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NEW MODEL OF ATOM

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ABSTRACT

In this paper I have proposed a new model of the atom. Though it sounds, atomic physics is a closed research area since a century ago. But I have discovered some problems in the existing model of the atom. In this model, I have proposed a static model of the atom, instead of the existing model, which is based on matter waves. Here the electrons are not moving, or rotating, and so, no s, p, d, f, sub shells for the atom, without which I have explained, the chemical and radiation nature of the atom.

Indexing terms/Keywords

New; model; atom

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Quantum mechanics, atoms and molecules.

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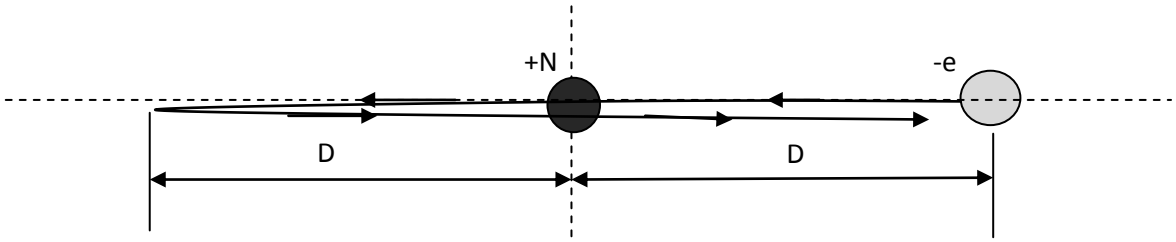
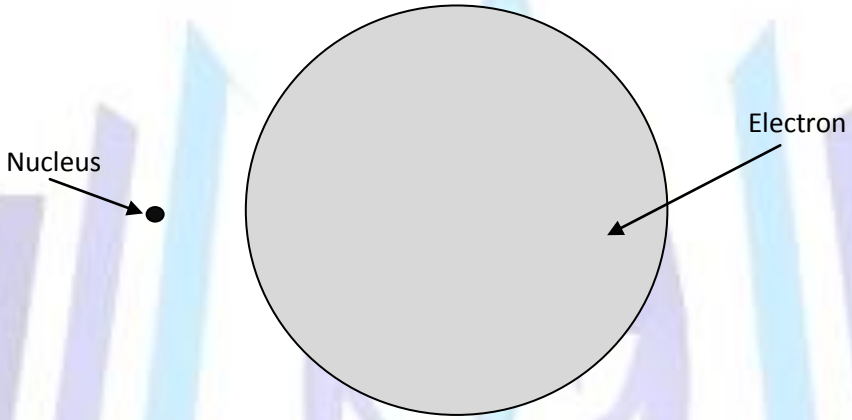
ELECTRON DYNAMICS

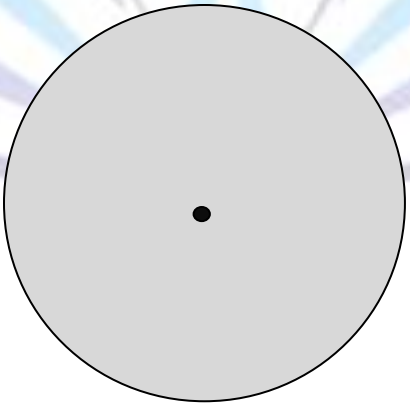


If electrons were particles, then, like as shown in the figure above, if we let free an electron, from a distance D from the nucleus, then, the electron, like a planet, would have gone an equal distance D on the other side of the nucleus. Considering nucleus is heavy and electron is light. And it would have wobbled or rotated around the nucleus, like a planet around the sun. But, the electron is a wave, a spongy substance, with infinite elasticity. It can be compressed or stretched to a large distance. And note, the electron is a fundamental particle, so it can't be torn or cut in to two pieces. So, consider what happens, when we leave a wavy electron free from a distance from nucleus.



The atom is 10^{-10} meters, and the nucleus is 10^{-15} meters, and we must take atoms size as electron cloud size. Then we can see, if the electron is 1 kilometer in size, the nucleus is 1 centimeter in size. Then, if you leave an electron around the nucleus, it will not try to make a standing wave first. But, first it will go and fit, as, how best it can pack itself around the nucleus, then standing waves can come later. Consider the experiment, where, even if you smash electron and proton in a particle accelerator the proton and electron don't annihilate each other. So proton and electron can be just sitting on top of each other.

