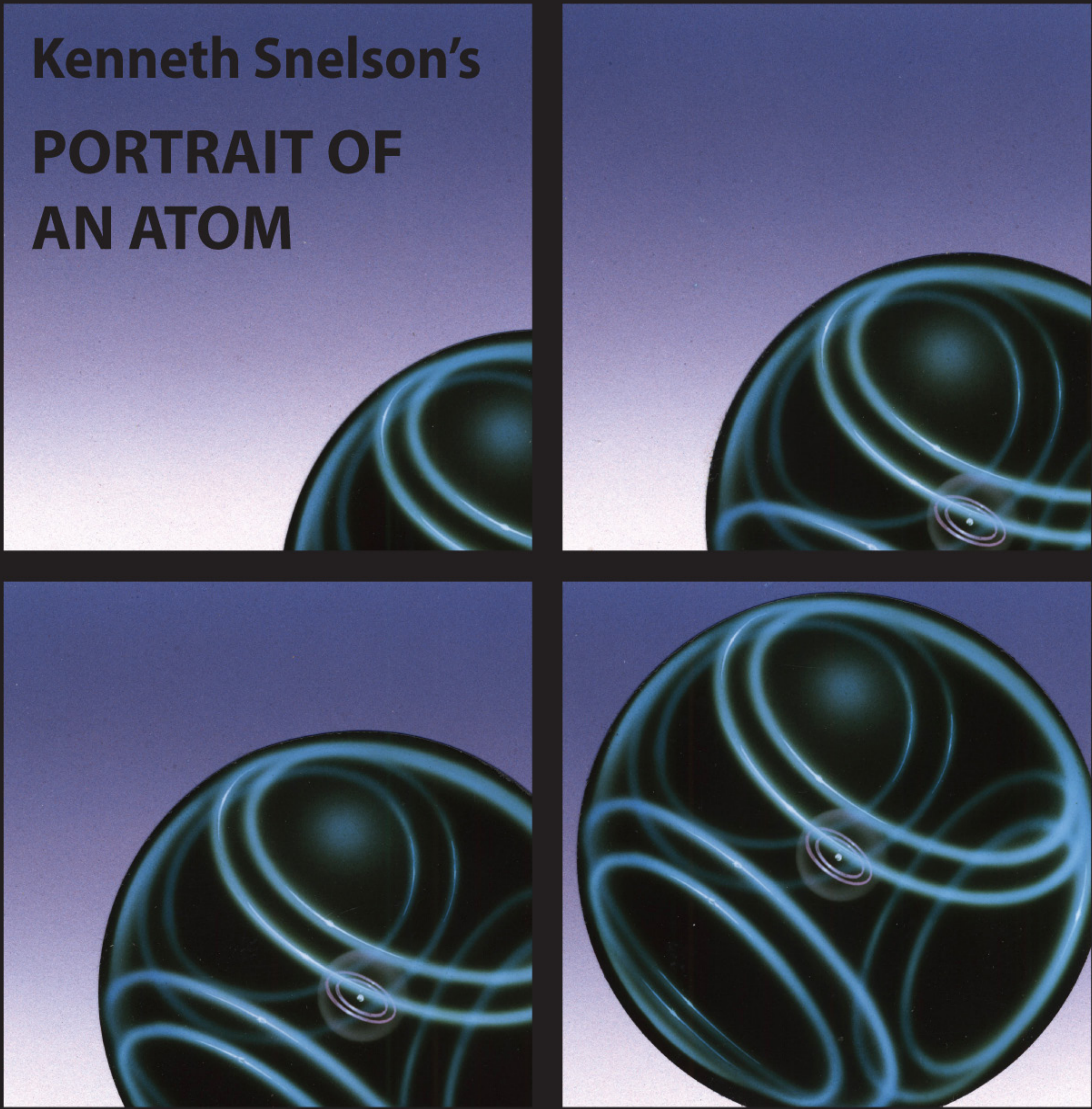
Kenneth Snelson's

PORTRAIT OF AN ATOM



PORTRAIT OF AN ATOM

Association of Science-Technology Centers
Final Report 1/24/84

PORTRAIT OF AN ATOM, Kenneth Snelson's visualization of the atom's electronic structure, was toured by the Association of Science-Technology Centers (ASTC) from March 1982 to September 1983. During the tour, the exhibition was viewed by more than 68,000 people at six museums.

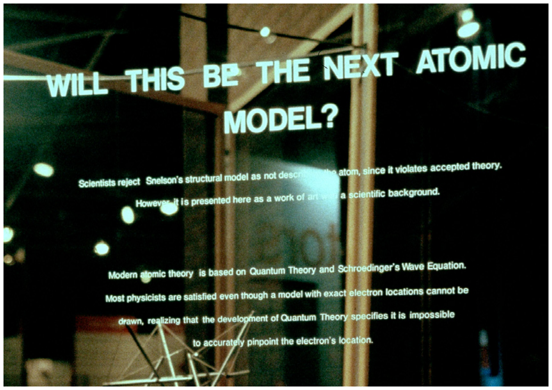
Kenneth Snelson, a well-known sculptor of tension and compression structures, has explored the relationships between the arts and science as they relate to atomic theory.

Snelson gathered the scientific information on the atom and through sculptural and structural experiments created his own model of the atom.

"My multimedia atom is portraiture though not quite in the classical sense. My subject is the atom and instead of paint and canvas I've used logic and three-dimensional space."

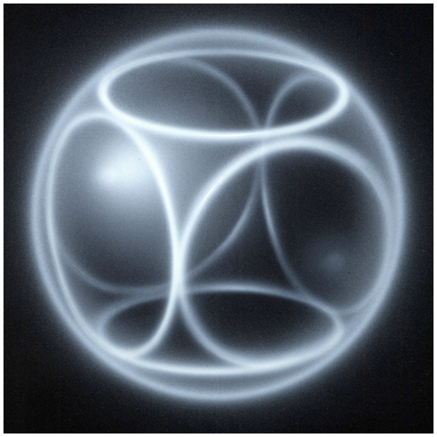
The exhibition consists of geometrical shapes formed out of framed plexiglas panels, two double-tray slide shows, graphic illustrations with explanations, and a videotape interview of the artist and is accompanied by a 26-page illustrated booklet by Snelson. The exhibition includes some of the criticisms it has received from members of the scientific community.

PORTRAIT OF AN ATOM was produced by the Maryland Science Center in Baltimore, Maryland with the support of the National Endowment for the Arts. General Electric provided support to ASTC for the circulation of the exhibition. The exhibition was returned to the Maryland Science Center at the end of its tour.



PORTRAIT OF AN ATOM

AN EXHIBITION



ARTIST–SCULPTOR KENNETH SNELSON'S

VISUALIZATION OF THE ATOM'S ELECTRONIC STRUCTURE

This is a revised web edition of the original exhibit booklet

PARTIAL SUPPORT FOR THIS EXHIBITION PROVIDED THROUGH A GRANT FROM THE
NATIONAL ENDOWMENT FOR THE ARTS

PORTRAIT OF AN ATOM

By Kenneth Snelson

BACKGROUND AND INTENT

This portrait comes from a tradition. Artists have often shown us the invisible; gods, spirits, goblins and demons. They have made tableaux of epic stories or battle scenes whose witnesses have long disappeared.

The details of the atom's structure are equally invisible and must be conjectured from scientific information. People have sought meaningful images of it since the Greek philosophers first conceived of atomism twenty-five hundred years ago.

Because it is my work to imagine and build sculptures from physical forces, the electronic atom's form and workings have seemed a kind of sculptural riddle, and as I see it, one not yet solved convincingly by science.

In the first quarter of this century there was great hope for achieving the goal of picturing the building block of matter. There were numerous models, some successful others not. There was J.J. Thomson's "raisin in pudding" model and G.N. Lewis's cubical octet atom as well as Parson's magneton electron atom. But great expectations began to blossom with the successes of the Rutherford-Bohr planetary model of 1913. It went through revisions in the decade that followed.

