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Electron Orbiting Patterns and Associated Molecular Formation

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Abstract: In the independent-particle model, the nucleus of an atom consists of nucleons moving about the center of mass in certain orbits. With this, molecular formation is described by principles of quantum mechanics and the behavior of electrons in relation to their nuclei. A lot of time has been spent on the measurement of angular momentum of nuclear states than on the measurement of any other parameter of nuclear physics.1 However, these associated concepts leave a lot of holes when trying to explain molecular formation. Basically, molecules are formed through covalent and ionic bonding. In covalent bonding, atoms share electrons to achieve a stable electron configuration. Ionic bonding involves holding atoms together by an electrostatic force. The general belief is that molecules are formed because the resulting arrangements are more stable than the original atoms, and that stability is achieved when the outermost electron shells are full. However, there is no clear explanation as to how the electrons move and how shell filling creates a stable state. This article attempts to clarify these questions by deviating away from the independent-particle model and assuming a symmetrical orthogonal arrangement of protons and neutrons in the nucleus. Using this arrangement, an electron orbiting model is developed whereby orbiting patterns group elements in accordance with the Periodic Table. This theory is further strengthened when it is found that molecular formation is directly related to magnetic fields produced by orbiting electrons, thus, leading to covalent and ionic bonding. This changes the fundamental way of looking at the nuclear model.

Keywords: molecular formation, how are molecules formed

INTRODUCTION

As outlined in a published article titled "*An Orthogonal Mechanical Model of Stable Nuclei* [2]," it was shown that protons and neutrons are arranged in an orthogonal manner. Figure 1 is an example of an orthogonal structure in which the neon nucleons are symmetrically arranged on the x, y and z axes.

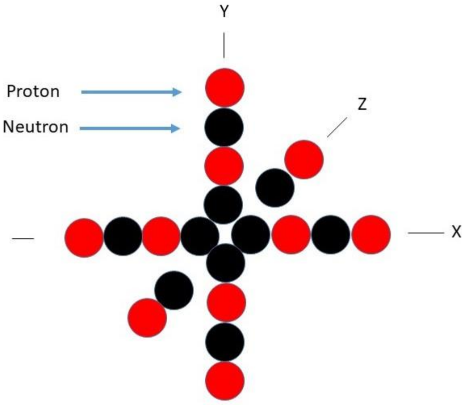


Fig. 1: Neon $_{10}Ne^{20}$ structure

In that article, an electron orbiting arrangement on the orthogonal axes was developed which adapted the mechanical models to the Periodic Table. A second article published in 2022 [3] demonstrated the commonality of orbiting electron schemes across several Groups of the Periodic Table. A third article, titled *"Electron Orbiting Patterns and Associated Crystal Formation* [4], expanded on the second article and demonstrated how a crystal structure is formed based on magnetic fields produced from the orbiting electrons. This article goes one step further and shows how molecular formation is based on a combination of magnetic fields and ionic bonding.

Given the orthogonal arrangements, electrons orbit perpendicular to the x and y axes, whereby the electrons on one side orbit in the opposite direction of those on the other side for each axis. Each electron is connected to a nucleon on its respective axis by an energy string (perhaps made up of photons). Figure 2 shows two quadrupoles rotating in opposite directions on a single axis. For neon, there are two non-rotating monopoles, one on each end of the axis. Using the right-hand rule (fingers pointing in the direction of the electron flow and the thumb pointing in the direction of magnetic flow), one can visualize magnetic fields flowing in the opposite direction on each side of the x-axis as shown by red arrows.

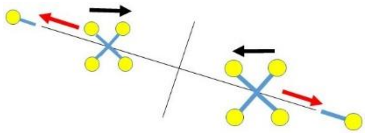


Fig. 2: The two quadrupoles of neon rotating in opposite directions on a single axis

As will be shown, this magnetic flow is key to the formation of molecules.