FIRST SHELL



So, electron will go and sit on the nucleus, wrapped around it. Proton won't give infinite force to it, because, electrons charge is distributed on a large scale. Proton and electron don't fall in to one another because of Pauli's exclusion principle.

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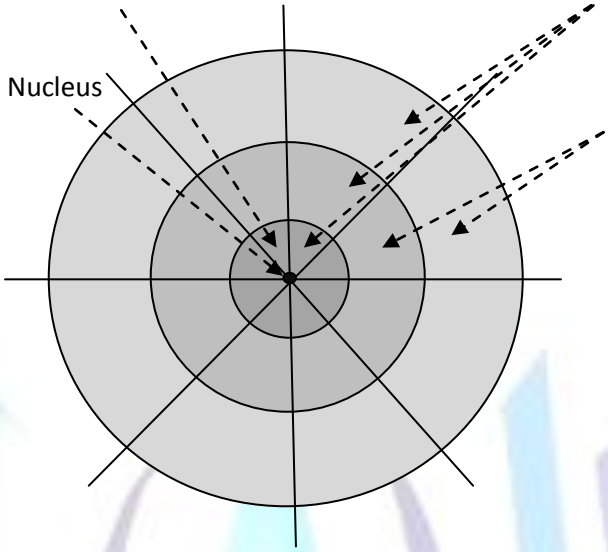
NEW MODEL OF ATOM

ELECTRONS ARE NOT ROTATING AROUND THE NUCLEUS, THEY ARE JUST SITTING ON TOP OF EACH OTHER.

First shell, sits on top of the nucleus. 1 or 2 electrons will completely wrap around the nucleus, and prevent any other electrons coming close to nucleus.

Shell thickness increases as it becomes more distant from nucleus



8 electrons occupy the 2nd and 3rd shell, all shells are in spherical shape.

Note: shell has upper and lower radius. (thickness).

NOTE: Problem with current model of atom is, the electrons don't have well defined boundary, and many of them are put together in an atom, and all of them are moving at different velocities. Which is not possible, one will slow down the other, and they will all stop. When nothing needs or keeps them moving.

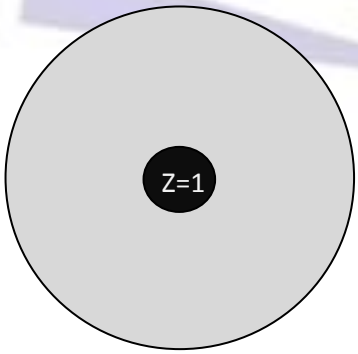
Also note: a moving electron may just stop, when it hits another atom or molecule. (by temperature)

Note: Electrons in a shell, will collectively make it spherical, so if you remove one electron, the remaining electrons make up as spherical shell

So far, rotation was needed to convince us, that, it prevents the electron from falling to nucleus, now anyway, since the electron does not fall in to the nucleus, we can think otherwise. Example: just like in rugby game, one player falls on the ball, and all the other players also fall on each other. Same way nucleus is the ball, and players are electrons, and they all fall on ball and on one another.

Quantum mechanics, never answered the question it started with, which is, a rotating electron would radiate (give out Electro Magnetic (EM) Waves). Then, so is the electron in standing wave condition. The standing wave electron has time variation in its charge density, and so would produce EM waves. So, an atom can't have its electrons in standing waves condition and not radiating. The only way a charge could have moved and not radiated, is by disguising its motion, or move in such a way that its charge density at any point does not vary with time (Or else emit EM waves). Like a rotating cycle rim, when you see a rotating cycle rim, (or rotating football), you will not be able to tell if it's rotating or not. Similarly, if the electron had moved like that, then we would not have seen its motion, and we would not have seen any radiation from the electron. But such electron motion does not give standing waves. So either way Quantum Mechanics does not answer "no radiation" from atom. Consider, when you say p shell is in dumb-bell (∞) shape, it does not mean the electrons are not moving in that shape. After all it's a wave, and so, in one half cycle the electron moves to one side (lobe), and then to the other half side in another half cycle, and this results in emission of EM waves (it's a dipole antenna). But, this new static model of atom has no such problems, as electrons at rest don't radiate anyway.

ATOMS ELECTRONIC CONFIGURATION AND THEIR CHEMICAL PROPERIES



1 proton, or hydrogen atom, and 1 electron wrapped on it. All are static (except their spin).