Finally, with Louis de Broglie's 1924 theory of the matter-wave electron, though no one could have anticipated it, the scientific world, by a surprising turn, was about to lay to rest its long search for the "real" and pictorial model that people had thought about for over two dozen centuries.

This reversal is generally attributed to the German physicist Werner Heisenberg's important discovery in 1926 that it is impossible to determine in one and the same experiment both the momentum and the position of an electron. Since to "follow an electron in its orbit" had been the physicist's aim, and because this now was seen as an impossibility, the entire proposition needed rethinking. What was an atomic model? It was now reasoned that for scientists to speculate on atomic problems beyond what could be verified was not truly scientific.

By 1930 the uncertainty principle and its implications became a hot issue that led to much debate and even to some name-calling. Anyone who argued against the new order was thought of either as naive or as an old fogy from the last century. Any model that explored how the atom's electrons might actually move was seen as heretical.

The classical search for cause and effect was replaced by a view that the atom was an *acausal* device. Its intricacies, what ever they might be, could be viewed only statistically, as millions of tiny micro-accidents and as the mathematical probability of locating an electron within the atom — if only there were some means to look for it.

A few important physicists held hope for a better model to come. "I do not believe that God throws dice," was Einstein's often quoted declaration.

Irwin Schroedinger, whose famous wave equation became the cornerstone of the standard model, strongly objected to the interpretation given his work. Commenting on the uncertainty principle he said, "It seemed to relieve us from the search for what I should call real understanding. It even rendered the endeavor suspect, as betraying an unphilosophical mind, the mind of a child who regretted the loss of its favorite toy, the picture or model, and would not realize that it was gone forever."

Max Born, one of the founders and staunch advocates of the new orthodoxy, described the new world view in this way: "What lies within the limits of the uncertainty principle is knowable. It is a world of experience, wide, rich enough in changing hues and patterns to allure us to explore it in all directions. What lies beyond, the dry tracts of metaphysics, we willingly leave to speculative philosophy."

Those dry tracts have lain unclaimed for five decades. From my view it may be that artists are the last of the speculative philosophers — at least the kind Max Born was speaking of. Even though this territory, a hunt for the "real" atom, is rejected by science it remains the place we might one day find out what an atom would be like in a photographic facsimile or a sculptured replica.

My point of departure for a visualized atom is at the point where de Broglie's picture left off. His was the last of the *physical* models. I have taken his matter-wave electron as a physical fact. What I introduce is the hypothesis that the electron's matter-wave orbit has that common property of gross matter which enables it to keep other piece of matter out. For the electron in an atom it means that its pathway is a "thing" that can push and otherwise limit the space of the other electron orbits just as whole atoms do with one another. Starting with this assumption the atom begins to make sense as an electromagnetic and mechanical object.

The features of my picture come close to those we should expect in order to see the atom as a workable device able to do all those remarkable things an atom can do. It gives off and receives light like a tiny space station. It can remain stable and resist collapse under great pressure. It collects and organizes its electrons in shells around the nucleus. It puts to use all of its electrical, dynamic and magnetic forces in its structure. It can attach itself to other atoms in molecules and crystals with astonishing virtuosity. And though its electrons are in rapid and perpetual motion, it can sit in tranquility in a rock for eternity.

My new model presents a structure that would do all these things. If it turns out to have nothing to do with real atoms then it is simply an incredible invention of an artist's mind. Its unfamiliar appearance may be irritating to those used to the usual images. "This is not what the way an atom ought to look!" said one famous physicist. However it is viewed I hope people will find it interesting and most of all thought-provoking.

I wish to thank the National Endowment for the Arts for its support in making this exhibition possible.

Kenneth Snelson,
November 24, 1980

A BRIEF HISTORY OF ATOMIC STRUCTURE

450 B.C.
DEMOCRITUS, a Greek philosopher, proposed that all matter is made up of particles called atoms, meaning indivisible.

1678
CHRISTIAN HUYGENS, postulated that light is a wave which moves and acts like waves in water.

1684
SIR ISAAC NEWTON stated that "matter is formed of solid, massy impenetrable particles", of some definite size which combine in various ways to produce substance.

1687
SIR ISAAC NEWTON developed the "corpuscular theory of light." Light is thought to be the result of "luminous corpuscles" or particles which produce the waves we see as light.

1864
CLERK MAXWELL developed a series of equations expressing the relationship between electric and magnetic forces.

1873
CLERK MAXWELL stated "we have strong reason to conclude that light itself is an electromagnetic disturbance."

1887
HEINRICH HERTZ discovered the photoelectric effect. If a beam of light falls on a clean metal plate in a vacuum, the plate becomes positively charged.

1895
SIR JOSEPH THOMPSON proved the existence of a negatively charged particle, termed the electron, which existed as part of the atom.

1900
MAX PLANCK developed the basis of modern Quantum Theory by finding that light is emitted or absorbed by an atom in discrete amounts called quanta.

1905
ALBERT EINSTEIN in his explanation of the photoelectric effect proposed that light must have both the properties of particles as well as those of waves.

1911
LORD ERNEST RUTHERFORD discovered that the atom's nucleus is very small in relation to the entire atom. He proposed that the negatively charged electrons were revolving around a heavier, charged nucleus.

1913

NIELS BOHR synthesized Rutherford's discovery into a reasonable model of an actual atom, using hydrogen as his example. Bohr proposed a positively charged central nucleus with electrons moving about it in circular orbits. The important feature in Bohr's theory was that electron orbits could occur only in specific, predetermined paths. If an electron absorbs energy, it is moved to an orbit further from the nucleus. Conversely, when it drops to an orbit nearer the nucleus, it gives off energy in the form of light. Different colors of light are produced depending on which orbit the electron starts from and to which orbit it drops.

1916

ARNOLD SOMMERFELD proposed elliptical orbits in addition to Bohr's circular ones. Sommerfeld's ellipses altered Bohr's model by showing electrons moving inwardly and outwardly without radiating or absorbing energy.

1923

LOUIS DE BROGLIE proposed that all objects have properties of waves. The lighter the object, the more pronounced the wave effect. An object as small as the electron would act very much like a wave, forming stationary waves around the nucleus.

1925

WOLFGANG PAULI developed the Pauli Exclusion Principle which states that no two electrons within the same atom can have the same set of quantum numbers.

1925

UHLENBECK & GOUDSMIT showed that the electron possesses a spin in either direction upon its axis.

1926

ERWIN SCHROEDINGER developed an equation, based on de Broglie's wave idea, expressing the probable location of an electron. These probable regions of occupancy were conceived as clouds of charge around the nucleus. Different shapes occurred for different types of orbitals.

1927

WERNER HEISENBERG derived his "Uncertainty Principle" which states that it is impossible to determine simultaneously the momentum and position of an electron.

1929

LINUS PAULING showed how 2 electrons could form a more stable wave arrangement if their spins were antiparallel.

CURRENTLY ACCEPTED SCIENTIFIC DESCRIPTION OF AN ATOM

1 At the center of the atom is a small, dense positively charged nucleus consisting primarily of protons and neutrons.

2 Moving around the nucleus are negatively charged electrons which account for only 1/5000 of the atom's mass — the rest of the mass being in the nucleus. Most of the atom is empty space. The motion of the electrons is not described.

3 The electrons in an atom are allowed to have only certain energies. The allowed states are described by a set of "quantum numbers", which indicate their average distance from the nucleus, their angular momentum and its direction, and the electrons' spin direction.

4 Light of a specific color is emitted or absorbed when electrons change from one state to another.

5 The "Heisenberg Uncertainty Principle" states that the position and momentum of an electron cannot be simultaneously determined. The interpretation of the Heisenberg principle is that the atom's structure and the interactions of its electrons are random and can be discussed only statistically.