Figure 3 is a top view of four quadrupoles rotating and meshing together on two axes. For this to work, electrons can't be orbiting on the z-axis. The number of electrons are limited to four on any given plane. The red arrows show the direction of the magnetic fields produced by the orbiting electrons.

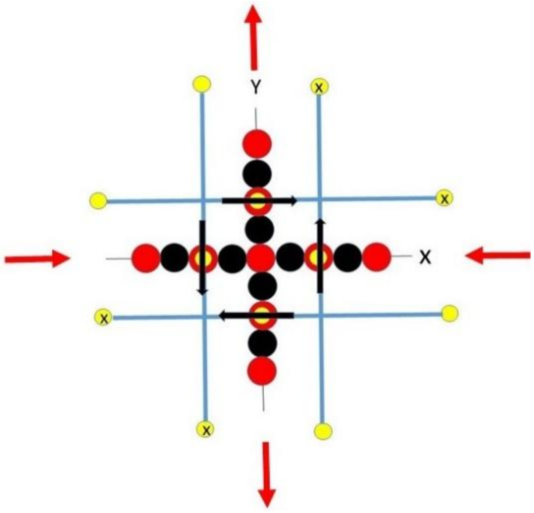


Fig. 3: A top view of four quadrupoles rotating and meshing together on two axes

Figure 4 is another top view showing electron flow direction and the resulting magnetic field.

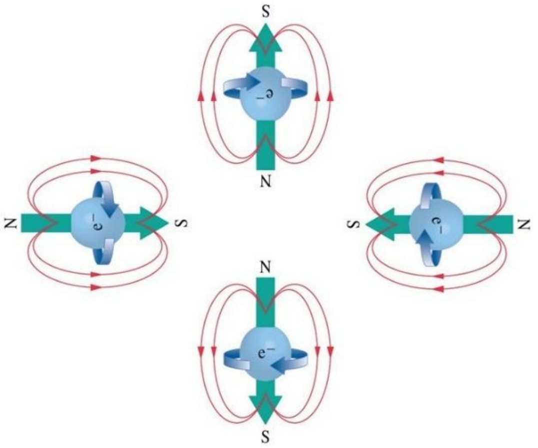
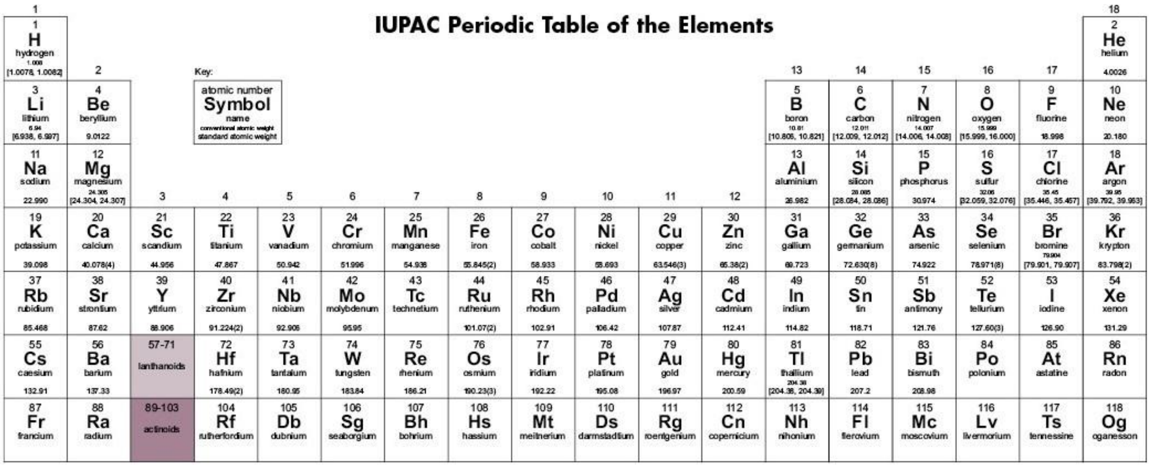


Fig. 4: Magnetic fields relative to the rotating electrons

MODEL DEVELOPMENT

The horizontal rows of the Periodic Table are called periods. Each vertical column (or Group) in the Table makes up a related group of elements based on their chemical behavior. This section will cover orbiting electron patterns using the Periodic Table as shown in Figure 5.