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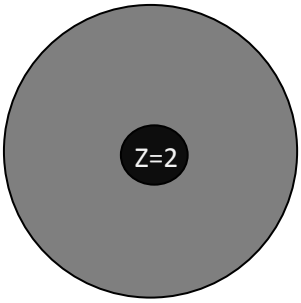
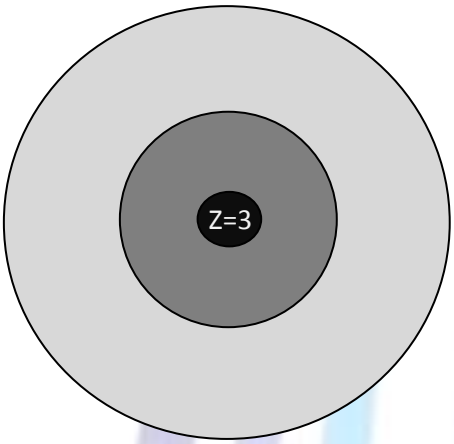
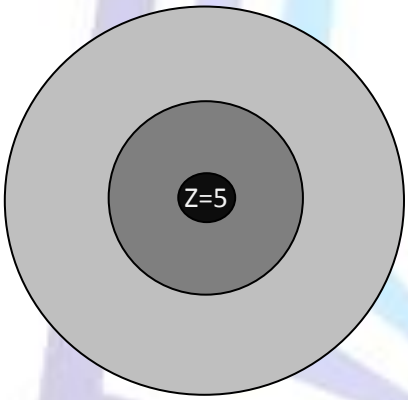


2 proton, or helium atom, and 2 electrons wrapped on it, which is shown in dark circle. This atom has lesser radius than hydrogen, because two protons pull each electron. The two electrons occupy the same space, and so two electrons merge in to one another. Because, though two electrons repel each other electrically, they attract magnetically, so they should have opposite spin. And the repulsion is exactly equal to attraction. (We can compute and show that).

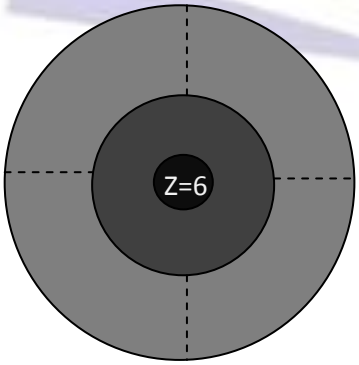


3 proton, or Lithium atom, the first 2 electrons occupy the first shell, and that's it, the shell cannot take any more electrons, and the remaining electrons must sit above these electrons, as shown. So the 3rd electron sits on top of these two electrons. And note the first shell has shrunk even more. The 3rd electron is fully wrapped around the atom, and takes a large radius above the first shell.



Next we will consider z=5 atom,

Z=5, or Boron atom, with 3 electron in the second shell. Note: the addition of each electron, in the same shell, does not add to increasing the height/radius of the shell, because, electrons in each shell sit next to each other. And not pile up. But, the nucleus exerts equal force to all electrons in the same shell. So, with increased nuclear force on each electron, the size of the shell comes down.



Z=6, or carbon atom, has its shells shrunk even more than its previous atom. The 2nd shell has 4 electrons. And importantly we can define the relative positions of electrons in the second shell. As the 4 electrons occupy space separated equally from each other. This helps in identifying the crystal/molecular structure of carbon atom, when it binds with other atoms. (This holds true for other atoms too)

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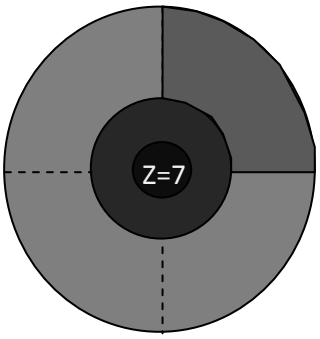
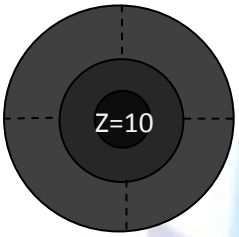


