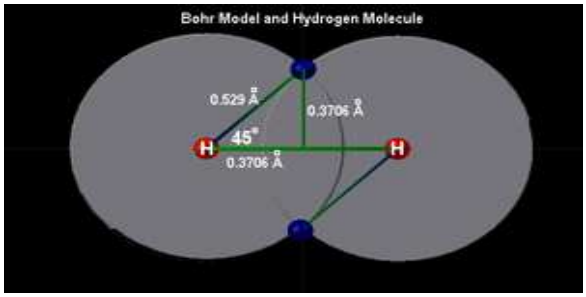
the general science journal

The Bohr Model, Electron Transfer and Newtonian-derived Quantum Numbers

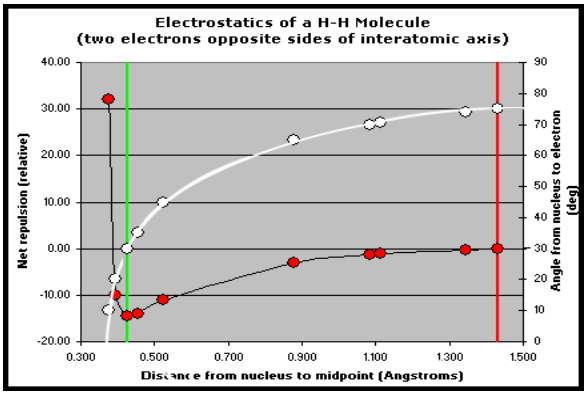
Joel M Williams ©2012
Los Alamos, NM

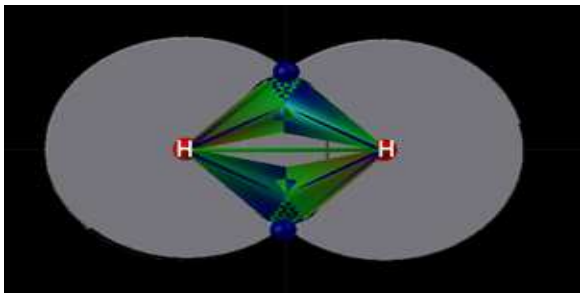
When first introduced to the Bohr model many decades ago, I was enamored like most students by its simplicity. I easily grasped the notion that an equation could be generated to model the simple case of an electron racing around a circular track. I had trouble, then and now, however, seeing what was causing the discrete "quantum jumps" that were thought to be needed to match the Balmer series. That i(***n***)teger factors would do the mathematical task was no great surprise as the subsequent, complex mathematical treatments clearly demonstrated that those steeped in that field could model just about anything. The physical world cause, however, never seemed to materialize for me.

It is interesting to note a few things about Bohr's model before proceeding. The Bohr radius for a hydrogen atom is just what would be expected for a 45-deg angle from the inter-nuclei axis. Newton's cannoneers would concur if the object was to reach the other nucleus with the optimum volley. This might have made sense if the electrons were simply "balls". But it does raise the point about what Bohr had in mind beyond this fitting his equations to the observations.

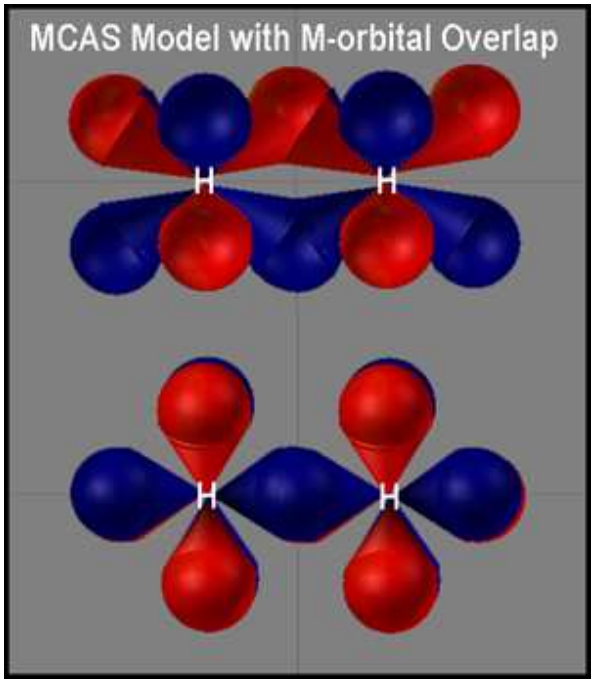


A 45-deg angle is not the optimum volley angle here, however! Unlike cannon-balls, electrons are 'electrostatically attracted to each nucleus" and "repel one another". Electrostatic energetics are minimized at the midpoint when the angle is 30-deg (see graph at right). If electrons are to be passed between hydrogen nuclei, then they should be passed at this angle. The image below shows how this is envisioned in the MCAS orbital model where the angle between adjacent M and M' orbitals of the MCAS model is ~35-deg from the bisect.