IUPAC Periodic Table of the Elements

Key:
atomic number
Symbol
name
conventional atomic weight
standard atomic weight

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 H hydrogen 1.008 [1.0078, 1.0082]																	2 He helium 4.0026
3 Li lithium 6.94 [6.938, 6.997]	4 Be beryllium 9.0122											5 B boron 10.81 [10.806, 10.821]	6 C carbon 12.011 [12.009, 12.012]	7 N nitrogen 14.007 [14.006, 14.008]	8 O oxygen 15.999 [15.999, 16.000]	9 F fluorine 18.998	10 Ne neon 20.180
11 Na sodium 22.990	12 Mg magnesium 24.305 [24.304, 24.307]											13 Al aluminium 26.982	14 Si silicon 28.085 [28.084, 28.086]	15 P phosphorus 30.974	16 S sulfur 32.06 [32.059, 32.076]	17 Cl chlorine 35.45 [35.446, 35.457]	18 Ar argon 39.95 [39.792, 39.963]
19 K potassium 39.098	20 Ca calcium 40.078(4)	21 Sc scandium 44.956	22 Ti titanium 47.867	23 V vanadium 50.942	24 Cr chromium 51.996	25 Mn manganese 54.938	26 Fe iron 55.845(2)	27 Co cobalt 58.933	28 Ni nickel 58.693	29 Cu copper 63.546(3)	30 Zn zinc 65.38(2)	31 Ga gallium 69.723	32 Ge germanium 72.630(8)	33 As arsenic 74.922	34 Se selenium 78.971(8)	35 Br bromine 79.904 [79.901, 79.907]	36 Kr krypton 83.798(2)
37 Rb rubidium 85.468	38 Sr strontium 87.62	39 Y yttrium 88.906	40 Zr zirconium 91.224(2)	41 Nb niobium 92.906	42 Mo molybdenum 95.95	43 Tc technetium	44 Ru ruthenium 101.07(2)	45 Rh rhodium 102.91	46 Pd palladium 106.42	47 Ag silver 107.87	48 Cd cadmium 112.41	49 In indium 114.82	50 Sn tin 118.71	51 Sb antimony 121.76	52 Te tellurium 127.60(3)	53 I iodine 126.90	54 Xe xenon 131.29
55 Cs caesium 132.91	56 Ba barium 137.33	57-71 lanthanoids	72 Hf hafnium 178.49(2)	73 Ta tantalum 180.95	74 W tungsten 183.84	75 Re rhenium 186.21	76 Os osmium 190.23(3)	77 Ir iridium 192.22	78 Pt platinum 195.08	79 Au gold 196.97	80 Hg mercury 200.59	81 Tl thallium 204.38 [204.38, 204.39]	82 Pb lead 207.2	83 Bi bismuth 208.98	84 Po polonium	85 At astatine	86 Rn radon
87 Fr francium	88 Ra radium	89-103 actinoids	104 Rf rutherfordium	105 Db dubnium	106 Sg seaborgium	107 Bh bohrium	108 Hs hassium	109 Mt meitnerium	110 Ds darmstadtium	111 Rg roentgenium	112 Cn copernicium	113 Nh nihonium	114 Fl flerovium	115 Mc moscovium	116 Lv livermorium	117 Ts tennessine	118 Og oganesson

Fig. 5: **IUPAC [5] Periodic Table of the Elements (minus elements 57-71 and 89-103)**

Figure 6 shows the electron orbit pattern for the Group 1 alkali metals; lithium, sodium and potassium.

