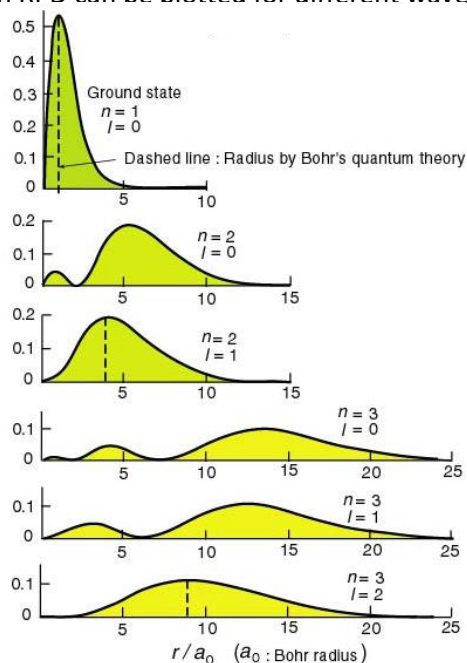


Radial probability distribution function $[4\pi r^2 R_{nl}^2(r)]$: For 1s, 2s and 3s, as r goes larger and larger, the value of the exponential function shoots up and the max value differs. For 2s, the second peak maxima has much more intensity. For 3s the third maxima has highest probability. As you from 1s to 2s to 3s the probability of finding the electron increases as you go slightly further away from the nucleus. For 1s the probability is much closer to the nucleus. The number of radial nodes increases as to go to higher quantum numbers. They are correlated by the equation:

$$\text{No of radial nodes} = n - l - 1$$

The closer it is to the nucleus the more tightly bound it is. So, the 1s is more tightly bound than 2s.

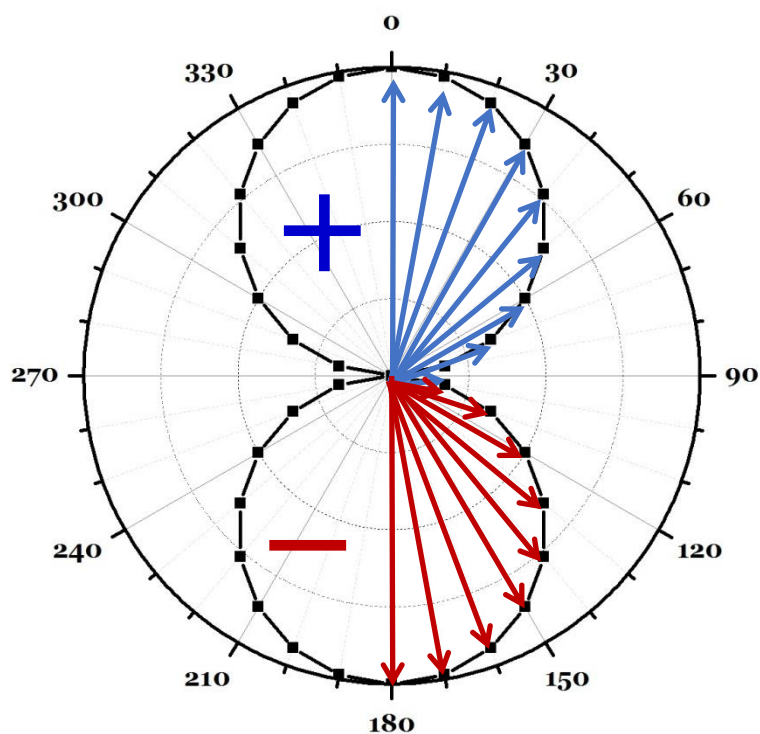
Such RPD can be plotted for different wave functions such as for 1s, 2s, 2p, 3s, 3p and 3d etc.



The most probable value of finding the electron will always be at the maxima of the RPD. For average radius, we need to integrate.

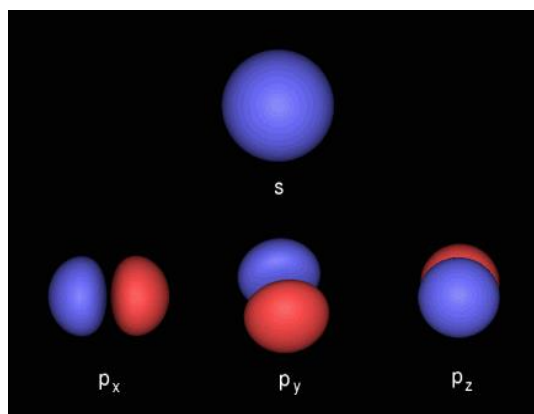
Now compare 2s and 2p. The most probable value of finding the electron for 2s is further away from the nucleus than 2p. However, for 2s there is a significant probability of finding the electron near the nucleus than 2p. In general average value of r gets smaller as l gets larger. These two facts which look contradictory are important, they dictate the behaviour of atoms.

For 2p_z, the wave function will change with r and θ , but not with ϕ . First let us look at the variation of $\cos \theta$ with θ . What we see here is a polar plot of the variation of $\cos \theta$ with θ .



The wave function changes direction (from +ve to -ve) as we go from 0 to π . The point where the wave function becomes 0 is called the node. This is called an angular node (different from radial node).

Then what really is an orbital?



We very familiar with the pictures depicted above. These are pictures we draw for our convenience. Orbitals have nothing to do with probability. Angular plots of $\psi(\theta, \phi)$ has no physical meaning – just mathematical functions - may be used to obtain information about probable electron distribution. But

can not be, in any way, regarded as the “picture” of an orbital. It is unfortunate that fuzzy drawings like these are often incorrectly represented as “orbitals”

However, ψ^2 might provide a better intuitive picture. However, you need to consider both the radial and angular part of the wave-function together and square of that wave function will give you sort of the most probable electron density.