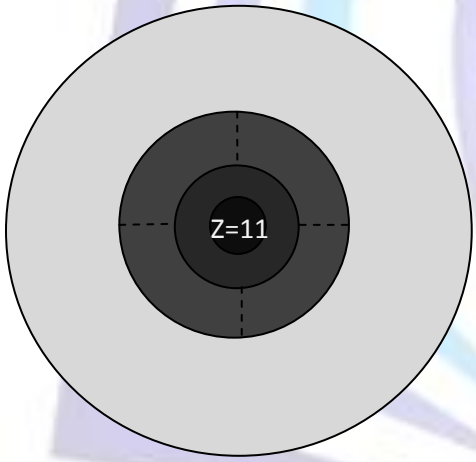
Z=7, or Nitrogen atom, it has interesting situation, because, since one more (at most) electron can sit in the same place as the existing electron, so the 7^{th} electron, will sit inside any existing 2^{nd} shell electron. Note, this electron cannot spread all over the atom, because 1 electron cannot sit inside two electrons, then, the magnetic field produced by it will be less and so will be repelled by both the electrons, so one electron can sit only inside one other electron. As shown in the fig.



Next, we can jump few atoms and consider Neon atom. As shown below.

Z=10 or Neon atom, as we see both the shells have shrunken most. And in second shell each electron has accommodated one extra electron, and the shell has shrunken enough too, so it can't fill anymore electrons in that shell. And if z increases, the next electrons must sit above that shell.

Note, the number of electrons in a shell depends on the available space. The available space increases as the square of the radius, (area of sphere is $4.\pi.R^2$). So each shell must get N^2 space. But, as Z increases, nucleus shrinks the shells, so the radius reduces, and so the available space decrease, so the pattern or the number of electrons in each shell follows the rule as, N^2, where N varies as, 1,2,2,3,3,4,4,5,5. And since due to spin each shell can double its accommodation the total number of electrons in a shell goes as $2.N^2$.



Z=11, or Sodium atom, the one electron is in the newly formed 3^{rd} shell. Though, the spherically shaped inside 10 electrons, will completely shield the effective nuclear charge, (electrostatics), and let the 11^{th} electron see only 1 proton charge. But unlike hydrogen atoms electron (which sits on top of the nucleus) this 11^{th} electron sits at a far distance from the nucleus, so this electron is loosely held by the atom. That determines its chemical property. So consider chlorine atom next,

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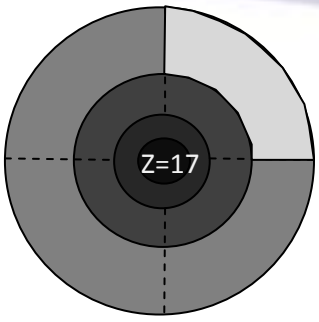

Z=17, or Chlorine atom, as we pointed out earlier the 3^{rd} shell too can take up max of 8 electrons, and in chlorine, even the 3^{rd} shell is full but one slot is free. The remaining 3 spaces already have 6 electrons with each slot already holding 2 electrons. Importantly the one empty slot (or 3^{rd} shell altogether) doesn't see one nuclear force, but, out of 17 protons, the 10 are fully shielded, the remaining 7 units of +ve charge is exposed in that empty slot. So Chlorine shows 7 units of attraction to any electron in that slot.

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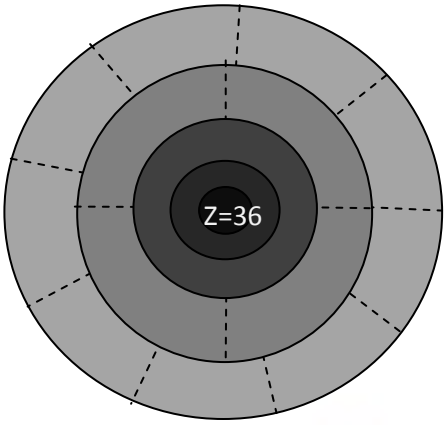
So, in that situation if a Sodium atom collides with it, then it will pull the one freely hanging electron of sodium, so that the 3rd shell of both sodium and chlorine overlap. And both atoms stick together, in trying to pull the electron towards them, and a chemical bond is made.