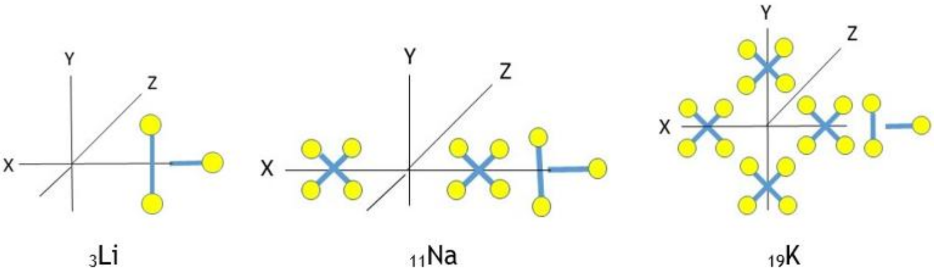


Fig. 6: **Electron orbit patterns for the first three Group 1 alkali metals**

For lithium, there is one electron (monopole) next to two orbiting electrons opposite each other (dipole) on the x-axis. For sodium, there are two quadrupoles orbiting on each side of the x-axis and the same pattern as lithium on the x-axis. For potassium, there are four quadrupoles evenly spread out on the x and y axes with the lithium pattern on the x-axis. As will be shown, this monopole and dipole pattern can be seen in the whole group with the exception of hydrogen which has only one electron and rubidium which has an electron orbiting pattern similar to the Group 17 elements. The dipole/monopole pattern found in most of the elements of Group 1 could explain why the elements in this group have common chemical characteristics.

To establish a reasonable scheme to demonstrate how orbiting patterns progress through the Periods and down through the Groups of the Periodic Table, it's best to think in terms of balance, stability and symmetry. As a scheme is completed, one can use a bootstrap method to go back over the Groups and Periods and adjust the orbiting patterns to a best fit. This leads to an excellent understanding of how grouped elements relate to each other and possibly how molecules are formed through covalent bonding.

To facilitate generating electron configurations and saving space, the following nomenclature is used.

Fig. 7: Nomenclature used in Electron Configurations

For example, Figure 6 would look like that in Figure 8.

Fig. 8: Lithium ($_3$Li), sodium ($_{11}$Na), and potassium ($_{19}$K) configurations

Figure 9 shows the electron configurations for Group 1 elements lithium through francium.

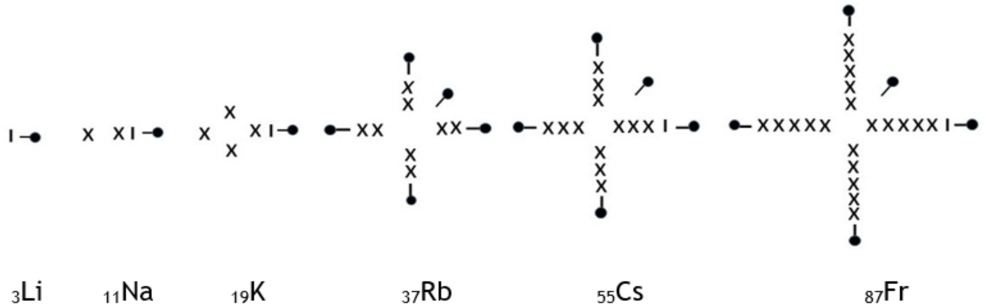


Fig. 9: Electron configurations for lithium, sodium, potassium, rubidium, cesium, and francium

Except for rubidium, notice the symmetrical arrangement of the quadrupoles in each element of Group 1 along with the lithium configuration (dipole and monopole). For the sake of consistency, one may conceive that the z monopole and one of the y monopoles of rubidium could form a dipole on the x-axis. A monopole is placed on the z-axis for rubidium, cesium and francium. It was found that in the higher elements, monopoles exist on the z-axis. When going through various schemes and generating electron configurations, it was found that when a quadrupole and a dipole or a quadrupole and a quadrupole are next to each other, a monopole is required on that side of the axis.

