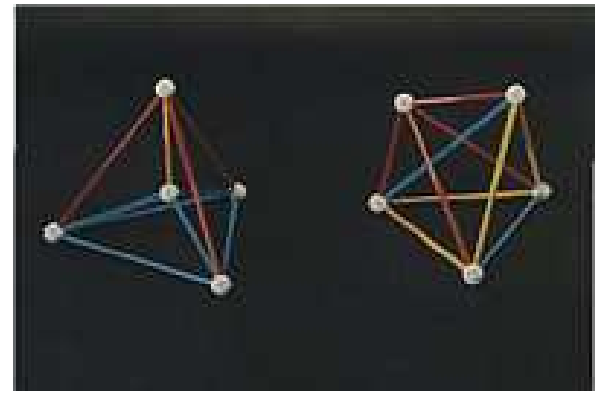
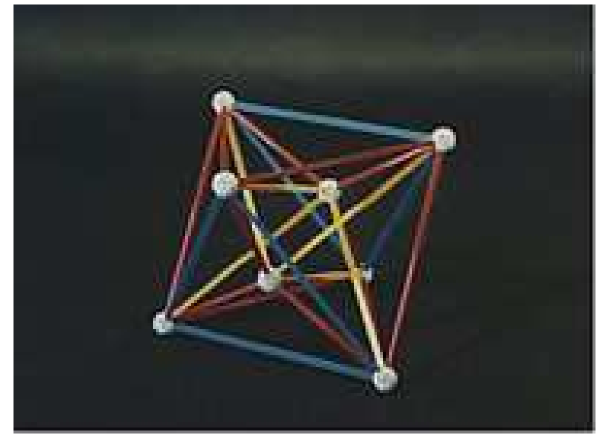
Model Images

1 Simplex



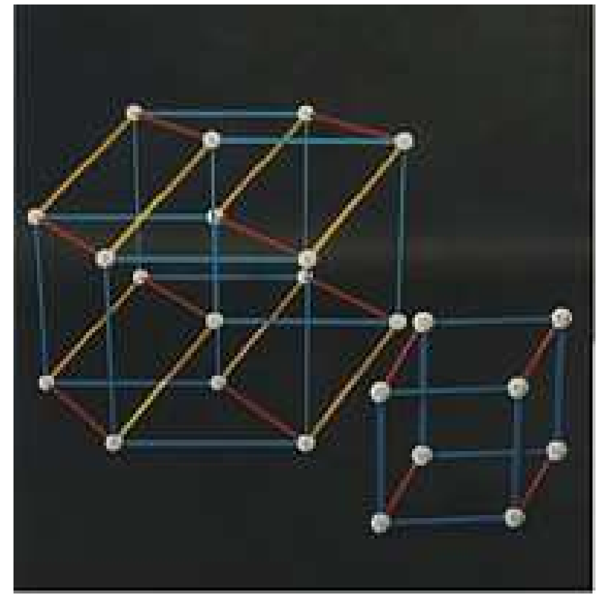
The figure on the left is the projected image of a simplex when looking “up” through the tetrahedral base and seeing the common point in the middle of the base. This is precisely like the 2-D image of a pyramid looking at the apex through its base. The model on the right is a view from a side of the simplex. It is clear in the picture how a 2-D image would appear as a pentagon with an inscribed pentagram. (The model is actually 3-D.)

2 Hyperoctahedron



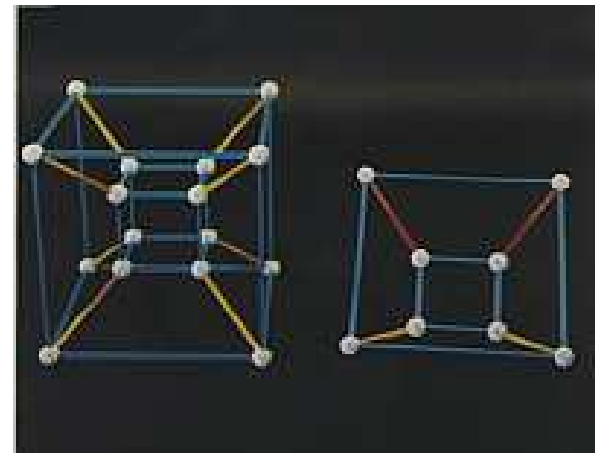
The view of the hyperoctahedron shows an pinched octahedron as the base of a dipyramid. The outside structure is itself another octahedron. The base octahedron can be changed to three different orientations to see a dipyramid.

3 Hypercube



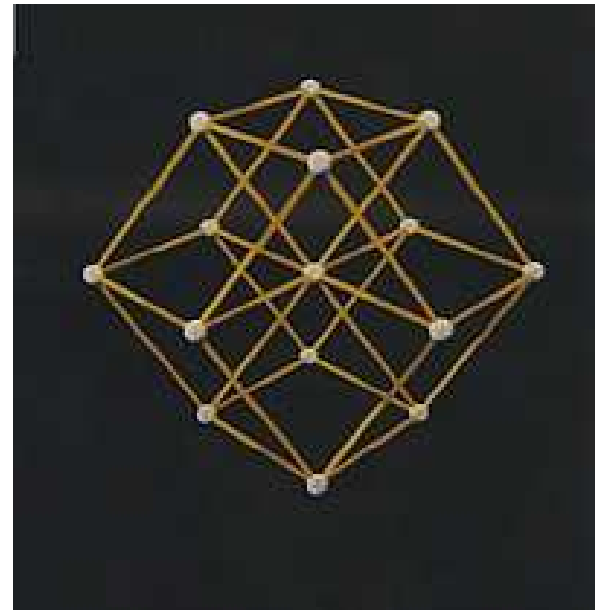
The hypercube has cells which are cubes, just as the cube has faces which are squares. The projection of the hypercube into 3-space on the left is analogous to the projection of the cube into 2-spce on the right. Squares either appear undistorted or as parallelograms. Cubes appear as parallelepipeds (slanted boxes).

