UNDERSTANDING THE STRUCTURE OF THE UNIVERSE

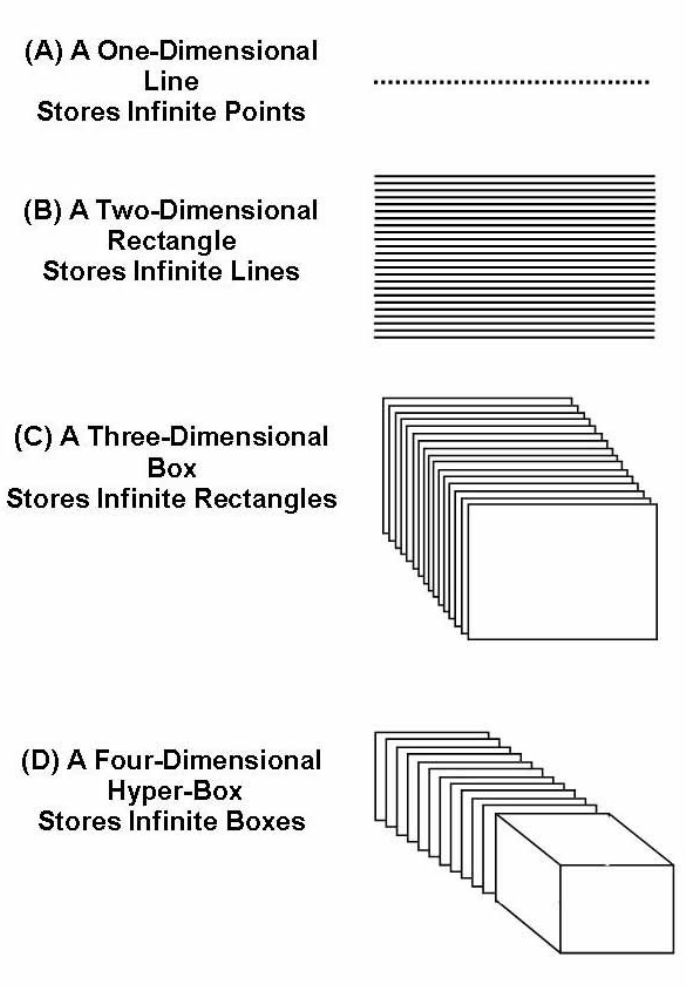
In another of my papers, The Structural Evolution of the Universe, on this GSL website, the universe is described as being on the surface of a four-dimensional ball expanding at the speed of light. Therefore as one goes back in time, the surface of the ball would become smaller and smaller, until it would shrink fitting into a four-dimensional box the size of an atomic particle, on each edge. A statement made in that discussion is that all the particles in the universe could, in principle, fit into this tiny box with no two particles touching each other. While this may appear non-intuitive, it is accurate. In fact, the universe started that way, and can be explained with the help of the following figure composed of four illustrations.

The top illustration (A) shows a one-dimensional line that can contain an infinite number of zero-dimensional points. In other words, an infinite number of zero dimensional objects can fit into a one-dimensional space, no matter how small the space. Illustration (B) portrays a two-dimensional rectangular sheet that can contain an infinite number of lines. Similar to (A), an infinite number of one-dimensional lines can fit into this two-dimentional rectangle, no matter how small the rectangle. The third illustration (C) depicts a three-dimensional box that can contain an infinite number of two-dimensional rectangular sheets. Keep in mind all of the points, lines, and sheets have finite width in order to be seen. In reality, these objects would have no width and they could be packed at an infinite density.

By inference, a finite larger dimensional container could hold an infinite number of lower dimensional objects. Finally, the last crude illustration (D) depicts a four-dimensional hyper-box that could store an infinite number of three-dimensional boxes. Each three-dimensional box has to be only big enough to fit one atom inside it. Thus, the box size need only be an angstrom on its edge, about the size of an atom. Since the boxes have no thickness in the fourth dimension, it can be packed at infinite density in that dimension. It would take about 10^{80} three-dimensional boxes to hold all the atoms in the universe, a huge number, but still much less than infinity of boxes that the hyper-box could contain. Since the universe started with atomic particles and not atoms, the boxes could even be several orders of magnitude smaller.

It would take 10^{80} (a 1 followed by 80 zeros) of points to place all the known universe atoms into it. This is a large number of points, but much less than the infinity of points contained in this fourth dimension. If one wanted to also include the empty space in our universe, 10^{110} of points are needed, which is still much less than infinity. Although all distance measurements in this four-dimensional hyper-box are small, the volume of the box is enormous. This idea can be further developed.

Figure – Four Illustrations



However, while the universe, as we know it would fit completely into a small four-dimensional space, it would not fit in it neatly. It would have to be shredded, like into atoms or atomic particles to make it fit. However, this is the way the universe started, but as the universe expanded it hugged the three-dimensional surface and grew, ultimately expanding at the speed of light to its present size, some 14 billion years later.

Interestingly, as the number of dimensions increases, the size of the available space becomes infinitely larger, allowing the universe to fit in it much neater. If the number of dimensions is increased sufficiently, for example to twelve, the universe could be "rolled-up" in it, keeping its outside size tiny, and still retain its present Euclidean appearance from the inside. Vast distances in the four-dimensional space would be kept

very small in the higher dimensional space. The gyroverse predicts that the universe is constructed this way. Showing this will be left for a future paper, but is explained in the gyroverse book. While many of the universe's characteristics can be gleaned from the four-dimensional view, some, like entanglement and the common mechanism for gravity and the strong force needs the twelve-dimensional outlook.