The next group of interest is the Inert or Nobel gases (Group 18) as shown in Figures 10a & b. (Note: Beginning with xenon, monopoles appear on the z axis.)

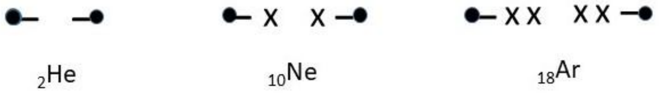


Fig. 10a: Group 18 configurations for helium through argon

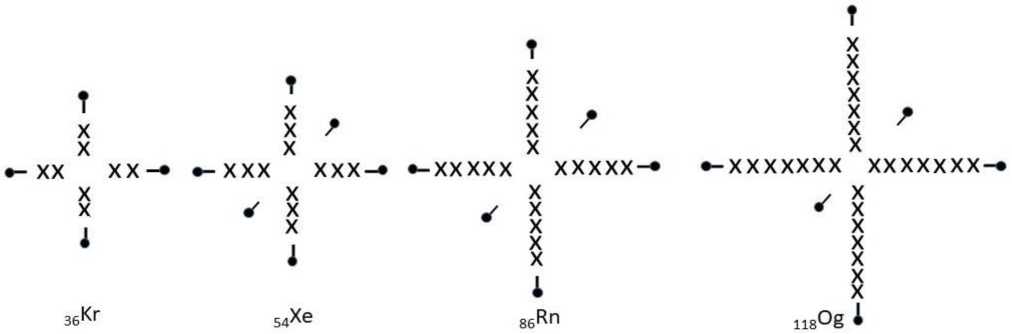


Fig. 10b: Group 18 configurations for krypton through oganesson

The symmetrical relationships of the quadrupoles along with the monopoles demonstrate chemical stability. In atomic chemistry, magic numbers refer to the total number of electrons in completely filled electron shells, which results in unusually stable configurations. The recognized numbers are 2, 10, 18, 36, 54, and 86 the atomic numbers of the Nobel gases. Oganesson is a synthetic element that is a Nobel gas. Its atomic number, 118, should be added to the magic number list.

A quantum mechanical system of particles confined spatially will take on certain discrete values of energy, called energy levels. Given the configurations in Group 18, each electron rotation along one axis has the same energy level as its counterpart. Using the right-hand rule where rotating electrons generate a magnetic field, and the energy level for each axis being the same due to the symmetrical arrangements, the interaction of the four fields would in essence cancel each other. Magnetic moments that align in opposite directions whereby the resulting magnetization is zero is called antiferromagnetism and could explain why the gases are inert. This hints at the possibility that magnetic fields play a role in combining elements into molecules.

The key word here is stability. As stated earlier, The general belief is that molecules are formed because the resulting arrangements are more stable than the original atoms, and that stability is achieved when the outermost electron shells are full. The pattern in Figure 11 shows the development of electron configurations for Groups 2 through 18 for Period 2.

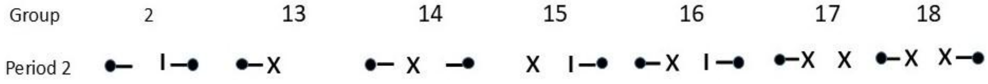


Fig. 11: Electron configurations for Groups 2 through 18 for Period 2.

Leveraging off the stability and symmetry of the atomic structures of the Nobel gases, one can go one step further and show how magnetic fields play a major role in the formation of molecules. Oxygen (atomic number 8) is found in Group 16 as shown in Figure 11.

Figure 12 shows the formation of O_2. The electron configuration on the left shows a resulting dipole moment as the quadrupole rotates in the opposite direction of the dipole. Just as a magnetic field will bend a stream of electrons in a cathode ray tube, the force of the magnetic field produced by the resulting dipole moment exceeds the binding energy of two electrons in a nearby oxygen atom and draws them to itself and forms a complementary quadrupole. This process is referred to as covalence, the sharing of electrons. Both atoms form a symmetrical arrangement like that of the Nobel atoms whereby the magnetic fields cancel each other. The positive and negative states of each atom create an ionic bond. Thus, the molecule becomes stable in a minimum reactive state.