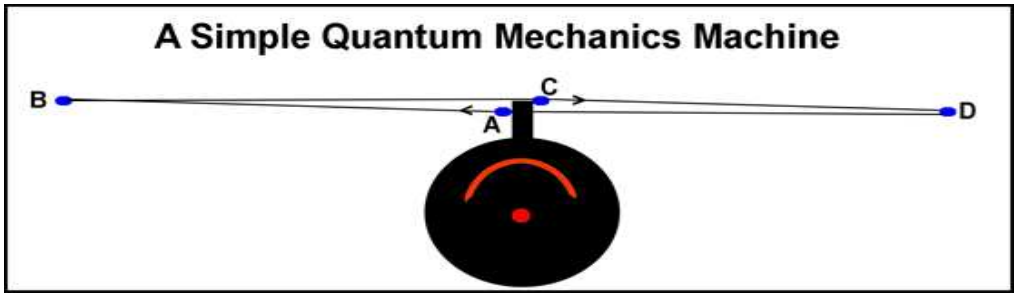


The full MCAS M-M' orbital system of the hydrogen molecule *with e-transfer* is shown at the right. With orbitals meshed in this manner, the two electrons move in opposite, well-defined space between and around the nuclei. There is no need for "spin-reversal" (real or virtual) or cohabitation of orbitals. The bottom image could easily be mistaken for electron concentration on the inter-nuclear axis. Such is not the case, as the upper image indicates.



So how does the Balmer series arise in all this? It does so because the nuclei and electrons have different motion parameters, but their interaction must coincide when the electron approaches the nucleus. It is not clear how a nucleus interacts with and directs the electron, but it must. Passing close to the nucleus allows the necessary intimacy, whereas the distant circular Bohr orbits never seemed to provide any such mechanism. None ever has been; just data fitting. Higher mathematical treatments have not provided a logical physical explanation either; just parameters to make it so. Retrofitting has met resistance even when the nucleus is being shown to be a highly structured assemblage of charges.

As a thought process about why energy character around a nucleus is "quantum" and not "continuum", I present the following discussion of a simple quantum-mechanics machine. It consists of a robotic batter and a moving ball. Shortly, you will see how it generates a "ball-mer" (sic) series.



The ball, *moving with velocity V_o at point A*, receives positive, but discrete, energy input from the bat, if not perpetual motion, and continues on to max point B as governed by a constant decelerating force. Reversing, it accelerates to point C where it receives the same, discrete, positive energy input from the bat and continues on to max point D, again exposed to the same decelerating force. Returning to point A, the ball repeats the cycle. The robotic batter reverses rotation with each hit in this thought experiment (in order to "touch" the ball from behind in both directions), but comes back to point AC, as set by its constant rate of rotation, in integer time-quantities of t.

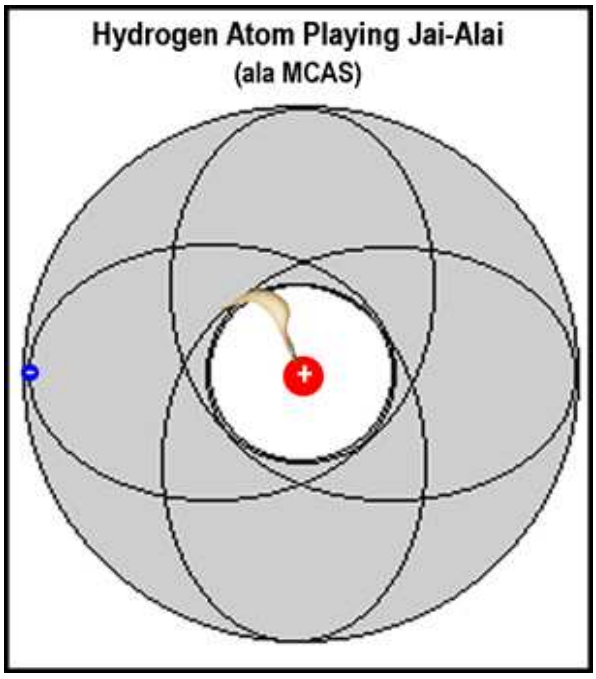
The bat and the ball operate under different parameters/forces, but must arrive at point AC at precisely the same moment.

