

# THE FIRST TEN MILLION MILLENNIA OR SO

Don L. Anderson

In the "beginning," nothing  
No time, no space, no matter.  
No energy, no strings  
nothing  
not even a point, not even a void  
nothing

No laws of physics  
no myths, no gods;  
nothing, absolutely nothing

Then, a singularity . . .  
Call it a bang, call it a Big Bang, call it light, call it God.  
Perhaps a thought.

In the beginning, the Laws of Logic begat the Laws of Physics.  
The rules.

From Nothing, expansion,  
false vacuums, phase changes, beginning of time, and space.  
Potential for something, Everything.

Energy, potential.  
Waves, strings;  
vibrating strings  
monopoles, sheets, threads  
webs.

From the void, chaos  
out of vacuum, Genesis.  
Condensation, knots,  
cosmic freezing,  
wrinkles in time, defects, domains,

Bubbles, foams. A detergent universe.

Strong force, weak force,  
symmetry breaking; machos, wimps,  
tubes of energy, gigantic loops.  
A pasta universe.

Plasma mist, quarks, gluons, muons  
nuclei, electrons  
protons  
collisions, bouncing  
binding  
Deuteronomy.

Add neutrons—  
Tritium;  
plus proton, Transmutation!  
Helium 3, Alchemy.  
Tritium swallows proton

Helium 4!  
3 billion degrees or more.

A helium universe  
three minutes gone.  
Aeons more to go  
before the Rest.

A Quantum world. The Dreams that Stuff are made of.  
4 minutes into it  
mostly light, photons swarm; electrons,  
positrons annihilate  
positrons gone.  
A proton-electron world  
of ghostly neutrinos and their anti's.

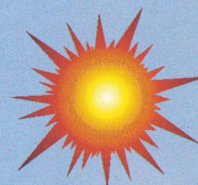
Lots of light, but no where to go; opaque.  
Universe rests at helium,  
but time goes on,  
cooling the first millennium,  
space expanding,  
great attractors,  
gravity.

Still opaque  
300 000 years  
3000 degrees  
electrons and protons  
hydrogen and photons  
atoms  
protons and electrons unite  
mate.

Create, annihilate  
create, annihilate  
cooling universe, changing color.

In the beginning, lurid gamma, off the spectral scale;  
shades to x-ray  
fades to UV, then violet and blue  
3000 degrees, yellow.

Visible matter, not the half of it,  
dark matter, the cosmic glue . . .  
dark invisible matter, holds the cosmos together  
not baryonic  
but what?  
gravitino, photino, axion faith?





Invisible dark matter  
closes the universe  
gas and dust and that. Clumps.

Then, The Stellar Delivery Room  
The crucibles of elements, the "metals."  
Mostly nothing, a few dense spots,  
patches made of "less nothing"  
in a spider web of strings,  
galaxies  
clusters of galaxies,  
150 million years into it.

Translucency;  
light moves off.  
Dense clumps  
nebular womb  
globules  
embryos  
Star birth! Here and there.  
Condensing, collapsing, heating.

Hydrogen, helium fuse  
150 million years into it  
Matter everywhere, Energy (kinetic)  
Flat whirling disks  
Black holes  
The Whole Shebang  
Quasars  
Ellipticals  
Spirals

Space, flat and isotropic and clumpy,  
burning stars  
the Philosophers' Stones  
hydrogen coal to helium gas  
helium coal  
carbon coal  
coal coal  
real coal for middle-aged stars.

Silicon cores  
Finally, iron  
The end of the road.

Superstars  
Collapse, rebound  
Supernova!

All the rows and columns of Mendeleev's Table  
Periodic.  
Stable, unstable.  
Scattered to space.

The stuff of fable  
two millennia ago, at 3 BC  
a beacon in the east.

Cobalt, nickel, xenon  
strontium, platinum, uranium and the rest  
blasted to space  
Stuff of Stars.  
Building blocks of us

Movie Stars and railway cars  
blown to a distant eddy  
a new congealing gas-dust cloud,  
on the edge of a spiral,  
gravity attracts  
rotation shapes  
knots and eddies  
a central star seed  
ignites, lights  
driving off its dust.

A disk  
a gassy ring  
condensing, cooling  
Ice at edges.  
In bulbous middle  
gas balls grow,

The Giant Gods of Legend  
Jovial, Neptunian, Saturnalia.  
Uranian.

Fe and Ni to dense cores of embryo planets, proto Earth  
Then rocks, oxygen, silicon, aluminum  
A growing world,  
Dante's Inferno, layer by layer.

Earth emerges, Gaea  
Bright it gleams, molten,  
heated by energy within and without  
Uranus and Thor's Daughters,  
Alpha and Beta,  
And stoned by Jove and Oort,  
Pebbles from space.

A hot birth  
volatiles boiled off, gone  
blown away by sunlight  
rarely, giant impacts  
towering walls of ejected lava,  
liquid craters  
magma oceans  
Dante's nightmare  
violent rebirths, Begin again.

Time . . .  
cooling, congealing  
. . . heals all  
rafts of rock, floating under  
a moonless sky.  
a cinder, healing,  
a cooling lump.  
A lonely sky.

Another world, passing by  
Perturbed, no doubt, closes in  
smashes, crashes,  
splashes molten mantle to orbit.  
A moon made out of Earth  
drying out our planet,  
already bone dry.

All gases, long gone; never there.





No water, methane, CO<sub>2</sub>,  
Ammonia, hydrogen; no air.

No noble gases  
Others either.  
Dry Earth, nothing to breathe,  
in a hydrogen Universe.

Cooling again  
Freezing again  
A crystalline sphere  
A merger of planets and their Luna child  
A Newtonian accident  
From chaos to Gaea  
Mother Earth.

Pelted from above by cosmic debris;  
A Jovial sneeze  
Rocks, stones, dirty iceballs  
Asteroids and meteoroids  
Comets

The final 1%  
carbon, water  
stirred in from the top  
Sulfur, phosphorous  
potential life.

Silicon, iron, aluminum,  
oxygen, nickel, calcium  
a boring planet make  
a lifeless crystal  
a hard, hard world  
an elastic, brittle world.

Add a dash of water  
Watch the action begin  
A flowing, viscous world  
A volcanic world  
A round opaque lava lamp  
Renewing itself  
Endlessly.

Steam, then water  
A gentle rain from far-off heavens  
Holy water  
Without it . . .  
no geology, no theology  
no arcs, islands nor Noah  
no regurgitation  
no renewal.  
No life.

A static dry Venereal planet  
no ridges, no plates  
no oceans, in or out  
nor myths  
nor gods  
nor prayers or devotions.

The final 1%  
a pinch  
an afterthought

brings in hydrogen and helium  
argon and krypton  
xenon and carbon  
a final veneer.  
and earth becomes Earth.

So, we finally arrive  
at Four Point Five.  
Earth and the brethren.

Look at Mercury,  
quick, silvery,  
dense, dry  
tide to Sol

Look at Mars  
rust  
moons  
thin air

Look at Moon  
dust  
dunes  
can't live there

Look at Venus  
swirling motions,  
cloudy and fair  
much too  
hot

Look at Earth  
crust  
oceans  
air  
Life  
Cool!  
a trivial speck, an afterthought  
But all we got.

So here we are,  
simple and meek,  
Now how do we get through the rest of the week?

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DON ANDERSON is the Eleanor and John R. McMillan Professor of Geophysics at the California Institute of Technology. He wrote this poem for the dedication of the new Benson Earth Sciences Building at the University of Colorado at Boulder.