Figure 12: O_2 formation

Figure 13 shows the electron configurations for Group 17 elements fluorine through astatine. If hydrogen is added to the atoms in this group, the electron from the hydrogen atom would be attracted to these elements. Thus, the electron configuration would match those of Group 18 (See Figure 10). For example, the HCl molecule would look like that in Figure 14. The addition of the electron as a monopole allows for two quadrupoles on the x-axis.

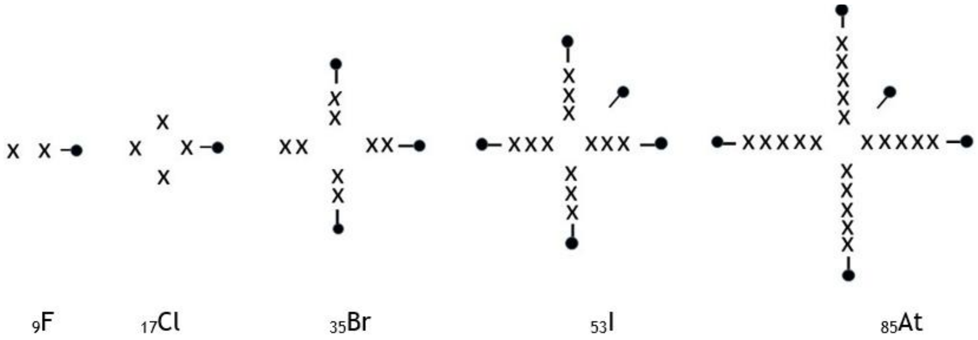


Figure 13: Group 17 electron configurations for fluorine through astatine

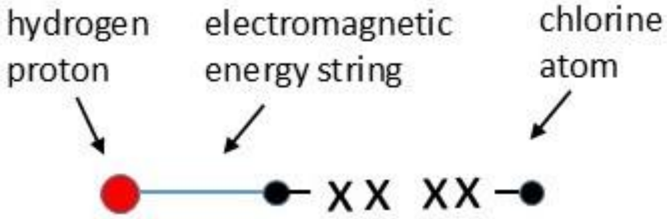


Figure 14: HCl molecule

The electron configuration of the chlorine atom is like the argon pattern as shown in Figure 10. Given this configuration, one might speculate that the crystal structure of this molecule would be a face centered cubic, the same crystal structure found in the inert or

Nobel elements (Group 18). Indeed, HCl does have a cubic lattice structure. Likewise, adding a hydrogen atom to the other Group 17 elements may result in cubic structures.

Selecting another Group 1 element such as sodium and combining it with chlorine would result in NaCl as shown in Figure 15. The monopole electron of sodium moves to the chlorine atom which takes the form on the right and mimics the electron configuration of the inert element argon. The dipole of sodium moves to the monopole positions and mimics the electron configuration of the inert element neon.