$V = V_A = V_C = V_o$ + energy from bat
$V_B = V_D = 0 = V - a(nt/2)$
$d_{A-B} = d_{C-D} = V*(t/2) - 1/2a(nt/2)^2$
$d_{B-C} = d_{D-A} = 1/2a(nt/2)^2$
a = constant
t is set by the batter's constant rate of rotation and bat arrival at point AC

# rotations to "hit" ball	V after "hit"	Ball-mer Series	H atom Bohr r	r ratio
n(t)	V	d_x	Å	
1	1 a(t/2)	1 (a/2)(t/2)^2	53	1
2	2 a(t/2)	4 (a/2)(t/2)^2	212	4
3	3 a(t/2)	9 (a/2)(t/2)^2	476	9
4	4 a(t/2)	16 (a/2)(t/2)^2	846	16
5	5 a(t/2)	25 (a/2)(t/2)^2	1322	25

The "Ball-mer" series indicates what was needed to generate the Balmer Series with the Bohr model; adding "principal quantum numbers" (***n***) to produce discretely separated orbits rather than an infinite continuum of orbits. The energies differences are just that needed to achieve each timing-sequence of correlated interactions. Designating the "quantum" energy size does not indicate how it is applied or removed from the action; only that it is. Ball-mer behavior can occur in a multitude of similar situations as the accelerating-decelerating forces involved are not specified. The quantum-phenomenon is not size dependent as was used to justify why Newtonian physics did not work at the atomic level and, therefore, new physics was necessary. Quite clearly, Newtonian physics does apply in the electron-nuclear realm to define the parameters, ***if*** the physical model is appropriate.

The nucleus acts as if it is playing jai-alai with itself and other nuclei; just not with a cesta, of course, as the cartoon at the right indicates. Most likely there is a negative force-field that comes into play at close quarters that prevents the electron from crashing into the nucleus. This field sends the electron on its way pass the nucleus. In the MCAS model, the simplest "3D-way" is indicated by a group of tetrahedrally oriented orbitals.



For more on the MCAS electronic model see these General Science Journal articles:

1. The MCAS Electronic Structure of Atoms: http://gsjournal.net/Science-Journals/Essays/View/4019

2. Electronic Bonding of Atoms: http://gsjournal.net/Science-Journals/Essays/View/4043

Notes about some of the pioneers involved in the structure of the atom:

23 of the 45 1911/1927 Solvay conference attendees got Nobels; all by 1936, except Pauli (exclusion principle) in 1945 and Born (probability distribution) in 1954. Add Nobelist Rutherford's mentor Nobelist JJ Thompson (in 1906 for discovering the electron; *not* for his "plum-pudding" atom model) and you have a tight, if not of singular mind, group.

Interestingly, Arnold Sommerfeld, who attended only the first of these two Solvay conferences, had these "Nobel" students [Werner Heisenberg (uncertainty), Wolfgang Pauli (exclusion), Peter Debye, Linus Pauling], but never got a Nobel himself. It was Sommerfeld who introduced "elliptical orbits" (quantum ℓ) in 1916 to replace Bohr's circular ones and then the quantum m in 1920 that led to the spin-factor (s). If Sommerfeld had connected his elliptical orbits to form a continuous 3-D spatial one, he surely would have come up with the MCAS model. BUT, the "Rutherford-Bohr" mold had "hardening".

With the basic electron model seemingly agreed upon, though still debated in some quarters, the Solvay group with Bohr and Einstein moved on, in 1933, to tackle the nucleus. Atomic energy weaponry eventually fueled the efforts more than Nobel's dynamite largesse ever could. Eighty years later, many (?) think ALMOST everything is known about the nucleus and how things were at the beginning of "time"; they just need a bigger "collider" to break that "nut" apart completely and get to the "God particle". That the nucleus attracts electrons without capturing them is still a mystery, however. Maybe, the nucleus does play jai-alai – setting the electron's color (spectral energy level) with each pass to specify the wave (return time). Schrödinger demonstrated that if you probe a box for a particle enough times you will get a wave pattern and maybe even touch upon the miracle of life. Scientists may eventually disassemble the nucleus into all its components (glue, too?), but will they be able to reassemble them into anything worthwhile by playing God? Or will they have to finally sit back and just marvel at the current masterpiece and wonder how it came to be as opposed to what it is?