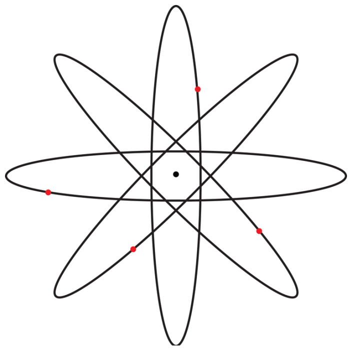
6 Even though the electron's exact position cannot be determined, if its energy is known, the theory predicts the probability that an electron could be at a particular place.

7 If the probability location of an electron of known energy is plotted in space, the plot looks like a fuzzy cloud of varying density, the shape varying with differences in angular momentum. It always has a definite symmetry about the nucleus. Some of the clouds or orbitals are spherical, others are like dumbbells, while others are more complex.

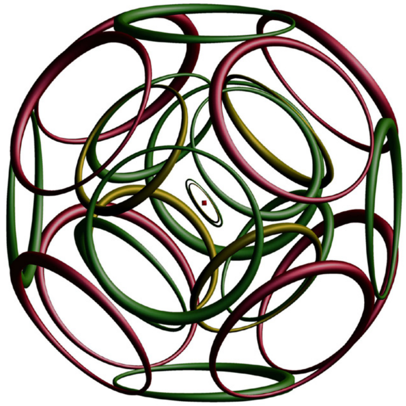
8 In describing an atom with many electrons, the charge clouds of one shell are superimposed in space with those of other shells.

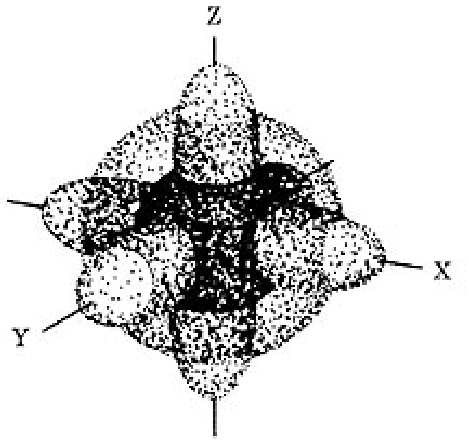
THE DIFFERENT "LOOK" OF SNELSON'S ATOM

We are used to atoms represented either with tiny glowing electrons racing about or by electrical clouds surrounding the nucleus.



Unlike conventional pictures the orbits of Snelson's model do not intersect or overlap one another. They are either great circles or small circles on imaginary spherical shells.





"Representations of the charge cloud model are often likened to clusters of balloons. My atom bears resemblance to the Chinese ivory carvings which are spheres within spheres."

GEOMETRY AND FORM OF CIRCLES ON SPHERES

A GREAT CIRCLE is the largest circle which can be drawn on a sphere. It goes around the girth like the Earth's equator.

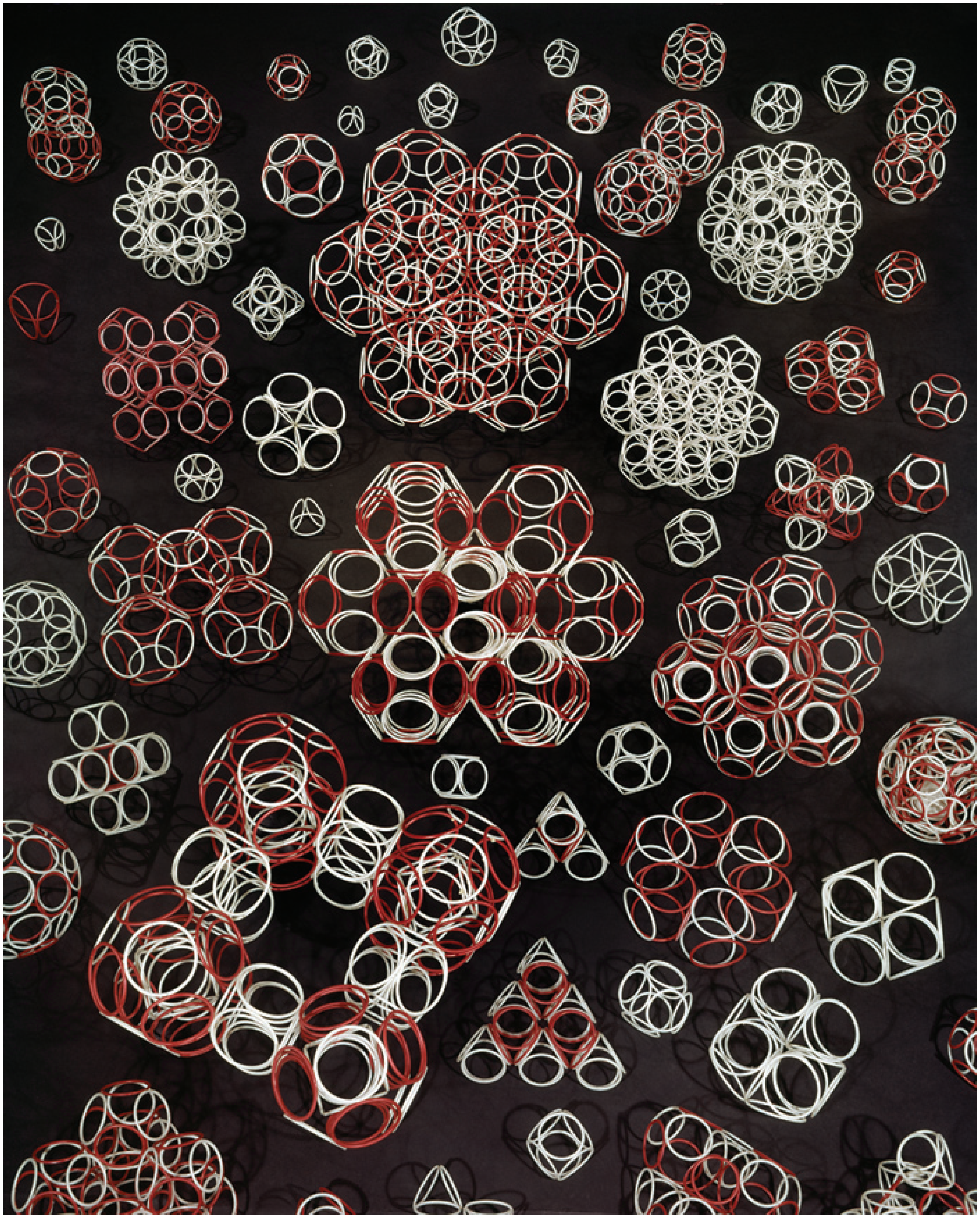
RANDOM sizes of smaller circles that do not overlap can be placed on a sphere in an infinite number of ways.

IDENTICAL size small circles that do not overlap can be placed on a sphere in many symmetrical arrangements.

Regardless of the size of the circles, they lie with their edges all at the same distance from their sphere's center.

Within this geometry there are many ways that these spherical skeletons can join with one another to generate patterns of three-dimensional, space-filling order.

With all of its endless combinations, this circle-on-sphere geometry makes up the general form of Snelson's model of the atom.



THE ORIGIN OF THE MATTER-WAVE ELECTRON ORBIT IN SNELSON'S PICTURE

The Bohr-de Broglie model was a brilliant and original insight into how electrons perform within the atom. De Broglie proposed that just as light is shown to have both a wave and a particle aspect, so might matter.