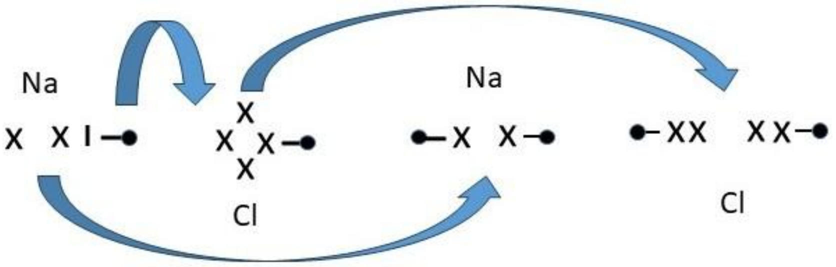


Figure 15: The formation of NaCl

An interesting pattern is seen as Group 1 elements combine with Group 17 elements. The resulting electron configurations are like the electron structures of the Nobel or Group 18 elements. As with Group 17, combining Group 1 with Group 16 elements results in a similar pattern. For example, to form hydrogen sulfide (H_2S), as shown in Figure 16, an electron from each of the two hydrogen atoms changes the dipole in the sulfur configuration to a quadrupole. The resulting configuration is like the argon pattern as shown in Figure 10. The magnetic fields cancel each other to put H_2S in a minimum reactive state. The hydrogen atoms form an ionic bond with sulfur. One could speculate that the proton connects to the monopole electrons by an electromagnetic energy string, like the energy string that connects orbiting electrons to an atom.

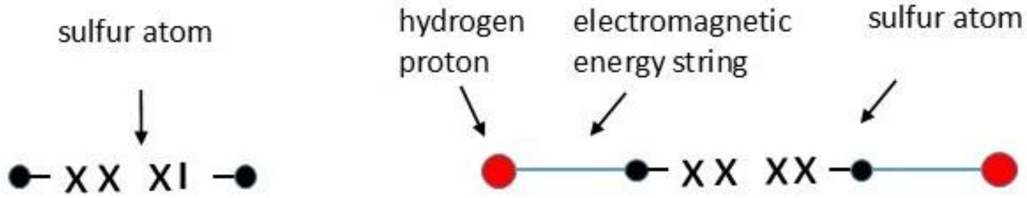


Figure 16: The formation of hydrogen sulfide.

Figure 17 shows the electron configurations for Group 2 (beryllium through radium, Periods 2-7).

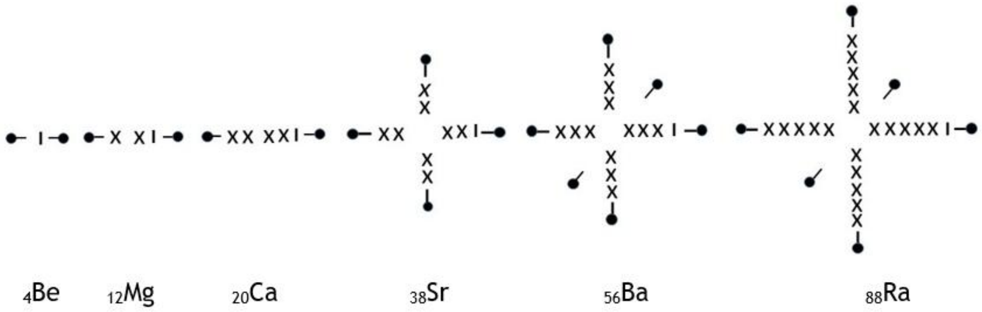


Fig. 17: Group 2 electron configurations for beryllium through radium

Figure 18 shows how calcium shares a dipole with oxygen. The resulting electron configurations for CaO are shown on the right side of Figure 18. The electron configuration of calcium becomes like that of the Nobel gas argon, and the oxygen configuration becomes like that of the Nobel gas neon.

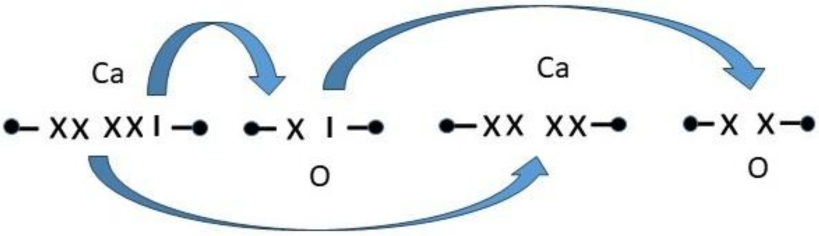


Figure 18: The molecular formation of CaO

Another calcium reaction is where the two electrons of the calcium dipole each combine with two iodine atoms (Group 17) to form CaI_2. The electron configurations of each of the iodine atoms are like the Nobel gas xenon (See Figure 10b). As in the CaO molecule shown in Figure 18, the electron configuration of calcium is like that of argon.

