-110
Current Quaternary Ice Age has cycles between severe glacial conditions (glacial period) and more temperate conditions (inter-glacial period)	65 to present
Marine isotope stages (MIS) indicate alternating warm and cool periods of the present Ice Age from oxygen isotope data from deep sea core samples:	
1. A 41 kyr cycle is indicated	2.5-1.2
2. A 100 kyr cycle is indicated	1.2 to present
The last glacial period of the present Quaternary Period starting the Holocene Epoch	10,000 yr ago
Ice core data estimates of atmospheric CO_2 varies having high concentrations about every 50,000 years measured over 800,000 years	800,000 yr ago

4. Geomagnetic Reversals

The rate of geomagnetic reversals has varied widely over time. Each reversal is called a chron. A reversal that remains for a long time is called a superchron. These reversals can only be measured from the present to 485 mya since the magnetic signature in the rocks of Earth's crust is removed due to the wasting of continents and tectonic plate processes. The rocks as they crystallize indicate the direction of the magnetic field created by the Earth's internal dynamo which is a spinning iron core. Our Sun has predictable magnetic reversals about 2 times every 11 years due to some dynamo affect within its interior. Any planetary body with a combination of liquid and solid iron core are theorized to have geomagnetic reversals. Electrical current from the dynamo follows magnetic field lines. These magnetic field lines change and are interrupted by the changing positions of the continents which in turn causes changes in the spans of time for Earth's magnetic reversals.

The reversal itself is caused by a capacitance that builds up between the poles. When the electrons concentrate too much at one pole they simply seek the more positive charge of the other pole and begin to flow in the opposite direction. This process repeats itself periodically especially for stars.

Table J - Geomagnetic Reversals

Major Geomagnetic Reversals	MYA
During the Ordovician Period a superchron lasted for 20 million years (my)	485-463
During the late Carboniferous to late Permian Period the Kiamian Reverse Superchron occurred for 50 my	312-262
During the Cretaceous Period a superchron occurred for 40 my	120-83
Eras of frequently reversing chrons:	
1. 5 times in 1 my	72
2. 10 reversals in 4 my-period	54
3. 17 reversals in a 3 my-period	42
4. 13 reversals in a 3 my-period	24
5. 51 reversals in a 12 my-period	15
Recently changing chrons:	
1. Opposite polarity	2.6-2.14
2. Today's polarity	2.0-1.8
3. Opposite polarity	1.8-1.1
4. Today's polarity	1.06-0.90
5. Opposite polarity	0.90-0.78
6. Present polarity	0.75- present

5. Milestones for Life

Life appeared on Earth but not until the after the Late Heavy Bombardment. Apparently, a continental crust formed and liquid water with atmosphere reappeared rather quickly. Chemical evidence of life occurred at 3800 mya. These milestones are very rough estimates that come from Wikipedia's geologic time scale clock representation; this clock shows the scale of time spans for each milestone and how very recently mammals and man began walking on Earth's crust.

Table K - Milestones for Life

Milestones for Life	MYA
Formation of Earth	4550
Formation of Moon	4527
Liquid water appears on Earth	4450
Earth is struck by large planetoid and displace toward Sun to share Moon's orbit	4100-3900
End of Late Heavy Bombardment (LHB)	4000-3900
Light bombardment of Moon and Earth	3900-3000
Chemical evidence of life	3800
Photo-synthesis starts	3500
Earliest fossils of cells	3400
Archaea/bacteria ancestor splits	3000
Atmosphere becomes oxygen enriched	2300
First "Snowball Earth" occurred	2400-2100
First evidence of multi-cellular life	2100
Second "Snowball Earth" occurred	800-635
"Cambrian Explosion" occurs creating life's rich diversity	542-500
First vertebrate land animals	380
Permian mass extinction	250
Dinosaurs and mammals roam the land	230-65
K-T extinction event	65.5
First humans appear	2

6. Extinction Intensities' Relation to Major Catastrophes

Extinction intensities are taken directly from a Wikipedia chart and listed below with spans of time between each event. The major extinctions or periods of great dying are charted over the last 542 million years which is basically the Phanerozoic Eon. Also, listed along with these events are known notable volcanic activity and impact events. Both of these catastrophic-type events seriously affect Earth's atmosphere which leads to pronounced climatic changes that in turn can cause die-offs on both land and in the sea. Global fires, tsunamis, earthquakes and volcanism can all be triggered by large impacts.

