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Powers of Ten

By Unknown

POWERS OF TEN:

The picnic near the lake shore in Chicago
was the start of a lazy afternoon
Early One October
We begin with a scene 1 meter wide,
Which we view from 1 meter away.
Now every 10 seconds we will look from
10x mais farther away
And our field of view will be
10x wider
This square is 10 meters wide
And in 10 seconds the next square will be
10x as wide
Our image is the center of the picnickers
Even after they've been lost the sight
100 meters wide, the distance a
man can run in 10 seconds
Cars crowd the highway,
power boats lie at their docs
The colorful bleechures of Soldier's Field
.
This square is 1 kilometer wide,
1000 meters
the distance a racing car can travel
in 10 seconds
We see the great city
on the lake shore
10 to the forth meter,
ten kilometers
the distance a super sonic airplane
can travel in 10 seconds
We see the first around end of Lake Michigan
then the whole Great Lake.
10 to the fifth meters, the distance
an orbiting satelite covers in 10 seconds
Longs parades of clouds,
the day weather of the Mid-West
10 to the sixth, one with 6 zeros.
One million meters
Soon the Earth will show us
its solid sphere
We are able to see the whole Earth now,
just over a minute along the jorney

The Earth diminish the distance, but these background stars are so much farther away. They do not yet appear to move. A line extends at the true speed of light. In 1 second we cross the tilted orbit of the Moon. Now we mark a small part of the path which the Earth moves about the Sun. On a Terra move around the Sun. Now the orbit passes on the neighbor planets Venus, Mars and Mercury. Entering in our field of view is the glowing center of our Solar System, the Sun. Followed by the massive other planets, swinging wide in their big orbits. That orbit belongs to Pluto. A fringe of miriads of comets too faint to see completes the solar system. 10 to the 14 th. While our Solar System shrinks into one bright point on the distance. Our sun is plain now only one between the stars. Looking back from here we note four southern constellations still much as they appear from the farside of the Earth. This square is 10 to the 16 th meters, one light year not yet out to the next star. Our last 10 seconds step took us 10 light years further. The next will be a 100 . Our perspective changes so much on each step now that even the background stars will appear to converge. At last we passed the bright star Arcturus and some stars in the deeper. Normal, but quite unfamiliar stars and clouds of gas surround us. as we transverse the Milky Way Galaxy.

Giant steps carry us into the
outskirts of the galaxy.
While we pull away we begin to see
the great flat spiral
facing us.
The time and path we chose to
leave Chicago
has brought us out of the galaxy along
a course
nearly perpendicular
to its disc.
The two little satellite galaxies of our own
are the clouds of the Jung.
Ten to the 22nd power.
One million light years.
Groups of galaxies bring a new level
of structure to the scene.
Glooming points are no longer
single stars,
But whole galaxies of stars
seen as one.
We pass the big Virgo cluster of galaxies
among many others
100 millions light years out
as we approach the limits of our vision
we pause to start back home
This lonely scene, the galaxy like dust
is what most space looks like.
This emptiness is normal.
The richness of our own neighborhood
is the exception.
The trip back to the picnic
on the lake front
will be a sped up version,
reducing the earth's surface by
one power of ten
every 2 seconds.
In each two seconds
we will appear to cover 90 % of the
remaining distance
back to Earth.
Notice the alternation between the great activity and
relative inactivity
A rhythm that will continue all the way until

our next goal:

A proton and a nucleus of a carbon atom
beneath the skin
of the hand of a sleepy man
at the picnic.

10 to the ninth meters

10 to the eight

Seven

Six

Five

Four

Three

Two

One

We are back at our starting point

We slow up at one meter,

10 to the zero power.

Now we reduce the distance to our
final destination by 9%
every 10 seconds.

Each step much smaller than
the one before.

At 10 to -2, 1/100 to the meter,
1 cm,

We approach the surface of the hand.

In a few seconds, we will enter in the skin.

Crossing layer after layer, from
the outermost dead cells
into a tiny blood vessel within.

Skin layers vanish and turn

An outer layer of cells,
felty collagen.

The capillary containing red blood cells
in a roughly lymphocyte.

We enter the white cell.

Among its vital organelles, the porous
wall of the cell nucleus appears.

The nucleus within holds the
heredity of the man

in the coiled coils of DNA

As we close in, we come to the
double helix itself.

A molecule, like a long twisted

ladder whose rungs of
paired bases spell out twice in
an alphabet of four letters
the words of a powerful genetic message.
At the atomic scale, the interplay
of four manned motion
becames more visible.
we focus on one commonplace group
of 3 hydrogen atoms
bonded by electrical forces
to a carbon atom.
4 electrons make up the outer
shell of the carbon itself.
They appear in quantum motion
as a swarm of shimmering points.
At 10 to the minus 10 meters,
1 angstrom,
we find ourselves right among
those outer electrons.
Now we come upon the two inner electrons
held in a tighter swarm.
as we draw to the atom's
attracting center,
we enter upon a vast inner space.
At last the carbon nucleus,
so massive and so small.
This carbon nucleus is made up
of 6 protons and 6 neutrons.
We are in a domain of universal modules.
There are protons and neutrons in
every nucleus; electrons in every atom.
Atoms bonded into every molecule
out to the farthest galaxy.
As a single proton fills our scene,
we reach the edge of present understanding.
Are these some quarks at intense
interaction?
our journey has taken us through
40 powers of 10.
If now the field is one unit,
then when we saw many clusters
of galaxies together.
It was 10 to the 40,
or one and 40 zeros.