The above examples show combinations of either even or odd atomic numbers. The next example shows the combination of an odd atomic number with an even atomic number. Figure 19 shows the formation of nitrogen monoxide (oxygen an even atomic number and nitrogen an odd atomic number). The dipole of oxygen combines with nitrogen to form the atomic structures of NO. The monopole of nitrogen is an unpaired electron which is typical of odd atomic numbers. One could conceive that the oxygen atom takes the dipole from nitrogen and leaves nitrogen with two dipoles rather than two quadrupoles.

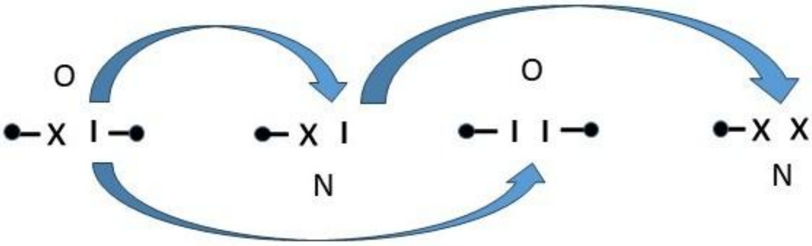


Figure 19: The molecular formation of NO

The following is an example of a larger molecule (sulfuric acid, H_2SO_4). Basically, the acid is formed by adding water to SO_3. As shown in Figure 20, the sulfur atom (with sixteen electrons) gives up 3 dipoles to three oxygen atoms. The sulfur atom takes on a positive state and an electron configuration like that of neon. Each of the oxygen atoms takes on a negative state and an electron configuration pattern like that of neon.

Figure 20: The formation of sulfur trioxide

The resulting SO_3 molecular structure is shown in Figure 21, where the sulfur atom has six less electrons and each of the oxygen atoms have gained two electrons.

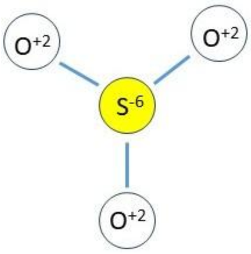


Figure 21: **SO_3 Molecular Structure**

For water, the oxygen atom borrows the electrons from the two hydrogen atoms to form another neon electron configuration. Combing the water molecule with the SO_3 molecule results in the pattern shown in Figure 22. The two hydrogen atoms form a combination of ionic and EM bond to the resulting molecular structure. One could easily speculate that the two hydrogen atoms remain with the original oxygen atom.

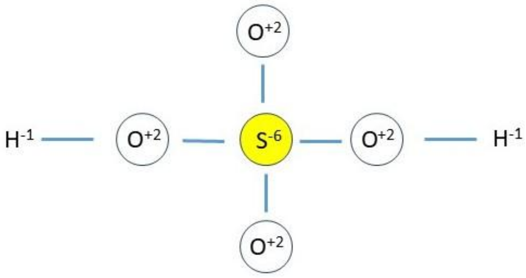


Figure 22: **H_2SO_4 Molecular Structure**

SUMMARY

In covalent bonding, atoms share electrons to achieve a stable electron configuration. The general belief is that molecules are formed because the resulting arrangements are more stable than the original atoms. Whether dealing with the independent-particle model or the with an orthogonal mechanical model, one can agree that the key word in the formation of molecules is stability. The independent particle model doesn't explain how electron configurations are set up to exchange electrons using magnetic fields. Nor does the shell filling routines group elements in accordance to the Periodic Table. The orthogonal mechanical model is a structure that allows electron orbiting patterns to group elements in accordance to the Periodic Table. Taking into consideration the magnetic fields produced from electron orbits and associated antiferromagnetism, molecular formations seem to take on patterns similar to the Nobel gases and thus, exist in a low reactive state. The nucleon arrangements along with the electron orbiting patterns and associated molecular structures go hand-in-hand and opens the door for pushing the understanding of nuclear physics beyond the standard mode (BSM).

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