The Sun and Other Stars

The Sun Today

The Sun in Deep Red Light



In this specific color of red light we can see more details of the Sun's magnetic activity.



The Sun in Ultraviolet



From space, we can observe the Sun in ultraviolet (UV) light and see hot gas trapped in magnetic fields on the Sun.

The Interior of the Sun



Exterior of the Sun

Photosphere: Sun's visible "surface"



Exterior of the Sun

Photosphere: Sun's visible "surface" **Chromosphere**: Just above the Photosphere



Exterior of the Sun

Photosphere: Sun's visible "surface" Chromosphere: Just above the Photosphere Corona: The Sun's outer atmosphere



The Corona extends far out into the Solar System, in fact we live in it! 8





The Sun's Magnetic Field





What Makes Up Sunspots?







Earth is Protected by it's Magnetic Field





August 14, 2003 • 9:29 p.m. EDT • About 20 hours before blackout



Solar Storms can cause massive power outages

August 15, 2003 • 9:14 p.m. EDT • About 7 hours after blackout



Solar Storms can disrupt communications between the ground, satellites, and transportation









HOW MANY STARS?

• How Many stars Can you see?

About 2000

- How many Stars are there in the universe? 10,000,000,000,000,000,000,000 (10 sextillion) to 1,000,000,000,000,000,000,000,000 (1 septillion)
- That is between 10,000 to 1,000,000 stars for every grain of sand on earth.



THE DISTANCE BETWEEN STARS

Shrinking the sun to the size of a golf ball.



The distance to the nearest star (Proxima Centauri) would be miles.



The Size of the Planets



The Size of the Planets



The Size of the Sun



The Size of the Sun



The Size of the Sun



Orion

Orion

< Giant

< Giant

Giant >

< Hot Bluish + Giant (Double star) < Giant

_Giant >

< Giant

This Explosion burns about ½ a pound of Hydrogen

The Sun burns 600 Million Tons of Hydrogen per second.

Fusion Reactions



LIFE OF A BUTTERFLY

Caterpillar

Eggs

Pupa

Butterfly

34

LIFE OF A STAR

LIFE OF A SUN-LIKE STAR

Sun-like Star

Protostars

. Red Giant Star-Forming Nebula

Planetary Nebula

White Dwarf

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PLANETARY NEBULA

LIFE OF A MASSIVE STAR

Massive Star Protostars

> Red Supergiant

Star-Forming Nebula

SUPERNOVA

Neutron Star

Black Hole

38

SUPERNOVA!