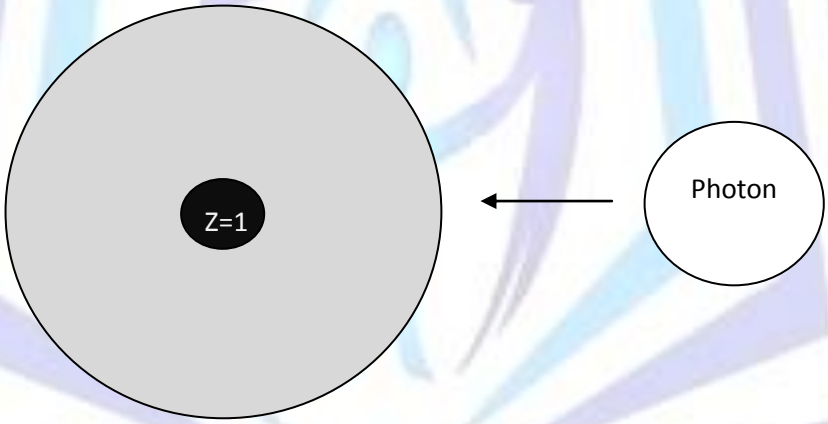
Next consider the z=36, Krypton atom.

z=36, or Krypton atom. As we said earlier, the number of electrons a shell can take varies as $2.N^2$. So the 4th shell can take up totally 18 electrons. And we can identify their position too. And instead of octet rule we can have 18 rule for these atoms to bond.

The electrons in a shell vary in numbers, as, 2,8,8,18,18,32,32..Which is = $2.N^2$ Where, N = 1,2,2,3,3,4,4,5,5,…. So, the outer most shell having place to hold 2,8,8,18,18,32,32,…electrons will determine the atoms chemical properties.

So, the first 20 atoms follow octet rule, and after that, it becomes easy for atoms to give or take few electrons. When such easy electron atoms are put together, then the electrons can easily go and come from one atom to another atom, then we call such collection of atoms as metals, which have good electrical and thermal conductivity. So in periodic table we see, after first 20 atoms, most of the atoms are metals.

RADIATION FROM HYDROGEN ATOM



Consider a hydrogen atom, and let a photon come and hit it, as shown. If the electron were to be in free space without having a proton attached to it, then the electron would have gone flying, just like how it goes in Compton Effect.

But now, since the electron is attached to a heavy proton, and so it has made hydrogen atom, now when the photon hits the electron, electron just can't go flying. Depending on how energetic the photon is, the proton may be stripped of its electron, or, if the photon is not so strong, then the collision may set the electron vibrate around the nucleus.

NOW! When the electron, a spongy, elastic substance, moves back and forth, waves are generated. Note: photon has kicked the electron to go away, but the nucleus pulls it back, and so the electron oscillates, back and forth, around the nucleus. This creates waves in electron, because, as we said, electron is not a rigid body, but a cloud like, very stretchable, elastic body. So, part of its body could be moving forward, and other part backwards, this creates standing waves. The scenario can be compared to plucking a guitar string, and setting the string to vibrate. And we know from that scenario, that things vibrate in their characteristic frequency, and guitar string vibrates with frequency such that, the total number of waves that are produced in them, must be integral multiple of its wavelength. As shown.

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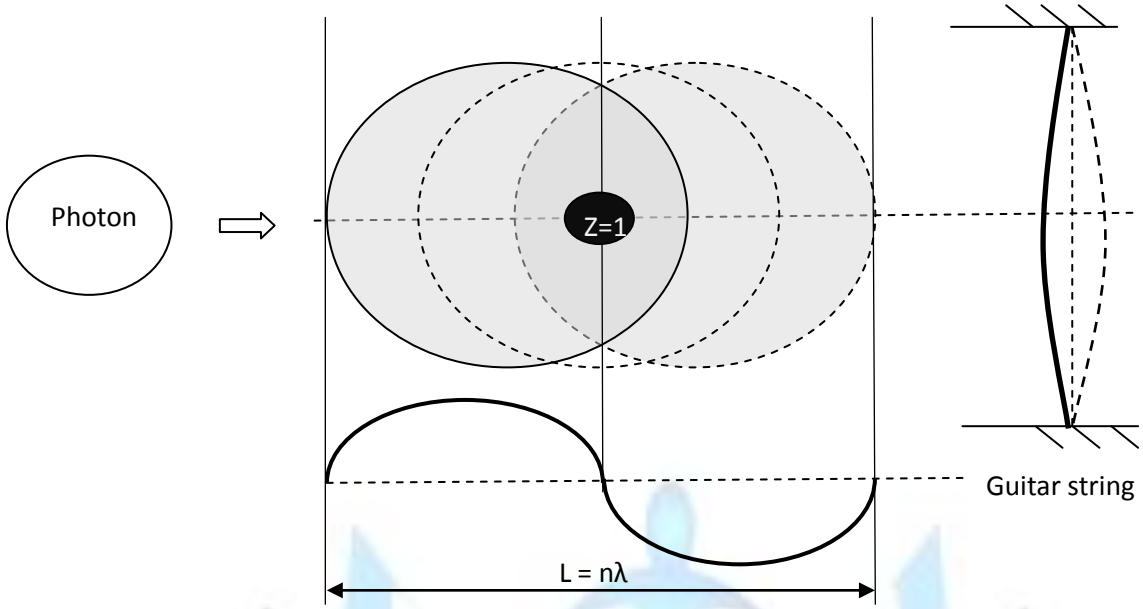