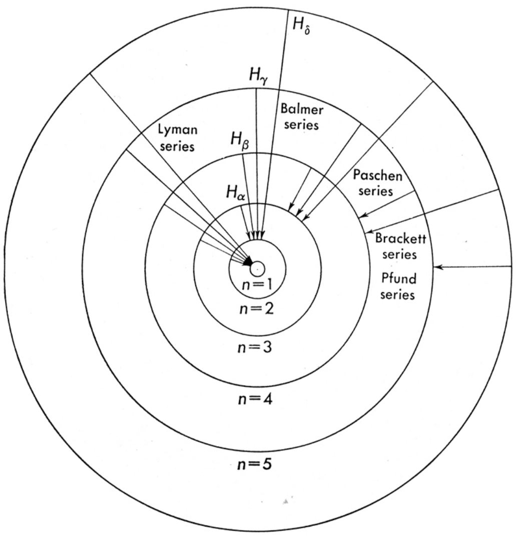
His now famous wave equation, indicated that an

$$\lambda = \frac{h}{p}$$

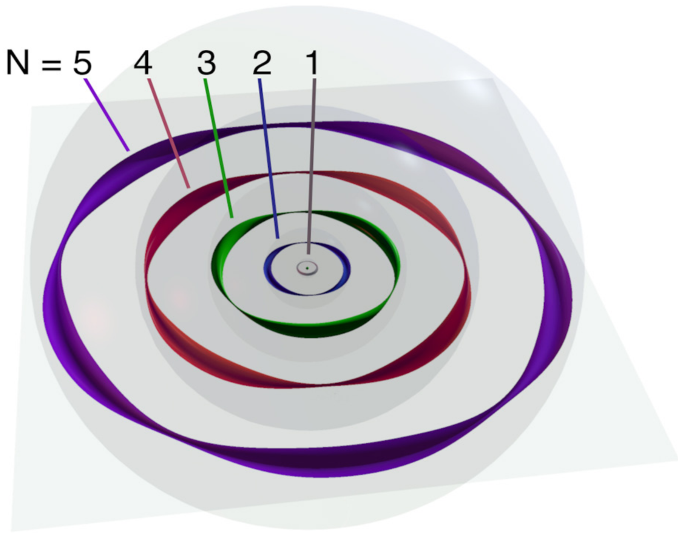
electron in a Bohr orbit racing around the atom's nucleus would possess a wavelength of the correct dimension to form a standing wave, a matter-wave. He envisioned the orbit as a pilot wave, continuous along the electron's path. It was like a vibrating string–where whole, identical waves are formed. In his picture, the electron must "remember" where it had been as well as where it was going on Bohr's energy spheres.

As in the illustration below, he showed that one standing wave could fit into the first shell, like a snake grabbing its tail. Two could form in the second shell, three in the third, etc.

As in Bohr's planetary electron model de Broglie's electron could move from one shell to another through varying electrical levels only by performing electrical work. This means taking in or giving off light. Normally the electron stays at the first shell, also called the ground state. As the shells and orbits of Bohr's model are quantized, so is the length of the wave of de Broglie's electron at each shell.



Niels Bohr's Planetary Electron Model, 1913



Louis de Broglie's *Bohr-de Broglie atom*, 1923

1913-1924 NIELS BOHR-LOUIS DE BROGLIE HYDROGEN ATOM

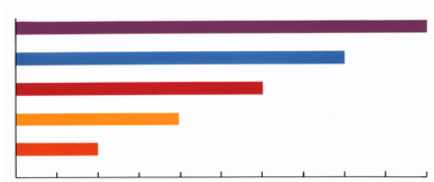
Represented below is the relationship between the electron's velocity and its de Broglie wavelength. The bars on the left symbolize velocity. As it reduces, the wave's length, on the right, increases. These are not continuous changes. They are quantized in jumps within the atom.

As light enters, the electron absorbs a quantity large enough to lift it to the next shell. Its de Broglie wavelength increases. Its growth rate in the Bohr-de Broglie picture is additive, for astonishingly, at each new shell the wave is longer than it was in the previous shell by the dimension of the first shell wave. The second shell wave is twice as long as the first shell wave; the third shell wave is three times as long, etc.

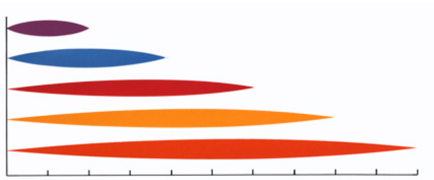
The growth rate of the shells is not additive, however. They grow geometrically, by the second power. Therefore, to continue to surround the equator at each successive level the electron must include an additional whole wave in its orbit. One wave fits around the first shell, two waves surround the second shell, three around the third.

Because each shell has its own unique wavelength, it is interesting to see how a single wave, at each shell, would relate to the size of its proper shell.

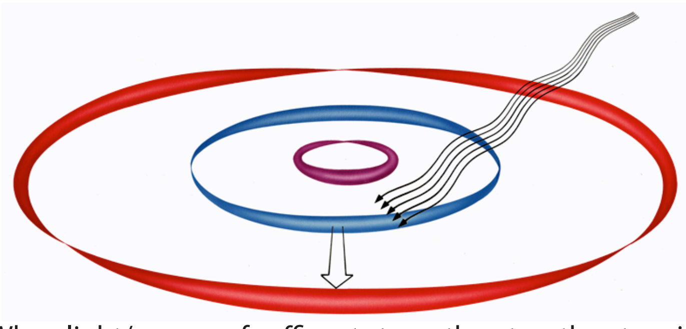
Shown here are the first five shells of the Bohr-de Broglie model. Drawn on them are one-wave orbits composed of just one of the waves appropriate for each successive shell. Only at the ground level can the wave surround the shell's equator.



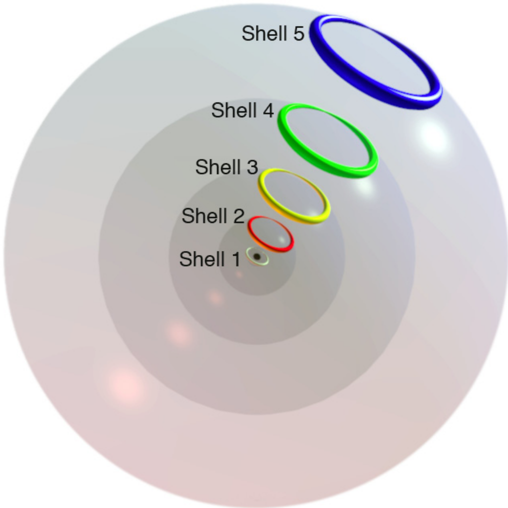
Electron's Velocity



Electron's de Broglie Wavelength



When light/energy of sufficent strength enters the atom it raises the electron to a higher energy shell.

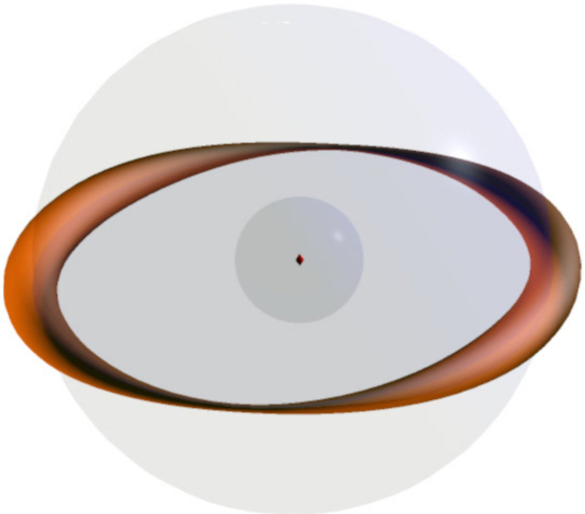


Hydrogen atom's 1 wave states for 5 energy levels: 1s, 2p, 2d, 4f, 5g

OPTIONAL HALO ORBITS IN SNELSON'S ATOM

The de Broglie standing wave is extended in Snelson's model to provide the required orbital choices for the electron. These are shown as off center, halo, orbits. They come about by this principle: At the left is the de Broglie orbit of the hydrogen atom's shell number two. Two standing waves surround the nucleus. Each wave is unique to this energy surface; twice as long as the wave in the first shell. Because this orbit is at the shells' equator it has no preferred direction in respect to the nucleus. It can move over the electrical shell to occupy the entire sphere.

At the right is the optional one-wave halo orbit of Snelson's model. Its single wave is identical to one of the waves of the two-wave state. Because it cannot surround the shell's girth it travels only a small circle portion of it. It has achieved a direction in space, "reaching out" from the nucleus even though it remains on the same sphere as the equatorial orbit. Because its path is half as long, it completes its orbit at twice the speed of the two-wave state.



