

Re: Bohr's Atom still number one

Source: <http://sci.tech--archive.net/Archive/sci.physics.relativity/2007-05/msg01234.html>

- *From:* bz <bz+spr@xxxxxxxxxxxxxxxxxxxxxxxx>
 - *Date:* Tue, 8 May 2007 01:26:54 +0000 (UTC)
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The_Man <me_so_horneeeee@xxxxxxxx> wrote in
<news:1178572539.034098.14560@xx>:

On May 5, 4:29 pm, bz <bz+...@xxxxxxxxxxxxxxxxxxxxxxxx> wrote:

"g...@xxxxxxxx" <g...@xxxxxxxx> wrote
<innews:1178394138.430885.325220@xx>:

On May 5, 10:41 am, bz <bz+...@xxxxxxxxxxxxxxxxxxxxxxxx>
wrote:
snip too long

....

My main point is that the Bohr model predicts a rapid loss of energy with all electrons collapsing into the nucleus. Bohr could not explain why orbiting electrons would not radiate constantly.

Bohr could not (well) explain why electrons would not radiate.

Agreed.

His best explanation was that the electrons were confined to "orbits" of specific energy.

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Not a very good explanation as 'orbits' implied circular motion, centripetal acceleration and radiation.

You suggest that electrons would collapse into the nucleus in the Bohr model. This is not accurate.

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The collapse into the nucleus is the classical prediction. Since Bohr knew already that this didn't happen, he had to model WHY this doesn't happen. He had mostly ad hoc explanations.

You are correct, it is the classical prediction. Bohr did know it didn't happen. He didn't know why.

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He ran into another problem. His model only works for a hydrogen atom with a single electron.

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What makes you think they have a high velocity in the atom?

One can easily calculate the KE of an electron, and therefore its velocity.

That assumes that the energy is expressed as a linear motion (along with a centripetal force, producing a circular motion). One can certainly calculate an orbital velocity for the electrons. However it fails to explain why electrons undergoing such motion would not be radiating constantly.

Core electrons travel at approximately c/Z , where Z is the nuclear charge. When Z gets large, the speed of the electrons becomes sufficiently close to c , so that relativistic effects become very important.

Are such effects observed? Wouldn't the atomic mass be effected?

If electrons were fired at an atom with the same velocity as the calculated velocity for a Bohr orbit, what would happen?

They don't in the modern atomic theory, but, you are correct when you think that, in Bohrs model, they will need to be traveling.

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They will need to be attracted to the nucleus. That attraction will 'push' them toward the nucleus. Only their speed keeps them from reaching it.

In fact, s electrons have a non-zero probability of being in the nucleus. Such is the basis of the hyperfine interaction.

Agreed. A significant probability. But this steps outside Bohr's model.

Electrons, when ever they travel at a high speed and their direction of travel is changed, radiate energy.

This is not true.

When is it not true?

The KE of a particle can be visualized by examining the wavefunction. Where the wavefunction is highly curved, the KE is high. Where the wavefunction is slowly changing, the KE is low. Since the wavefunction for a 1s orbital is essentially $\exp(-r)$, the function is obviously more highly curved near the nucleus, than at infinity.

Agreed, but what does this have to do with showing flaws in the Bohr model?

I am trying to show guskz the problems with Bohr's model and where it fails to correspond with observations.

We DO observe that electrons, when their path is changed, radiate energy.

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bz

please pardon my infinite ignorance, the set-of-things-I-do-not-know is an infinite set.

bz+nanae@xxxxxxxxxxxxxxxxxxxxxx

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bz

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