Atomic Sizes

I'd like to put the subatomic world in perspective for you. Molecules are huge compared to atoms and the particles that make them up. And using normal numbering would take too long to write their values out. For example, a typical nuclear diameter may be 0.000000000000006 meters. There had to be an easier way to write this. That's where something called scientific notation comes in. This is a method that was developed to write large numbers in powers of ten. So the number above would be written as 6×10^{-14} meters in scientific notation. Using this method, let's look at the relative size of these three subatomic particles.

- The electron is the negatively charged particle that “orbits” the nucleus.
  It has a mass of 9.1×10^{-28} grams.
- The proton is the positively charged particle in the nucleus of the atom.
  It has a mass of 1.67×10^{-24} grams.
  It has a mass 1,836 times greater than the electron
  And its radius is 8.4×10^{-16} meters.
- The neutron is the neutral particle in the nucleus of the atom.
  It has a mass almost identical to that of the proton.
  And it is 1,839 times as heavy as the electron.
- The radius of a typical nucleus is 3×10^{-15} meters,
  while the radius of a typical atom is 3×10^{-10} meters.
  That means that the diameter of the nucleus is about 1/100,000th
  of the diameter of the whole atom.
- The volume of the nucleus, the space it takes up, is one trillionth of the whole atom.

To relate this to a more understandable perspective, let's increase the size of the nucleus to about a foot, maybe the size of a bowling ball or medium-sized melon. How big would the atom be? Close to twenty miles in diameter. So if the nucleus of our atom were as large as a bowling ball, the rest of the atom would consist of pea-sized electrons scattered around a sphere twenty miles across with the bowling ball at the center. Imagine putting a bowling ball in the center of a city and then scattering peas throughout the rest of the city and you'll have some idea of how empty an atom really is.