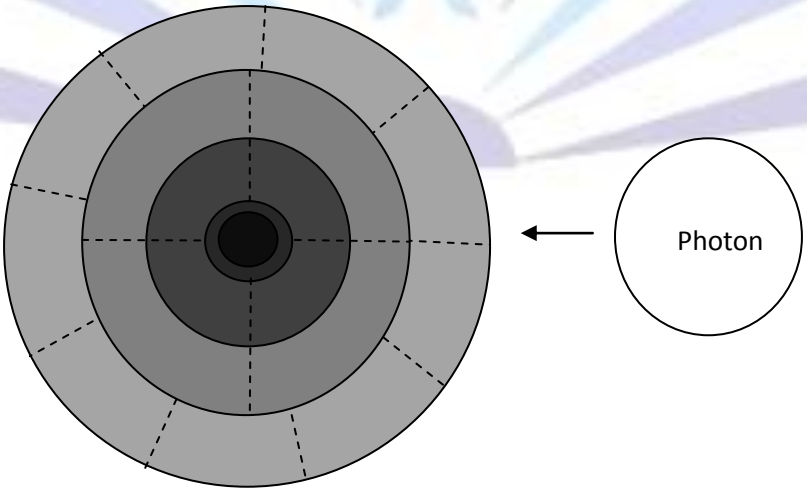
Considering the nucleus is very massive, the first vibration wave is shown. The electron will vibrate around the nucleus, with frequency, whose wave length as integer multiple of its total displacement. Note: the string produces transverse waves, therefore, the longitudinal waves produced by reciprocating piston in an air column, is a better example.

Now, if a photon can hit and cause vibrations in electron, similarly, we can reverse the argument and say, if the electron vibrates, because the atom may be hit by other atom, because of temperature, which is random motion of molecules. So, when the atom is hit by another atom or molecule, it vibrates the electron, and the electron emits a photon and then keeps quite.

And note, we can still use Schrödinger's equation to find the energy states of vibrating electron in a coulomb electric field. The energy levels given by Schrödinger's equation for hydrogen atom are true. The electron shapes, like s, p, d, f etc, are shapes of the exited single electron, for hydrogen atom only.

As we have shown in our earlier analysis that, all electrons in a shell make up a spherically shaped shell. And all electrons, just sit on one another in multi electron atom. So there is no s, p, d, f electron shapes in multi-electron atom. Note, however, a photon can hit a multi electron atom and can produce exited shapes of electron, but in a normal atom, there are no s, p, d, f, , , electron shapes in their shells.

RADITION FROM A MULTI-ELECTRON ATOM



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Consider a multi-electron atom as shown, let a photon of some energy hit it. Then, in the case of hydrogen atom there was only one electron, which was there to receive the full blow of the photon. But now, in a multi-electron atom, one or more outermost shell electrons may receive the first blow, and then the force is transferred to even the inner electrons, just like to push a group of people you just have to push the outer circle of people, then even the inner circle people will also move.

So, when a photon hits a multi-electron atom, many electrons may receive the energy. And they all start vibrating around the nucleus, the situation may get really complicated, because the change in place of one electron may affect the situation of the other. Note: electrons in a multi electron atom may have different conditions as how they are packed. Some, which are close to nucleus, are tightly packed, while some others, which are far away, are loosely held. And when a photon hits the atom, it gives different energy to different electrons, and they all emit back photons of varying energies. So effectively, each electron which was set to vibration (exited) will emit a photon. So, one photon hitting this atom can result in the emission of many photons of various energies. (According to the energy law anyway). So we see a huge number of lines in emission spectra of multi-electron atoms.

Note, in chemistry, or when an atom makes a chemical bond, only outermost or outermost shell electrons are involved. But in radiation, many (lots of, if not all) electrons of the atom are involved. I.e., even inner shell electrons are also involved in radiation.

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