2 wave orbit (2s)

1 wave orbit (2p)

HOW MIGHT AN ELECTRON REMAIN IN A SMALL CIRCLE HALO ORBIT?

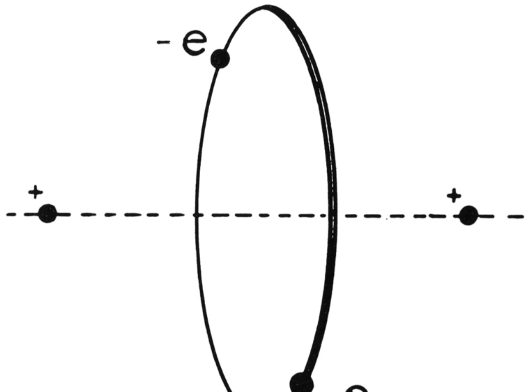
Niels Bohr originally introduced the idea of electrons in halo orbits, non-equatorial to the nucleus. (see below) This was Bohr's proposed model of the Hydrogen molecule H_2 composed of two protons with a pair of shared electrons in a common orbit lying midway between the two nuclei.

A similar structure occurs in NASA's libration-point satellite, the International Sun-Earth Explorer 3, which orbits at a point of gravitational equilibrium in between the Earth and the Sun.

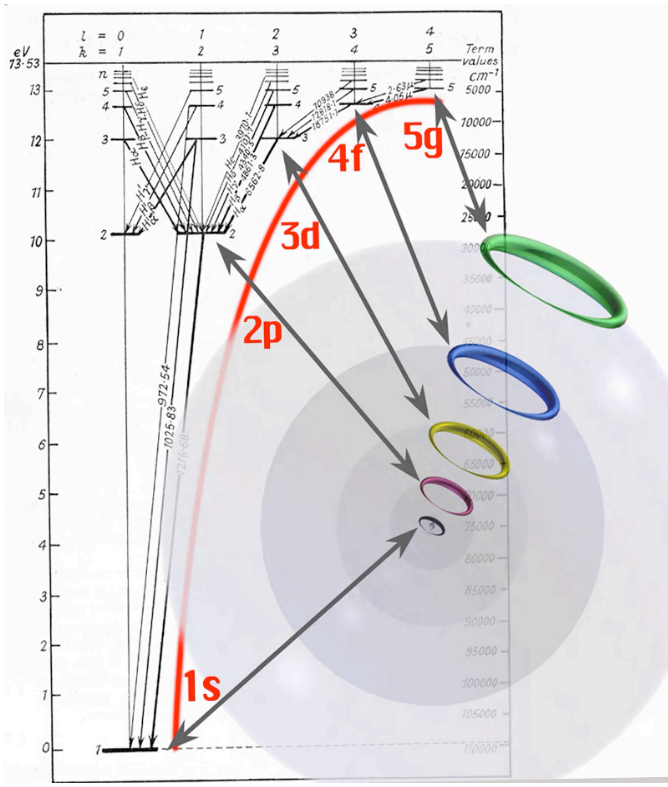
In Snelson's model, in a complex atom with many electrons, those in the same shell provide one another with the supplemental force, their matter-wave barrier, to maintain their energy level.

In the hydrogen atom there is no such supplemental force available to keep the electron in a halo orbit. Its "p", "d" , "f... orbits are but metastable shelves the electron is raised to by incoming light-energy. The absorbed energy will be expelled in discrete amounts as the electron drops back to its lowest energy state.

Pictured below are hydrogen's one-wave orbits for five quantized shells, as the electron drops from one level to the next with the emission of light. The energy states in its descent are shown in the "Grotrian diagram" below. They go from the *5g* to *4f*, *3d*, *2p* and finally to *1s*, the ground state.



Niels Bohr's H2 molecule
(after Coulson)



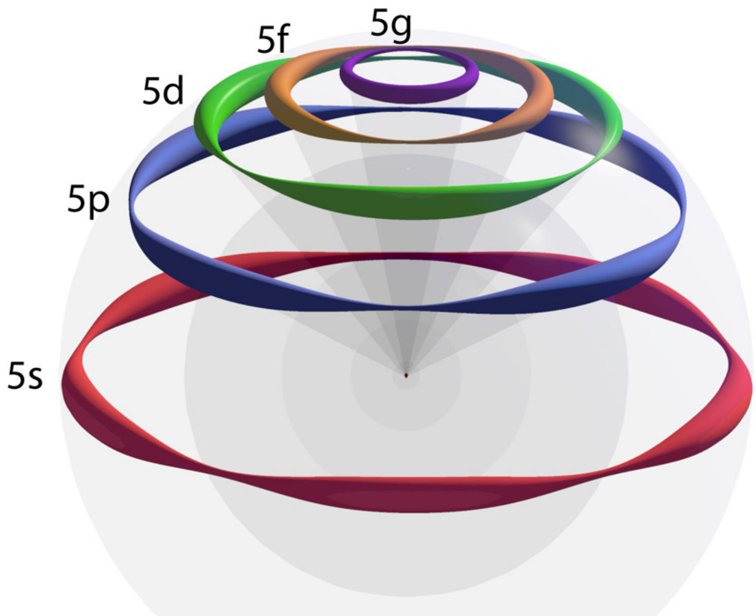
Superimposed on a "Grotrian diagram" for the hydrogen atom are the electron's one-wave orbits according to Snelson's model for levels 1-5

The picture below represents the hydrogen atom's fifth shell with five optional states according to Snelson's model. Surrounding the shell's equator is de Broglie's original 5s equatorial matter-wave orbit composed of five waves.

The optional 5p, 5d, 5f and 5g are halo orbits, off center from the nucleus. The electron generates its auxiliary states by incrementally reducing the number of whole waves, with one less wave for each smaller orbit.

The electron's linear velocity remains constant with each shorter trajectory, but its cycles per second increases in jumps to the maximum in the one-wave orbit. With each transition to a smaller orbit, from 5s to 5p, 5d, 5f to 5g, orbital and spin magnetism are more and more concentrated. This produces a lever-arm effect illustrated below by the overlay of transparent cones extending from the nucleus to each orbit. The smaller the orbit the more it extends directionally from the nucleus.

In de Broglie's model, all "s" orbits circumscribe the nucleus as flat disks. Historically "s" electron states are assigned zero orbital magnetism and angular momentum. Successively the "p", "d", "f", "g"... the orbits are shown to have an increase in orbital magnetism. According to Snelson's model the reason the "s" states display no angular momentum is because they are planar disks with no selective direction in respect to the nucleus.



The hydrogen atom electron's orbital options for shell 5 according to Snelson's model.

EACH ELECTRON'S MATTER-WAVE ORBIT AN "ATOM" WITHIN THE ATOM

Free electrons particles have three properties:

1. Mass.
2. Negative electrostatic charge.
3. Electron spin: Spin gives the particle a gyroscopic angular momentum plus a north-south magnetic field. In Snelson's model, electron spin itself initiates the electron's orbit as it enters the atom.

When the particle electron is suddenly captured by an atom it is tranformed into a de Broglie matter wave orbit. In its new atomic state the electron transforms itself into a set of five tools (forces) that enable it to interact with neighboring electrons as well to manage energy exchanges. The electron's matter-wave forces:

1. In orbit the electron's mass, creates a top-like angular momentum which provides the orbit a stabilizing force.

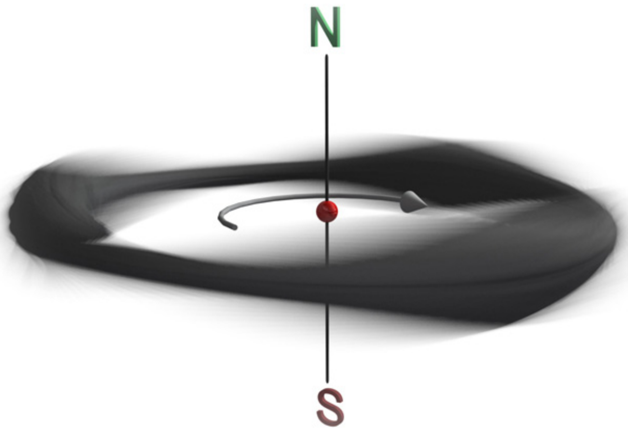
2. The particle electron's negative charge is evenly distributed over the orbit but it is nulled electrostatically by the positive electrical nuclear field.