One can clearly see a connection between major impacts and volcanic eruptions with periods of extinction as measured by both fossil records on land and in the deep sea sediments. Fossil records from the sea sediment are no older than about 170 million years due to the oceanic crust being constantly converted to younger sediments at subduction and rift zones. But during that period good agreement between all fossils is obtained. It also appears that the two "Snowball Earth" periods have connections with Earth impactors.

Table L - Extinction Intensities' Relation to Major Catastrophes

Geological Period	Extinction Event	MYA	Time Interval - MY	Big Mass Extinction	Other Notable Extinctions	Known Impact Events	Major Volcanic Eruptions
Paleoproterozoic Era: Rhyacian and Orosirian Periods	Multi-cellular life has started.	2100-2000	100				Major building of continents and mountain forcing greater volcanism
Paleoproterozoic Era: end of Orosirian Period	Most severe Snowball Earth	2050-1800	250			Vredefort Crater in S. Africa 300 km ø; Sudbury Crater 250 km ø; Yarrabubba in W. Australia 30 km ø; Keurusselka in Finland 30 km ø	
Cambrian	"Cambrian Explosion"	570-500	70	Diversity and amount of life increases dramatically		No known major impacts	Rodinia breaks up lessening volcanism
Cambrian	Botomanian	520					
Cambrian	Dresbuchian	500	20			Presqu'ile in Quebec 24 km ø	
Ordovician	Earlier	490	10				
Ordovician	Later	470	20				
Ordovician	End of Period	445	25	x		Slate Island in Ontaria 30 km ø	
Silurian	End of Period	419	26		x		
Devonian	First Late	390	29				

Geological Period	Extinction Event	MYA	Time Interval - MY	Big Mass Extinction	Other Notable Extinctions	Known Impact Events	Major Volcanic Eruptions
Devonian	Middle Late	375	15	x		Siljan Ring in Sweden 52 km ø	
Devonian	Last Late	360	15			Woodleigh in West Australia 40 km ø	
Carboniferous	Middle Period	320	40		x		
Carboniferous	End of Period	304	16			Clearwater in Quebec 36 and 26 km ø	
Permian	Middle of Period	275	29				Emeishan Traps
Permian	End of Period	254	21	x			Siberian Traps
Triassic	End of Period	203	51	x		Manicouagan in Quebec 100 km ø	
Jurassic	First	180	23			Obolon in Ukraine 20 km ø	
Jurassic	End of Period	151	`29		x	Puchezh-Katunki in Russia 80 km ø	
Cretaceous	End of Period	65.5	85.5	x(K-T event)		Chicxulub Crater in the Yucatan 170 km ø; Boltysh in Ukraine 24 km ø	Deccan Traps in India
Eocene	End of Epoch	37	28.5			Popigai in Russia 100 km ø; Chesapeake Bay	

Geological Period	Extinction Event	MYA	Time Interval - MY	Big Mass Extinction	Other Notable Extinctions	Known Impact Events	Major Volcanic Eruptions
						90 km ø; Mistastin in Canada 28 km ø; Haughton in Canada 23 km ø	
Paleogene	End of Period	22	15				Yellowstone hotspot erupted
Quaternary	11,700 yr ago	≈0	22		x		End of last glaciation

C. Timeline for Living through the Space Age

The following events list space exploration from 1957 to 2008 and include some of the author's personal milestones.

