with alpha particles. His experiments provided him with two important pieces of information. First, most of the alpha particles traveled right through the foil without being deflected at all. This result tells us, Rutherford concluded, that atoms consist mostly of empty space. Second, a few of the alpha particles were deflected at very sharp angles. In fact, some reflected completely backwards and were detected next to the gun from which they were first produced. According to Rutherford, the conclusion to be drawn from this result was that the positive charge in an atom must all be packed together in one small region of the atom. He called that region the nucleus of the atom.

One part of Rutherford's model—the nucleus—has turned out to be correct. However, his placement of electrons created some problems, which he himself recognized. The solution to this dilemma was proposed in a new and brilliant atomic theory in 1913. Suppose, said Danish physicist Niels Bohr (1885–1962), that places exist in the atom where electrons can travel without losing energy. Let's call those places "permitted orbits," something like the orbits that planets travel in their journey around the Sun. If we can accept that idea, Bohr said, the problem with electrons in Rutherford's atom would be solved. The test, of course, was to see if the Bohr model could survive experiments designed specifically to test it. And it did Within a very short period of time, other scientists were able to report that the Bohr model not all the tests they were able to devise for it. By 1930, then, the accepted model of the atom consisted of two parts, a nucleus whose positive charge was known to be outsold the nucleus.

One final problem remained. If the Bour model, there must be an equal number of protons and electrons. This balance is the only way to be sure that an atom is electrically neutral, which we know to be the case for all atoms the cluster to this problem was suggested by English physicit James Chadwick (1891–1974) in 1932. The reason for mass differences, Chadwick found, was that the nuclei of atoms contain a particle with no electric charge. He called this particle a neutron. Chadwick's discovery resulted in a model of the atom that is fairly easy to understand. The core of the atom is the atomic nucleus, in which are found one or more protons and neutrons. Outside the nucleus are electrons traveling in discrete orbits.

Here is a graphical representation of our changing view of the atom:

