

Notes : COSMOLOGY

Selections from Chapter 31
(+ more current research)

Some vocabulary prior to starting:

Singularity: A single point in space of great gravity, density, and pressure.

Prevailing: The most accepted/the most popular

Implode: The opposite of an explosion. . . . So much gravity pulls matter inward, that it causes a collapse, and a vacuum is created from space between atomic particles suddenly disappearing.



MEASURING GREAT DISTANCES!

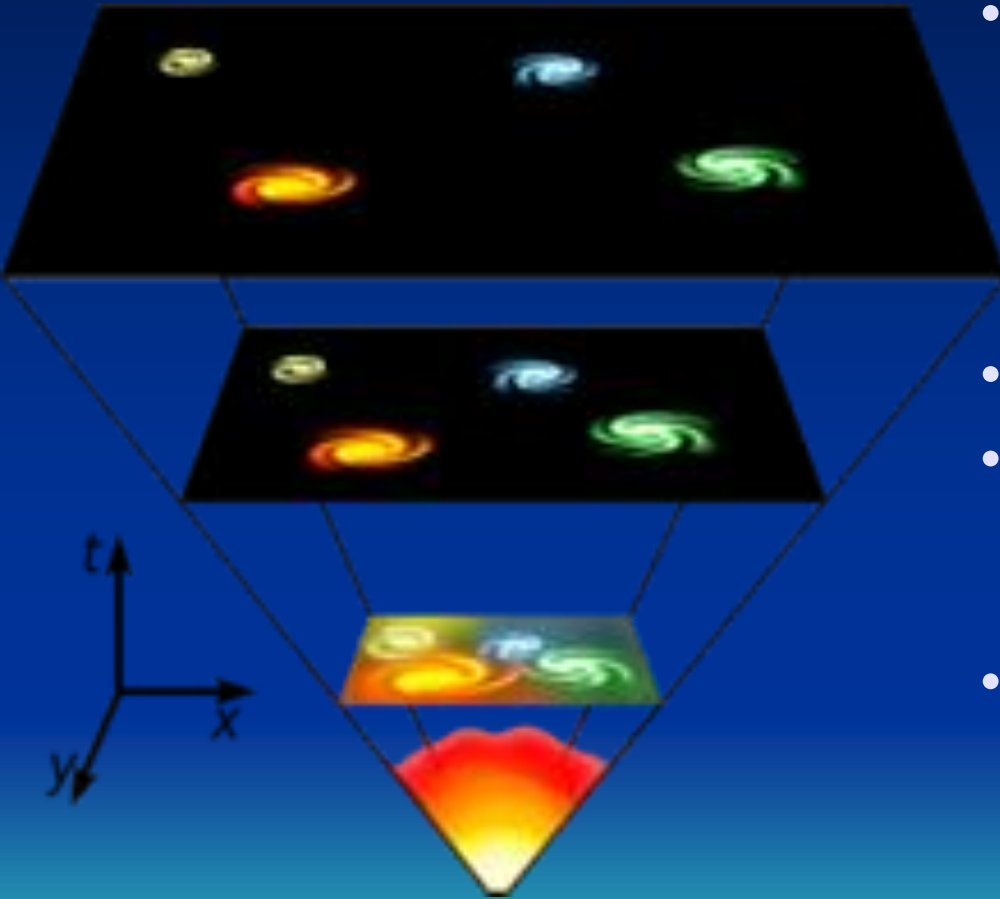
Astronomical Unit: One unit of earth-sun distance (approximately 93,000,000 mi) **Ex:** ***Jupiter is 4.95 AU's from the sun.***

Light Year: How far light traveling at 300,000 km/sec would travel in one year. **Ex: Our Milky Way Galaxy is 100 – 120 Light Years in diameter.**



The Universe:

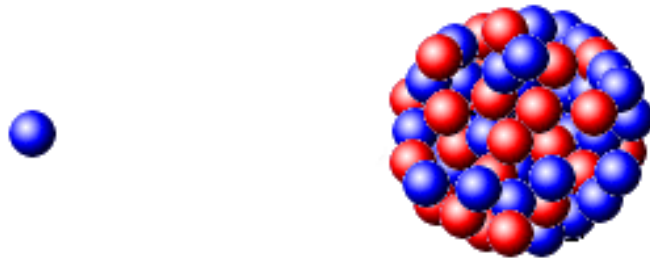
(The Big Bang is the Prevailing Theory)



- The Big Bang Theory describes a **singularity** in space, that contained all the energy and matter in the universe.
- The singularity **imploded**
- It then **blew outward** in a giant explosion 13.7 billion years ago.
- If this is true, then matter is **STILL** blowing outward, and traveling farther apart due to **inertia**.

Nuclear fission: splitting of atoms and molecules by forces acting on them, or other particles splitting them.

- This creates a very ***FORCEFUL, FAST*** chain reaction which results in an explosion (atomic bomb technology uses this). The new pieces go on to split other atoms!



Sounds from Big Bang . . .

- As matter was thrown in the explosion, a tremendous amount of energy was also released and transferred.
- **As matter flies outward in a molten state, some of it clumped together to form larger bodies, and some of them were captured by other bodies into an orbit.**
- Since many things in space revolve and rotate, this motion is said to be from the original inertia of the explosion, also called “Dark Energy”.
- **Waves in the form of light and sound are said to be recorded from the actual Big Bang event, since those waves traveled such a long distance and are still in motion.**
- It also means the universe could be expanding and spreading.



DARK MATTER

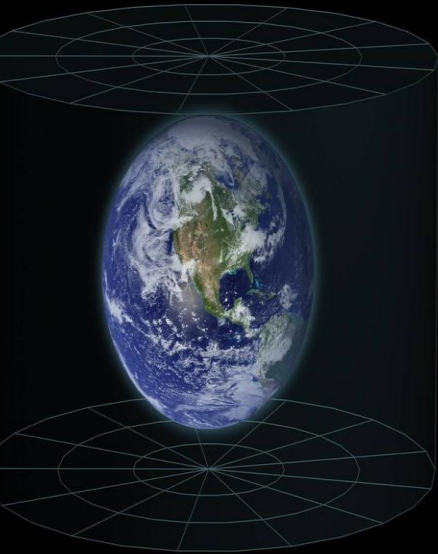
- Dark Matter is said to be “non-illuminated” matter that is in space.
- It is so tiny, it is passing through your atoms right now.
- Dark Matter clumps to form larger dark matter, or light matter clumps onto it.
- Dark Matter + Dark Energy is said to take up 72.1% of the universe. . . which provides the “fuel” and building materials for everything in space.
- That means what we see in the night sky is only 27.9% of the universe!

Our Solar System is a tiny dot on the arm of the **MILKY WAY GALAXY**

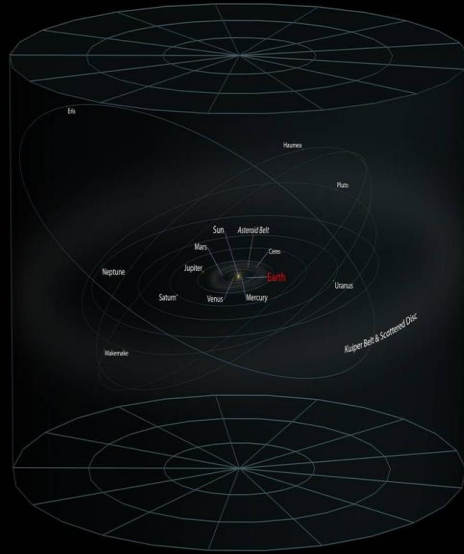


- That means that all the other points of light are other stars and solar systems as well!
- Our nearest “neighbor”, Alpha Centauri, is 4 light years away.

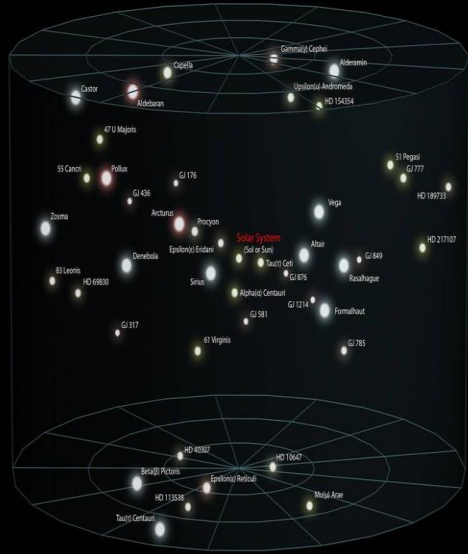
Earth



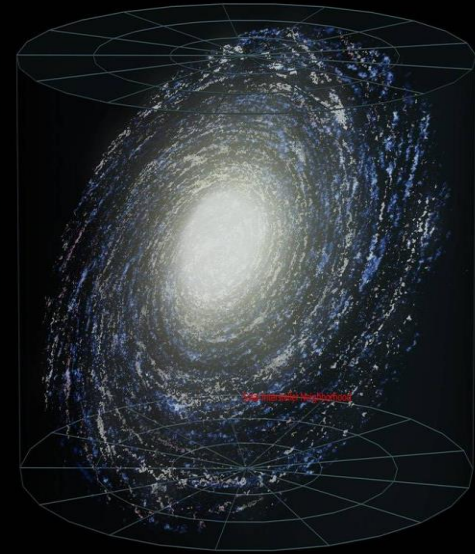
Solar System



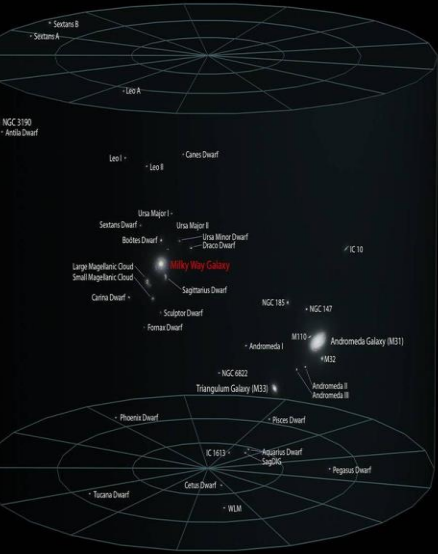
Solar Interstellar Neighborhood



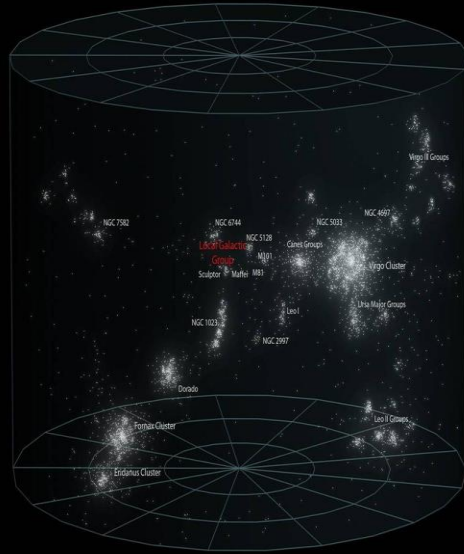
Milky Way Galaxy



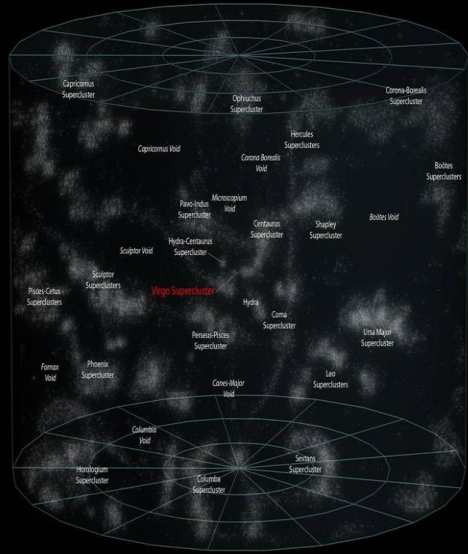
Local Galactic Group



Virgo Supercluster



Local Superclusters



Observable Universe



("Globular Cluster" is the Prevailing Theory)



- Up until now, it was thought that the Milky Way and other galaxies began small and grew bit by bit, gravitationally acquiring **matter** and merging with **other galaxies**.
- As it continued to spin, it became larger, thicker in the middle, and wider by collecting more material (**accretion**)

(CHUNKING is a new Theory!)

- Recently, the “CHUNKING” theory has emerged. . . *That Galaxies form suddenly in **large chunks** of matter, rather than spinning slowly.*

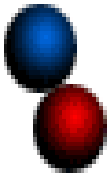
Milky Way \approx 13.2 Billion Years old



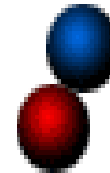
The Universe lights up from Nuclear Fusion: Hydrogen isotopes fuse to make one Helium isotope. Light/heat energy and neutrons are released in the process. . .

Deuterium-Deuterium Fusion Reaction

Deuterium



Deuterium



 = Proton

 = Neutron

When all of the H is used up,
 then elements will be stuck
together to form larger, heavier
elements: (Example with teacher...)

IA																VIIA		VIII
1 H 1.00794	IIA											III	IV	V	VI	7 H 1.00794	8 He 4.002602	
3 Li 6.941	4 Be 9.012182												5 B 10.811	6 C 12.0043	7 N 14.00674	8 O 15.9994	9 F 18.9984032	10 Ne 20.1797
11 Na 22.989770	12 Mg 24.3050												13 Al 26.981538	14 Si 28.0855	15 P 30.973761	16 S 32.066	17 Cl 35.4527	18 Ar 39.948
		III	IV	V	VI	VII	VIII				IX	X						
19 K 39.0983	20 Ca 40.078	21 Sc 44.955910	22 Ti 47.867	23 V 50.9415	24 Cr 51.9961	25 Mn 54.938049	26 Fe 55.845	27 Co 58.933200	28 Ni 58.6934	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.92160	34 Se 78.96	35 Br 79.904	36 Kr 83.80	
37 Rb 85.4678	38 Sr 87.62	39 Y 88.90585	40 Zr 91.224	41 Nb 92.90638	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.90550	46 Pd 106.42	47 Ag 107.8682	48 Cd 112.411	49 In 114.818	50 Sn 118.710	51 Sb 121.760	52 Te 127.60	53 I 126.90447	54 Xe 131.29	
55 Cs 132.90545	56 Ba 137.327	57 La* 138.9055	72 Hf 178.49	73 Ta 180.9479	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.227	78 Pt 195.078	79 Au 196.96655	80 Hg 200.59	81 Tl 204.3833	82 Pb 207.2	83 Bi 208.98048	84 Po (209)	85 At (210)	86 Rn (222)	
87 Fr (223)	88 Ra (226)	89 Ac** (227)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 Ds (269)	111 Uuu (272)	112 Uub (277)		114 Uug (289) (287)		116 Uuh (289)		118 Uuo (289)	