Table M - Timeline for Living through the Space Age

Date	Event
Oct. 1957	First Sputnik satellite was launched by USSR.
Nov. 1957	A Sputnik with a dog was launched.
Jan. 1958	USA launched Explorer-I in sub-orbit in response to Sputnik.
Sep. 1958	Sixth USA Vanguard failed in race to launch an orbiting satellite.
Aug. 1959	The beginning of the Mercury Project was announced by the President to launch a satellite into orbit and then a manned satellite into orbit.
1960 onward	Astronomers began to realize the possibilities of Earth impacts. Various asteroid deflection strategies were proposed. There was a flurry of near-Earth asteroid discoveries in the 1960s with 69230 Hermes approaching within 0.0005 AU of Earth in 1967.
May 1961	First American man, Shephard, was launched in sub-orbit.
1962	Mariner-2 does a flyby pass Venus.
Feb. 1962	First American man, Glenn, launched into full orbit.
Jun. 1962	***Author graduated from high school.***
May 1963	First man, Cooper, was launched into orbit for a one day mission.
1964	First successful flyby of Mars was performed by Mariner 4.
Mar. 1965	First Gemini Mission for an earth orbiter with two astronauts was launched.
Oct. 1966	***Author graduated from college and worked as an engineer.***
Oct. 1968	First Earth orbiter with three astronauts was accomplished by Apollo 8 mission.
May 1969	Apollo 10 became the first lunar orbiter.
Jul. 1969	First lunar landing was achieved by Armstrong, Aldrin, and Collins in Apollo 11.
1971	The last successful flyby of Mars with Mariner 9 occurred that included the First close-up photographs of asteroid-like objects was taken while imaging the two small moons of Mars, which were then hypothesized to be captured asteroids.
Dec. 1972	The last Apollo 17 lunar landing with astronauts occurred.
1973	Pioneer 10 became the first spacecraft to reach Jupiter.
Mar. 1975	***Author's son #1 was born***
Aug. 1975	Viking 1 Orbiter and Lander was launched and arrived at Mars in Jul 1976.
Sep. 1975	Viking 2 Orbiter and Lander was launched and arrived in Sep 1976. This mission ended in 1982 after six years of operation.
Oct. 1976	***Author's son #2 was born***
1977	Voyager Missions to Jupiter, Saturn, Uranus, Neptune and beyond occurred.
1977	First centaur, 2060 Chiron asteroid, was discovered beyond Jupiter.
Aug. 1977	The first X-ray space telescope HEAO-1 was launched by NASA.
1978	Pluto's moon Charon was discovered which enabled a determination of Pluto's mass; the mass is 1/5 the Earth's Moon, 1/20 the mass of Mercury, and only 10 times larger than the asteroid Ceres much to everybody's surprise.
Dec. 1978	Launched Pioneer Venus Orbiter was launched that reached Earth's twin planet in May

Date	Event
	1979.
Jul. 1978	***First printing of Sitchin's The 12th Planet.***
Aug. 1978	Pioneer Venus had a multi-probe that was launched to descend to the surface of Venus and take measurements of the atmosphere.
Sep. 1979	First gamma ray space telescope, HEAO-3, was launched by NASA.
1980	***First printing of Pole Shift by John White***
1981	Walter Alvarez presented his hypothesis that an impact event, causing the Chicxulub Crater in the Yucatan of Mexico, caused the Cretacious-Tertiary extinction. In 1980 he located a layer of sediment associated with the boundary of mass extinction. The sediment was enriched with iridium, a rare earth element which is rare to the Earth's crust but common to asteroids and meteorites. Subsequent research showed that the layer of iridium was worldwide.
Apr. 1981 through 2012	Launched first space shuttle with missions that would continue to 2012.
1986	Soviet Vega 1 and 2 and the Giotto probe flew through the coma of Halley's Comet.
1987	Supernova Type II 1987A was discovered in the Large Magellanic Cloud.
1989	Magellan Mission accomplished radar mapping of Venus.
Oct. 1989	The Galileo spacecraft was launched aboard space shuttle Atlantis.
Nov. 1989	Cosmic Background Explorer (COBE) was launched by NASA.
Apr. 1990	The Hubble Space Telescope was launched and used for the visible and ultraviolet spectrum ranges.
1990	***Author read Sitchin's The 12th Planet.***
Oct. 1991	The first close flyby of an asteroid, 951 Gaspra, was performed.
1992	The first trans-Neptunian object, 1992 QB1, was discovered.
1992	The first exo-planet was discovered via pulsar timing.
1992	***Author helped Son #1 with his Science Fair Project using the Gravitator Program.***
Mar. 1993	The first ultraviolet space telescope, Astro 2, was launched by NASA.
1993	***Son #1 took his science project to Penn State where the judges stated that calculus can show that the Sun's or large planet's gravity fields could not capture fast moving bodies.***
Aug. 1993	Galileo spacecraft discovers Dactyl, the first confirmed moon of an asteroid, Ida.
1994	The International Astronomical Union (IAU) approved a new naming system of comets due the large number being discovered.
Jul. 1994	Comet Shoemaker-Levy 9 broke into pieces and collided with Jupiter. This event became the first observed collision in the solar system.
1995	***Author read White's Pole Shift.***
1995	The U.S. military declassified and released the information that its military satellites, built to detect nuclear explosions, had detected hundreds of upper-atmosphere impacts of objects ranging from one to 10 meters across.
1995	Comet Hale-Bopp reached a maximum brightness by 1997 and triggered a mass suicide of Heaven's Gate cult.
1995	The first extra-solar planet or exo-planet was confirmed by radial velocity detection; it was a gas giant orbiting 51 Pegasi in 4 days.
Jul. 1995	A Jupiter probe, Galileo, was released to study the planet's atmosphere.
Dec. 1995	Galileo arrives at Jupiter.
1996	NASA Rendezvous Mission is launched to study a Near-Earth asteroid.