3. The orbital revolutions of the electrostatic charge causes the matter-wave to become a dipole magnetic field like a current-loop. The more rapidly the electron completes its cycle, the greater is its orbital magnetism.

4. Spin magnetism is smeared throughout the orbit and can set its north-south polarity either to support the orbital magnetic field or to counter it.

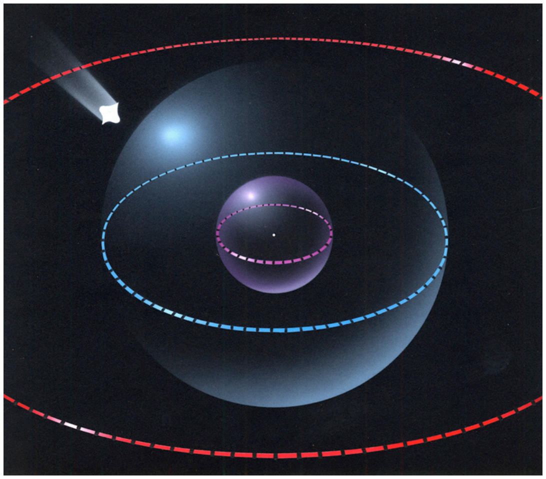
5. The **matter-wave orbit** itself is a force, a barricade that enables each atomic electron to exclude neighboring electrons from its protected space just as larger chunks of matter are mutually impenetrable

Armed with these forces, each atomic electron can interact with other electrons. As pseudo-objects, these matter-wave orbits perform in the manner of real electro-magnetic-mechanical items, contructing and maintaining the atom's electronic architecture.

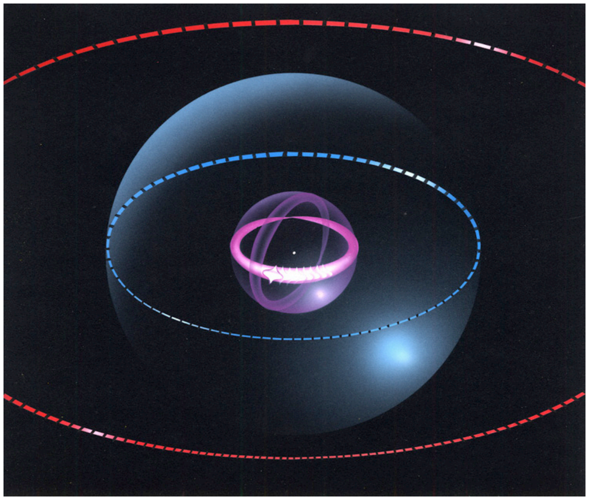


Electron orbits are individual objects that interact with one another through their tool box of forces: coulomb negative charge, de Broglie wave solidity, orbital magnetism, spin magnetism and gyroscopic angular momentum.

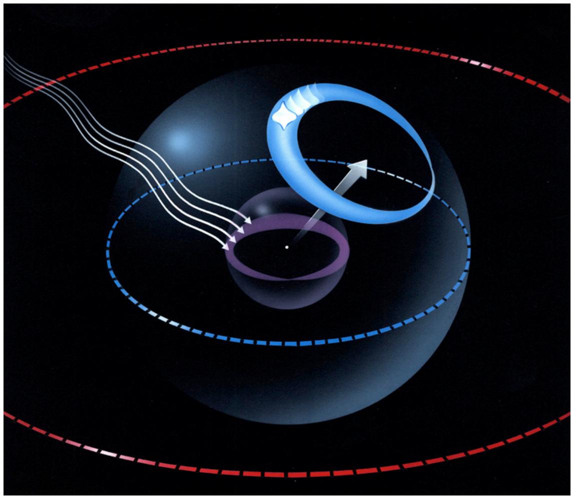
Computer graphic Jon Monaghan



1. An electron, is drawn into a nucleus' positive electrical sphere.



2. The particle is transmuted into a matter-wave, orbit.



3. Incoming light-energy is absorbed by the electron, raising it to a higher energy level.

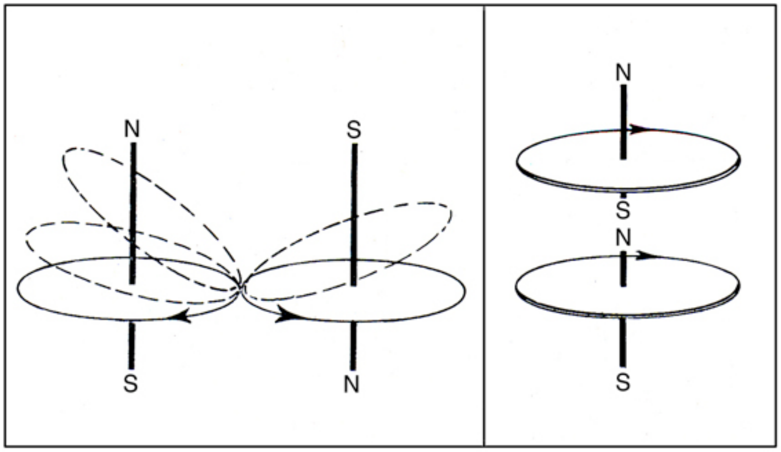
Airbrush illustration: George Kelvin

SNELSON'S EXPERIMENTS WITH MAGNETS

A ring-shaped current-loop magnet has a magnetic field like that of a single electron in a circular orbit.

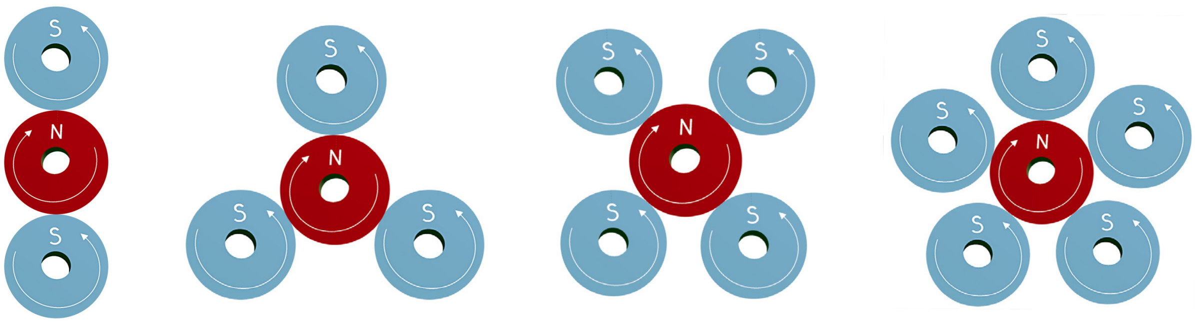
Two current-loop magnetic fields snap together edge-to-edge if they are antiparallel (N-S poles facing in opposite directions). If made to hinge, like folding a book, they still cling together even to the point of contact when they are face to face in parallel.

Simple experiments can be performed with circular permanent magnets to simulate current-loops. Two, three, four or five link to a central one if N-S poles are opposite. These patterns are the basis for the spherical magnet sets on the following page.



Permanant magnets, antiparallel edge to edge attraction.

Permanant magnets, antiparallel face to face attraction.



7 MAGNET SPHERES

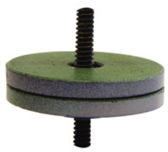
Snelson has discovered a unique set of seven symmetry arrangements that enable identical disk shape magnets to link continuously, north-south, on spheres. These comprise 2, 5, 8, 10, 14, 18 or 32 magnets.