* Lanthanide	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
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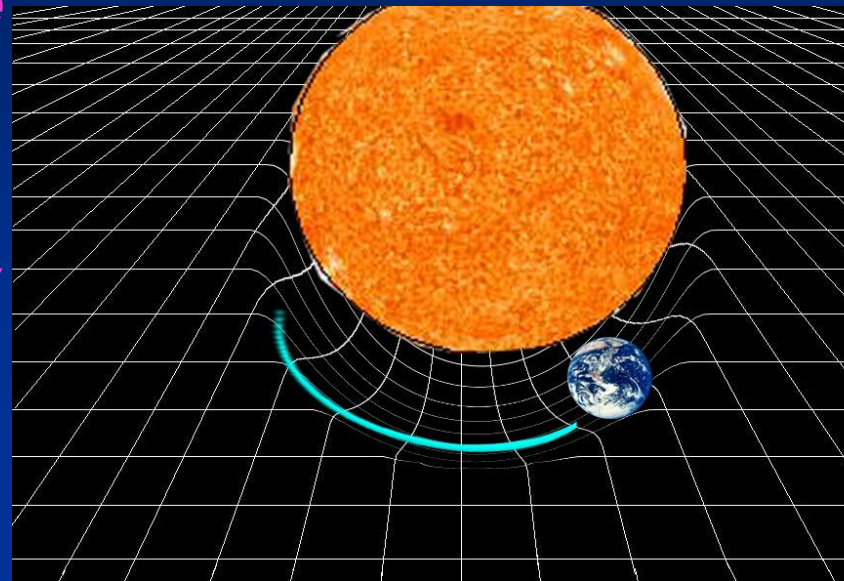
The largest element built by fusion is IRON (Atomic # of 26).

- Fusing heavier elements together **actually absorbs energy**, not releases it.
- When this happens, the body will start to cool and collapse on itself.

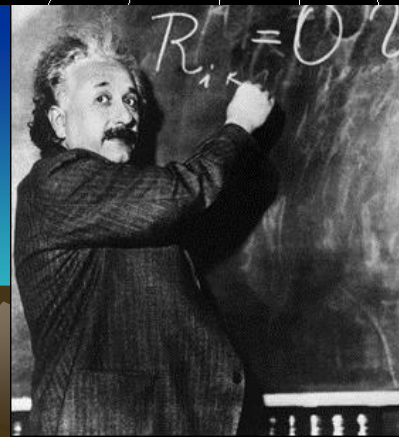
IA																VIIA		VIII	
1															1	2			
H															H	He			
1.00794															1.00794	4.002602			
IIA												IIIA	IVA	VA	VIA				
3	4											5	6	7	8	9	10		
Li	Be											B	C	N	O	F	Ne		
6.941	9.012182											10.811	12.0097	14.00674	15.9994	18.9984032	20.1797		
11	12	IIIB		IVB	VB	VIB	VIIIB	VIII			IB	IIB	13	14	15	16	17	18	
Na	Mg							26	27	28	29	30	31	32	33	34	35	36	
22.989770	24.3050							Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
39.0983	40.078	44.955910	47.867	50.9415	51.9961	54.938049	55.845	58.933200	58.6934	63.546	65.39	69.723	72.06	74.92160	78.96	79.904	85.80		
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54		
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe		
85.4678	87.62	88.90585	91.224	92.90638	95.94	(98)	101.07	102.90550	106.42	107.8682	112.411	114.818	118.710	121.760	127.60	126.90447	131.29		
55	56	57	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86		
Cs	Ba	La*	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn		
132.90545	137.327	138.9055	178.49	180.9479	183.84	186.207	190.23	192.217	195.078	196.96655	200.59	204.3833	207.2	208.98038	(209)	(210)	(222)		
87	88	89	104	105	106	107	108	109	110	111	112			114			118		
Fr	Ra	Ac**	Rf	Db	Sg	Bh	Hs	Mt	Ds	Uuu	Uub			Uug			Uuo		
(223)	(226)	(227)	(261)	(262)	(263)	(262)	(265)	(266)	(269)	(272)	(277)			(289)			(293)		
* Lanthanide			58	59	60	61	62	63	64	65	66	67	68	69	70	71			

EINSTEIN: "The Theory of Relativity"

- Einstein believed that **GRAVITY** comes from space behaving like a **piece of fabric**, and can be "warped" or "bent".
- Bodies in space are attracted by gravity, because the smaller body will fall into the "dip" of the fabric around the bigger body.



[Video: Einstein & Gravity](#)



This may also mean that black holes may be powerful enough to. .

- Tear a hole in the “fabric of space”, creating a tunnel somewhere called a WORM HOLE.
- We can't find out, because we would be compressed and crushed before we got there!