4 Perspective Hypercube



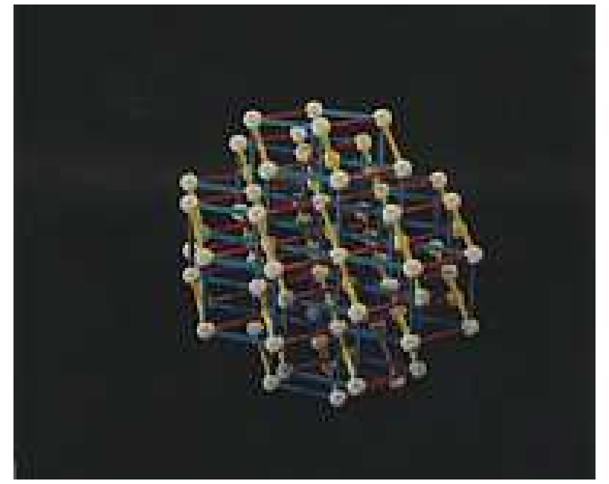
The perspective image of the hypercube is probably the most well-known 3-D image of a hypersolid. The perspective image of a cube in 2-space is included to explain. In the 2-D image, the closer face appears larger, and the back face is contained in it. In the 3-D case, the closer cell appears larger, and the back cell is contained in it. Just as the four side faces of the cube become trapezoids, the six "side" cubes of the hypercube become truncated pyramids. One can think of the projection in 2-space of a cube as the edges of a square sweeping out to a larger square. Likewise, the projection in 3-space of the hypercube can be seen as a cube whose sides sweep outward to a larger cube.

5 Diamond Structure



This view of the hypercube is along a line containing two of the vertices. They are thus both projected to a center point, which is seen as having eight edges emerge from it, rather than four. The outside of this projection figure is a semi-regular solid called a rhombidodecahedron, as its faces are 12 rhombi. The central structure of this wire-frame also contains the crystal structure of carbon in the form of diamond.

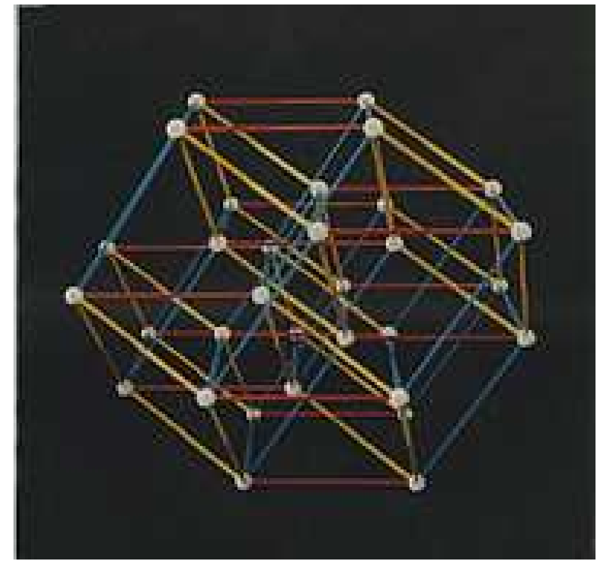
6 Hypercube Cluster

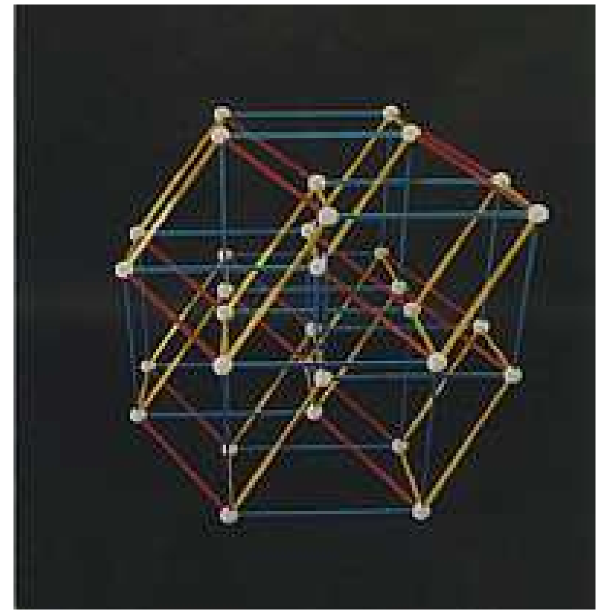


The image shown above is analogous to a cube with six cubes surrounding it, one on each face. It is a hypercube surrounded by eight other hypercubes. Just as two cubes in contact share a square (and two squares share a line), two hypercubes share a cube where they meet. Thus, there is a hypercube in contact with the central hypercube at each of its eight cubes. This structure shows the way in which hypercubes would be stacked to fill 4-space.

7 5-Cube

The model pictured below is a three-dimensional projection of a 5-cube. It is generated by sliding a hypercube "up" in 5-space and connecting each of the vertices from the starting hypercube to the vertices of the final hypercube. Each vertex has five mutually perpendicular edges. The 5-cube contains 10 hypercubes. Since each hypercube shares a cube, it consists of 40 cubes. When looking at this projection along any of the five axes, one can see 8 cubes at a time, which together form the "front" hypercube.





8 24-Cell

The following are each views of the same 24-cell model from different angles. Looking at any triangular face, one can pick two other sets of three vertices which form an octahedral cell of this polytope. As the name suggests, there are 24 cells which can be found this way.