Date	Event
1996	The Galileo spacecraft returns hints of sub-surface oceans on Europa.
1996	The Mars Pathfinder was a successful mission amidst numerous failures by both the USA and USSR.
Jul. 1996	***The movie, "Independence Day", starring Randy Quaid and Bill Pullman, was released depicting an invasion by hostile aliens. The story mixed thoughts that controlled others and our present digitized communications. My personal thoughts are that if the aliens possessed thought control then they would have the most powerful weapons for winning the invasion; however, our mastery of radio digitized communication and nuclear weapons won the battle.***
1998 onward	Various automated systems were launched consisting of Charge-Coupled Device (CCD) cameras and computers connected to telescopes. Such project teams were Lincoln Near-Earth Asteroid Research (LINEAR), Near-Earth Asteroid Tracking (NEAT), and Lowell Observatory Near-Earth-Object Search (LONEOS).
May 1998	***The movie, "Comet", starring Morgan Freeman, has a comet that was unsuccessfully deflected by space probes strike the earth and cause huge destructive 300 foot high tsunamis. This movie was lauded by astronomers as being more technically accurate as compared with the movie "Armageddon".***
Jul. 1998	***The movie "Armageddon", starring Bruce Willis, was released. It depicts an asteroid being blown up before it can strike and destroy earth.***
1999	NASA Coma sample return mission to Comet P/Wild 2 returned material samples of its coma.
Jan. 1999	The Far Ultraviolet Spectroscopic Explorer (FUSE) was launched by NASA.
Feb. 1999	Stardust spacecraft collected particles from the coma of Comet Wild 2 and showed the nucleus numerous jets; the comet dust resembled asteroid material born in an extremely hot environment much to everybody's surprise.
Mar. 2000	IMAGE Explorer Satellite was launched to perform Aurora Global Exploration and image the magnetosphere.
Oct. 2000 through present	The beginning of the manned International Space Station occurred this year.
Dec. 2000	***Author divorced after marriage of 30 years.***
2001	Asteroid probe orbited 433 Eros and finally landed on its surface.
2001	Mars Odyssey Orbiter indicated sub-surface water ice in the Martian polar regions.
2002	First exo-planet discovered via transit which had already been discovered by another method.
Sep. 2002	Deep Space 1 spacecraft flew past the nucleus of Comet Borrelly and showed a surface dry and free of ices indicating a possible continuum between comets and asteroids.
Oct. 2002	International Gamma Ray Astrophysics Lab launched for use mostly in the X-ray frequency range of the spectrum.
2003	Mars Exploration Rover, Spirit, successfully runs experiments and gathers images of surface.
2003	Mars Exploration Rover, Opportunity, repeats what the surface probe, Spirit, achieved.
Aug. 2003	The Spitzer Space Telescope was launched into solar orbit to study infrared astronomy.
Oct. 2003	Eris was discovered and briefly called the 10^{th} planet.
2004	First directly imaged planet in the infrared found around a brown dwarf.
Jun. 2004	Discovery of near-Earth asteroid 99942-Apophis.