SUPERNOVA: Explosion of a Massive Star





Table of Elements

1																	2
Hydrogen			6	•		- Atomic	Number										Helium
п		1				(Number	of Protons)						_			пе
3	4		C	arhor		Chami	al Nama					5	6	7	8	9	10
Lithium	Beryllium		U	ainni		- Chemie	cal Name					Boron	Carbon	Nitrogen	Oxygen	Fluorine	Neon
Li	Be			0								B	C	N	0	F	Ne
11	12	C Chemical Symbol 13 14 15 16 17							17	18							
Sodium	Magnesium	Aluminum Silicon Phosphorus Sulfur Chlorine										Argon					
Na	Mg	AI SI P S CI A												Ar			
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Potassium	Calcium	Scandium	Titanium	Vanadium	Chromium	Manganese	Iron	Cobalt	Nickel	Copper	Zinc	Gallium	Germanium	Arsenic	Selenium	Bromine	Krypton
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	Δs	Se	Br	Kr
07	vu	00															
	00	20	10	44	40	40	44	45	40	47	10	10	50	54	50	50	54
3/ Dubidium	38 Strentium	39	40 Ziroonium	41 Nichium	42 Malubdonum	43 Technotium	44 Buthonium	45 Rhadium	46 Balladium	47 Silver	48 Codmium	49 Indiam	50	51	52 Tallusium	53	54
3/ Rubidium	38 Strontium	39 Yttrium	40 Zirconium	41 Niobium	42 Molybdenum	43 Technetium	44 Ruthenium	45 Rhodium	46 Palladium	47 Silver	48 Cadmium	49 Indium	50 Tin	51 Antimony	52 Tellurium	53 Iodine	54 Xenon
Rubidium Rb	38 Strontium Sr	39 Yttrium Y	40 Zirconium Zr	41 Niobium Nb	42 ^{Molybdenum} Mo	43 Technetium TC	44 Ruthenium Ru	45 Rhodium Rh	46 Palladium Pd	47 Silver Ag	48 Cadmium Cd	49 Indium	50 Tin Sn	51 Antimony Sb	52 Tellurium Te	53 Iodine	54 Xenon Xe
Rubidium Rb 55	38 Strontium Sr 56	39 Yttrium Y 57-71	40 Zirconium Zr 72	41 Niobium Nb 73	42 Molybdenum Mo	43 Technetium Tc 75	44 Ruthenium Ru 76	45 Rhodium Rh 77	46 Palladium Pd 78	47 Silver Ag 79	48 Cadmium Cd 80	49 Indium In 81	50 Tin Sn 82	51 Antimony Sb 83	52 Tellurium Te 84	53 Iodine 85	54 Xenon Xe 86
Rubidium Rb 55 Cesium	38 Strontium Sr 56 Barium	39 Yttrium Y 57-71	40 Zirconium Zr 72 Hafnium	41 Niobium Nb 73 Tantalum	42 Molybdenum Mo 74 Tungsten	43 Technetium Tc 75 Rhenium	44 Ruthenium Ru 76 Osmium	45 Rhodium Rh 77 Iridium	46 Palladium Pd 78 Platinum	47 Silver Ag 79 Gold	48 Cadmium Cd 80 Mercury	49 Indium In 81 Thallium	50 Tin Sn 82 Lead	51 Antimony Sb 83 Bismuth	52 Tellurium Te 84 Polonium	53 Iodine I 85 Astatine	54 Xenon Xe 86 Radon
Rubidium Rb 55 Cesium Cs	38 strontium Sr 56 Barium Ba	39 Yttrium Y 57-71	40 Zirconium Zr 72 Hafnium Hf	41 Niobium Nb 73 Tantalum Ta	42 Molybdenum Mo 74 Tungsten W	43 Technetium TC 75 Rhenium Re	44 Ruthenium Ru 76 Osmium Os	45 Rhodium Rh 77 Iridium Ir	46 Palladium Pd 78 Platinum Pt	47 Silver Ag 79 Gold Au	48 Cadmium Cd 80 Mercury Hg	49 Indium In 81 Thallium TI	50 Tin Sn 82 Lead Pb	51 Antimony Sb 83 Bismuth Bi	52 Tellurium Te 84 Polonium Po	53 lodine l 85 Astatine At	54 Xenon Xe 86 Radon Rn
Rubidium Rb 55 Cesium Cs 87	38 strontium Sr 56 Barium Ba 88	39 Yttrium Y 57-71 * 89-103	40 Zirconium Zr 72 Hafnium Hf 104	41 Niobium Nb 73 Tantalum Ta 105	42 Molybdenum 74 Tungsten W 106	43 Technetium TC 75 Rhenium Re 107	44 Ruthenium Ru 76 Osmium OS 108	45 Rhodium Rh 77 Iridium Ir 109	46 Palladium Pd 78 Platinum Pt 110	47 Silver Ag 79 Gold Au 111	48 Cadmium Cd 80 Mercury Hg 112	49 Indium 81 Thallium TI 113	50 Tin Sn 82 Lead Pb 114	51 Antimony Sb 83 Bismuth Bi 115	52 Tellurium Te 84 Polonium Po 116	53 Iodine I 85 Astatine At 117	54 Xenon Xe 86 Radon Rn 118
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	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
*	Lanthanum	Cerium	Praseodymium	Neodymium	Promethium	Samarium	Europium	Gadolinium	Terbium	Dysprosium	Holmium	Erbium	Thulium	Ytterbium	Lutetium
	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103
**	Actinium	Thorium	Protactinium	Uranium	Neptunium	Plutonium	Americium	Curium	Berkelium	Californium	Einsteinium	Fermium	Mendelevium	Nobelium	Lawrencium
	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

CREATION OF ELEMENTS

- When the universe was formed there was only Hydrogen.
- Every element from Helium to Iron was made inside a star.
- All elements heavier than Iron were created in a Supernova explosion.











THE NITROGEN IN OUR DNA, THE CALCIUM IN OUR TEETH, THE IRON IN OUR BLOCD, THE CARBON IN OUR APPLE PIES,

WERE MADE IN THE INTERIORS OF COLLAPSING STARS.

WE ARE MADE OF STAR STUFF

CARL SAGAN

Neil deGrasse Tyson

