

# Powers of Ten Part 1 Transcript

## Chicago

The picnic near the lakeside in Chicago is the start of a lazy afternoon early one October. We begin with a scene one meter wide which we view from just one meter away. Now every ten seconds we will look from ten times farther away and our field of view will be ten times wider. This square is ten meters wide, and in ten seconds the next square will be ten times as wide. Our picture will center on the picnickers even after they've been lost to sight.



## Earth

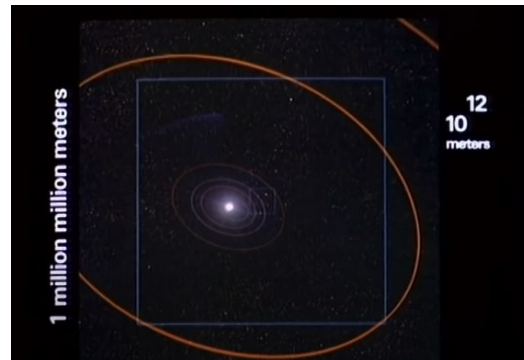
One hundred meters wide, the distance a man can run in ten seconds; cars crowd the highway; power boats lie at their docks; the colorful bleachers are Soldier Field. This square is a kilometre wide, one thousand meters, the distance a racing car can travel in ten seconds. We see the Great City on the lake shore. Ten to the fourth meters, ten kilometres, the distance a supersonic airplane can travel in ten seconds.



We see first the rounded end of Lake Michigan, then the whole Great Lake. Ten to the fifth meters, the distance an orbiting satellite covers in ten seconds, long parades of clouds, the day's weather in the Middle West. Ten to the sixth, a one with six zeros, a million meters. Soon the Earth will show as a solid sphere. We are able to see the whole Earth now, just over a minute along the journey.

## The Solar System

The Earth diminishes into the distance, but those background stars are so much farther away that they do not yet appear to move. A line extends at the true speed of light. In one second, it half crosses the tilted orbit of the Moon. Now we mark a small part of the path in which the Earth moves about the Sun. Now the orbital paths of the neighbour planets, Venus and Mars then Mercury. Entering our field of view is the glowing center of our solar system--the Sun, followed by the massive outer planets, swinging wide in their big orbits. That odd orbit belongs to Pluto. A fringe of a myriad comets too faint to see completes the solar system.



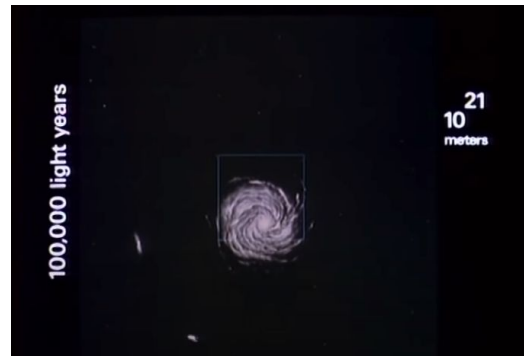
## The Stars

Ten to the fourteenth, as the solar system shrinks to one bright point in the distance, our Sun is plainly now only one among the stars. Looking back from here we note four southern constellations, still much as they appear from the far side of the Earth. This square is ten to the sixteenth meters, one light year, not yet out to the next star. Our last ten-second step took us ten light years further; the next will be a hundred.



## The Milky Way Galaxy

Our perspective changes so much in each step now that even the background stars will appear to converge. At last we pass the bright star Arcturus and some stars of the Dipper. Normal but quite unfamiliar stars and clouds of gas surround us as we traverse the Milky Way galaxy. Giant steps carry us into the outskirts of the galaxy, and as 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 disk. The two little satellite galaxies of our own are the clouds of Magellan.



## Clusters of Galaxies

Ten to the twenty-second power, a million light years, groups of galaxies bring a new level of structure to the scene. Glowing 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, a hundred million light years out. As we approach the limit of our vision, we pause to start back home. This lonely scene, the galaxies like dust, is what most of space looks like. This emptiness is normal. The richness of our own neighbourhood is the exception