Date	Event
Nov. 2004	Swift Gamma Ray Burst Explorer was launched by NASA.
Dec. 2004	An asteroid with a near miss trajectory was calculated to have a low probability of impact in 2029 and in 2036 passing within the orbits of geo-synchronous communication satellites.
Dec. 2004	Haumea, a trans-Neptunian body, was discovered and accepted as a dwarf planet in Jul 2008.
Sept. 2004	Genesis Mission was launched to measure the solar wind in interplanetary place and try to resolve isotopes found on the Moon's surface.
Nov. 2004	***Author met present significant other, Rhonda Smith***
Mar. 2005	Makemake, another planet beyond Pluto, was discovered and accepted as a dwarf planet in Jul. 2008.
Jun. 2005	***Author retired from regular "daytime" job.***
Jul. 2005	Deep Impact Probe blasted a crater on Comet Tempel 1.
2006	The IAU introduced a new class for the solar system called "small solar system bodies" previously classified as minor planets and comets; dwarf planet designation was also created for bodies with sufficient mass that generated ellipsoidal orbits under their own gravity.
Apr. 2006	A survey led to 175 comets identified as being periodic with more than one perihelion passage.
May 2006	Comet Schwassmann-Wachman 3 breaks into large fragments due to tidal gravitational forces of the Sun or a large planet.
2007	Comet Holmes has a huge outburst of gas and dust temporarily increasing the size of its coma.
Jan. 2007	Comet McNaught became the brightest comet in 40 years and was given the title as the first great comet of the 21st century.
Apr. 2007	Comet Encke's ion tail was observed to be disconnected due to a coronal mass injection by the Sun.
Apr. 2007	A third exo-planet was discovered around the red dwarf star Gliese 581 which has, to date, the most matching parameters for a terrestrial planet.
2008	The first planet, Fomalhaut B, was directly imaged by visible light; and first multi-planet system was also directly imaged.
Sep. 2008	The LINEAR asteroid search team alone had discovered 97,479 asteroids. Between all the automated systems like LINEAR 4711 near-Earth asteroids were discovered that included over 600 having a diameter larger than 1 km.
Oct. 2008	The Herschel Space Observatory was launched at Earth's Lagrangian 2 point for infrared astronomy.
Dec. 2008	333 exo-planets were listed that are detected largely by radial velocity detection.
Dec. 2008	Machholz 1 comet has a chemical make-up that is postulated to come from another star system.
2009	NASA launched a Laser Interferometer Space Antenna (LISA) traveling in solar orbit behind Earth to detect gravitation waves and ripples in space time.
2010	***The author began writing his journals in earnest after much study and research was performed. So much more space exploration in cooperation between countries has occurred since I ended my timeline in 2008. I hope mankind's space exploration never ends.***
Aug. 2012	***EttingerJournals.com is released on the web.***

IV. Conclusions

I am privileged to live in a time and in a country that devotes an enormous amount of time and effort to exploring places beyond this planet and sharing with the public all the wonderful discoveries about our planet, its solar system, its galaxy, its neighborhood of galaxies, and finally deep space. I anticipate every new space probe and telescope and the new information it will bring back to mankind's home. And, I relish the review of new data and determining what it all means.

It is truly unbelievable how much knowledge of the universe has been gained since my childhood. I dearly hope everyone is enjoying at least one half as much as I am of this great show of Creation unveiling its curtain for all to see. Most of the data of these timelines has been gathered since my childhood. Now, I can travel with confidence backward through time over 13 billion years and forward for millions of years, if not longer. Of course, there will be more trepidation about our future due to our increased knowledge, but beginnings and endings for all things should now be clearly understood. There will always be rebirth.