Snelson's explanation for his magnetic structures:

"Physicists point out that the strength of the electron's orbital magnetic field is quite meager, about 1/100th that of their electrostatic force which pushes electrons away from another. How, then, can such relatively small magnetism enable them to attract one another?

It seems to me this picture overlooks the actual condition of electrons inside the atom. Yes, when they are outside as free electrons they can easily repel one another. But once inside the atom they are captives and their prime role is to neutralize the nuclear protons' positive electrostatic force. In this electrically neutral field they can no longer forcefully push one another away electrostatically. Instead, as de Broglie matter-waves, the orbits themselves become genuine matter.

In my model the atom's orbits defend their space just as macro objects do. Orbital magnetism and spin-magnetism are tools that electron orbits work with; for energy transactions, for bonding atom-to-atom and for maintaining the atom's lowest, most economical, energy state."



2

5

8

10

14

18

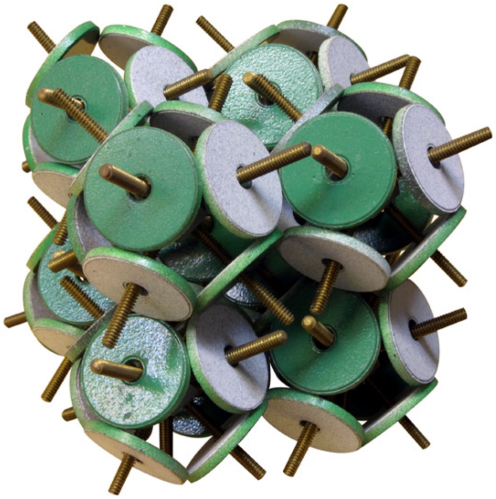
32

EXPANDNG MAGNET SPHERES

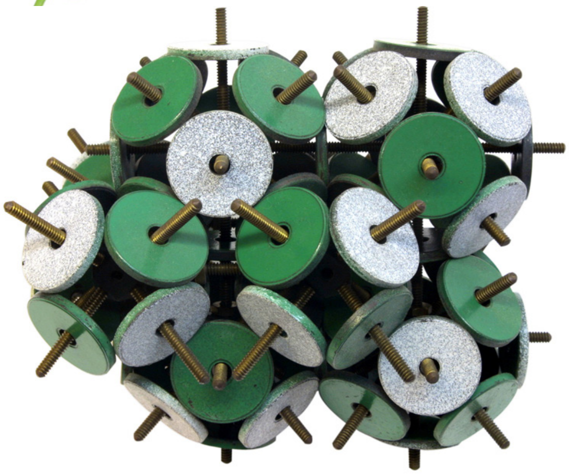
Because these spherical forms have symmetry properties like polyhedra, with the planes of cubes and other geometrical shapes, they can form larger systems by joining at their magnetic faces. Three such patterns are shown here.

The five-magnet group can be extended in a honeycomb pattern. Magnetic polarities are reversed from cell to cell, linking one group to the next. In all arrays, antiparallel linkages continue indefinitely to create an endless three-dimensional magnetic structure.

A plane of graphite with its carbon atoms arranged in hexagons.



Eight-magnet spheres in a body-centered-cubic order.



Fourteen-magnet spheres and eight magnet spheres alternate in space as two interlocking cubic patterns.

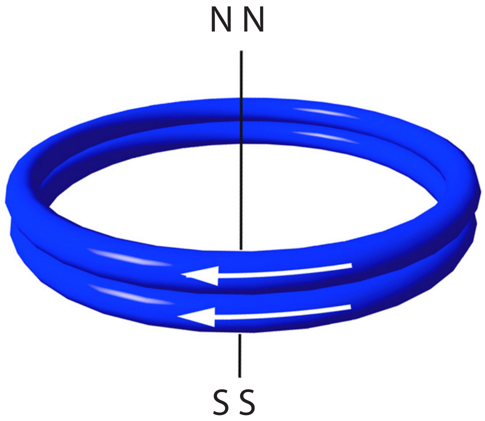
SNELSON REPRESENTS ELECTRON PAIRING IN TWO WAYS

In addition to attaching edge-to-edge in antiparallel, there are two alternate ways for ring-shaped magnets to form attractive relationships.

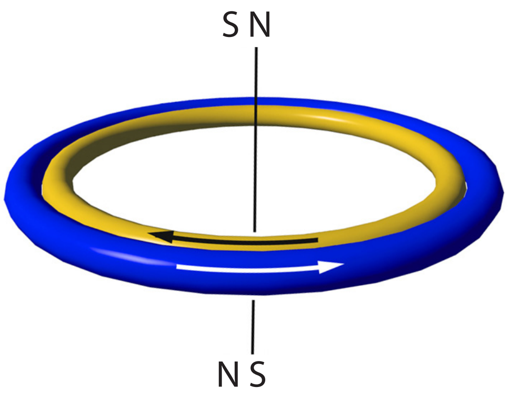
1. If two magnets are placed one on top of another, in parallel, they will attract face to face. (Fig. on left) The fields add together as a double strength magnet.

2. If two magnets are of different diameters, so that one can fit within the other as a ring within a ring, they will attract if antiparallel. (Fig. on right) If the magnets are of the same strength, they cancel one another to zero.

In Snelson's model these become the two modes of magnetic attraction by which electrons can pair together, either in the covalent bond or in the outer shell configurations of the noble gases.



Face to face in parallel



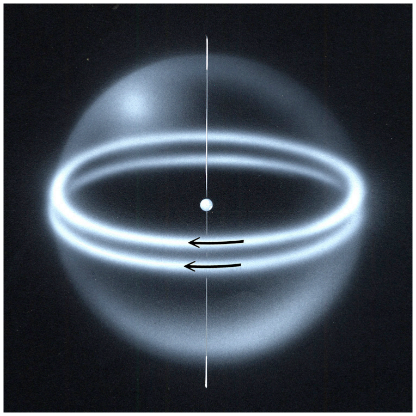
One inside another, antiparallel

PAIRS OF ELECTRONS; HELIUM AND HYDROGEN

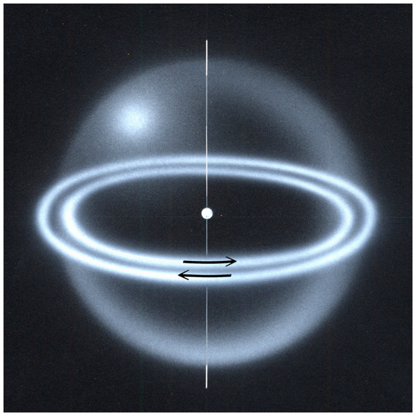
Snelson represents the alternate electronic states of *helium* as two different magnetic relationships for the electron orbits.

Similarly, Snelson represents two structures for the *hydrogen molecule*. This bears resemblance to Bohr's original model with two protons sharing a pair of electrons, in orbit between them.

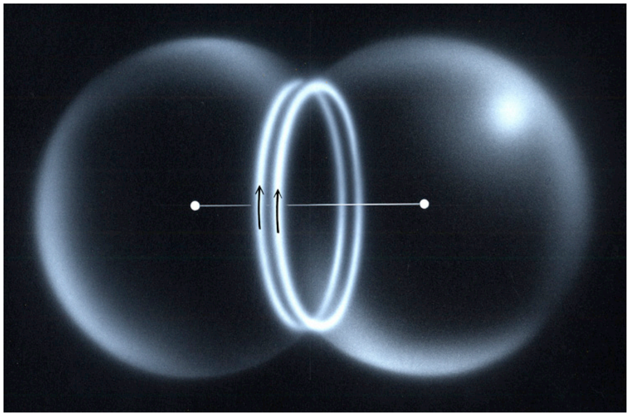
In Snelson's picture, the two electrons occupy exclusive orbits which associate magnetically either in parallel (ortho-hydrogen), or in antiparallel (para-hydrogen).



