not only was emitted in little bundles, but came in little bundles; and finally, with Bohr's attempt to use the quantum theory in solving the problems of spectroscopy.

I am sure you are all familiar with the Bohr atom. It was essentially Rutherford's atom which he had proposed as a result of work with alpha particles shooting through thin gold leaf. He showed that if you have a very massive nucleus which is very small, then some of these alpha particles will turn around and come back at you, indicating there must be something very massive there, and that the electron must be in an orbit around the nucleus.

What Bohr did was simply this. According to classical electrodynamics, of course, such an atom is impossible, because, as the electron goes around the nucleus it is accelerating, since it is moving in a circle. It is well-known that an accelerating electrical charge radiates energy and therefore it would simply spin into the nucleus. So, Bohr said, "That is right; let us forget it. Let us assume that the electron goes around the nucleus and does not radiate. We have spectral lines so there must be specific areas where it does radiate. Let us assume that the electron can jump to another orbit and then when it collapses back, it emits radiation which will have the frequency represented by this jump." And with this in his great paper in 1913 Bohr was able to solve the problem of hydrogen spectra.

You see it is an impossible atom. It cannot exist by classical laws. It has all kinds of ad hoc hypotheses; forbidden orbits; areas where the electron cannot exist but does, for where is it when it "jumps"? How did it get from here to there if it cannot exist in between? It was Werner Heisenberg who said, "This is a lot of rot. We have passed beyond models; we are not little children anymore with erector sets; let us turn to pure science. We have three things we know about atoms."

"We know the frequency of radiation. We know the intensity of the radiation, and we know its plane of polarization. Let us take these three things. These are given facts. Let us see if we cannot work out a mathematical system by which we can predict spectral lines. We do not need atoms; we do not need models."

Heisenberg worked out a system of physics which simply works this way; it says, "We do not, nor can we ever, know the ultimate