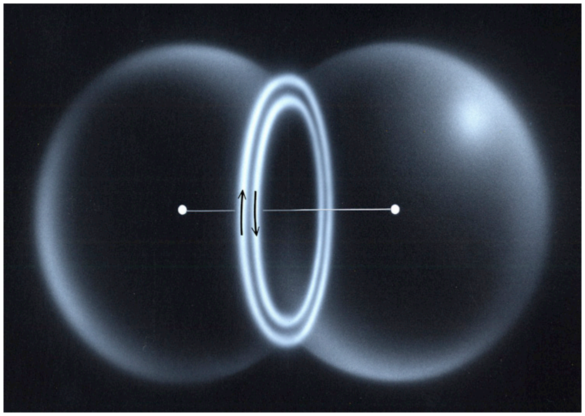
Parallel
Ortho-Helium



Antiparallel
Para-Helium



Parallel
Ortho-Hydrogen



Antiparallel
Para-Hydrogen

MAGNET MODELS OF MOLECULES

Magnet model cyclopropane molecule

Magnet model methane molecule

Magnet model nitrogen molecule

THE INERT GAS SHELL

The noble gas configuration is represented by Snelson as a tetrahedral structure composed of four pairs of magnetically antiparallel orbits.

Most molecules are not geometrically regular. In H_2O for example, the two hydrogen atoms sit at 104.5 degrees to one another instead of the true tetrahedral angles of 109.5 degrees. In Snelson's model these "bent" angles result from the geometric properties of differently sized circles

By taking two pennies and two dimes, one can hold them to form a spherical closure — a tetrahedron. But, because the dimes are smaller than the pennies they form a more acute angle in respect to the sphere's center.

Snelson describes the H2O molecule as like the neon structure except that the two hydrogen protons are at the centers of two of the tetrahedral faces. These positive fields draw in their pairs of electrons, making these circles smaller, deforming the symmetry into what could be described as "bent" bonds.

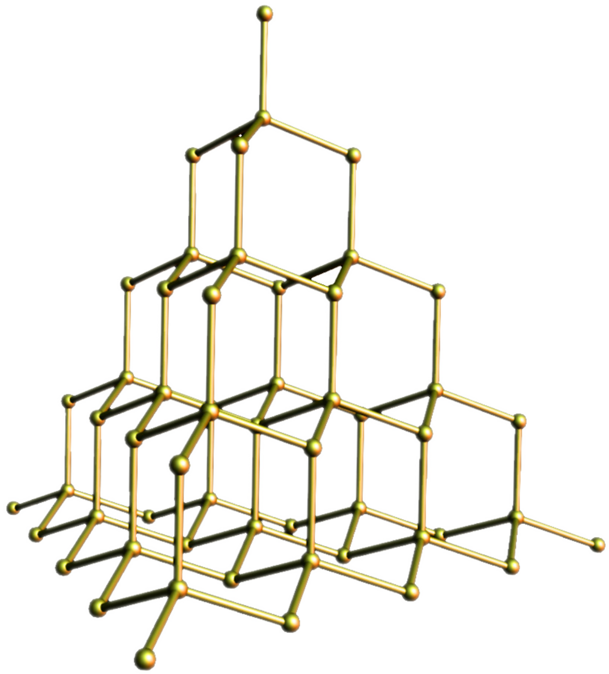
Snelson's description of the neon atom.

Tetrahedron of pennies and dimes, showing altering angles with respect to the center.

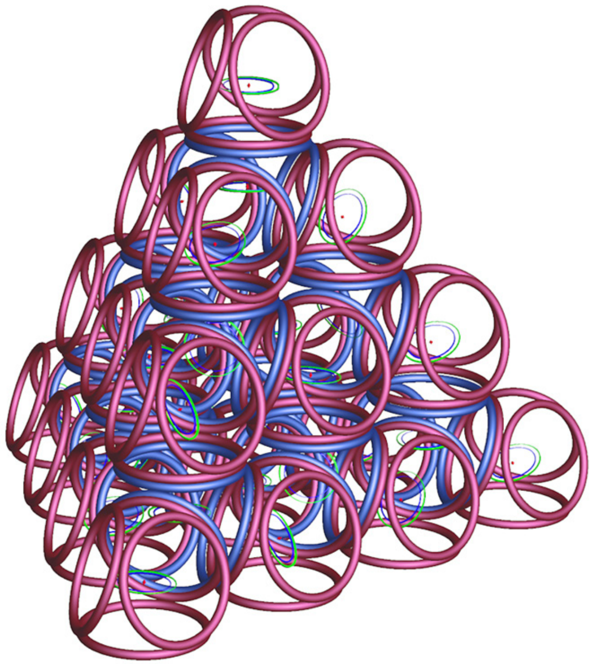
THE STRUCTURE OF DIAMOND

THE DIAMOND is a giant molecule made only of carbon atoms, bound together by covalent bonds, in the arrangement shown on left.

The strength of the diamond in Snelson's model is attributed to the matter-wave orbits' impenetrability along with its covalent bonds. "The paradox of the diamond is interesting. Its atoms are not arranged in a tight, closest-packing order. They lack the triangulation of sound architecture. In order for its remarkable rigidity to be understood, it can only be that the solidity of the electrons' matter-wave orbits in this otherwise flacid structure provide it with its remarkable solidity and strength."



The arrangement of carbon atoms in a diamond



Orbital structure of Snelson's diamond

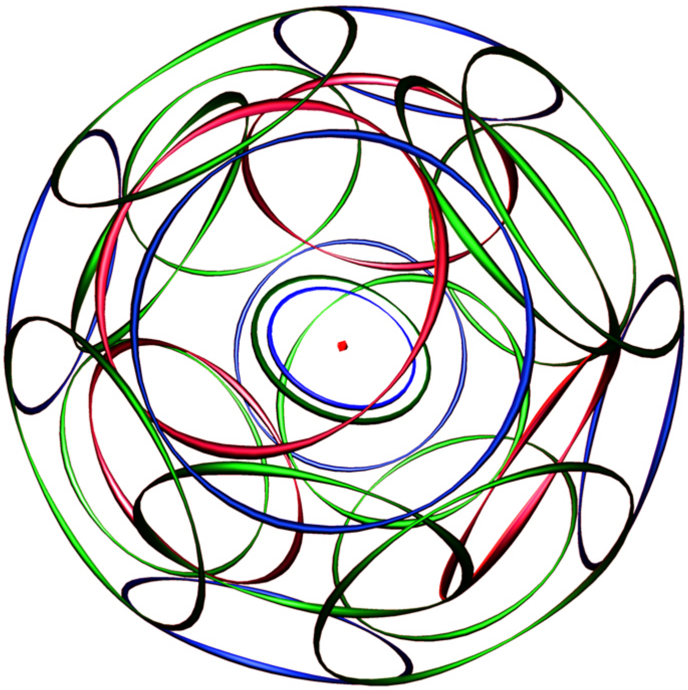
COMPLEX ATOMS WITH MANY ELECTRONS

Complex atoms are arranged as concentric spheres. Proper numbers of electrons in shells are included according to the requirements of the periodic table of elements.

Subshells are provisional arrangements and can combine with other subshells to form more spatially economical structures. For example, beyond the first shell, the two "s" electrons and the six "p" electrons are integrated into an eight-magnet octahedral form in Snelson's model.

Because of the intense nuclear attraction in the inner shells of heavy atoms, all electrons are forced to occupy one-wave orbits which carry the maximum of orbital magnetism. They form a linking group around the sphere with whichever magnetic mosaic is most economical. As in a game of musical chairs, those unable to enter try to find a place in the next higher shell.

Near the surface of the atom, where the nuclear attraction is less intense, electrons provide one another more freedom to change their relationships by using orbits of more than one wave. It is in the outermost shell that chemical bonding can occur.



KENNETH SNELSON
EASY LANDING, 1977
30′ × 85′ × 65′
COLL. CITY OF BALTIMORE