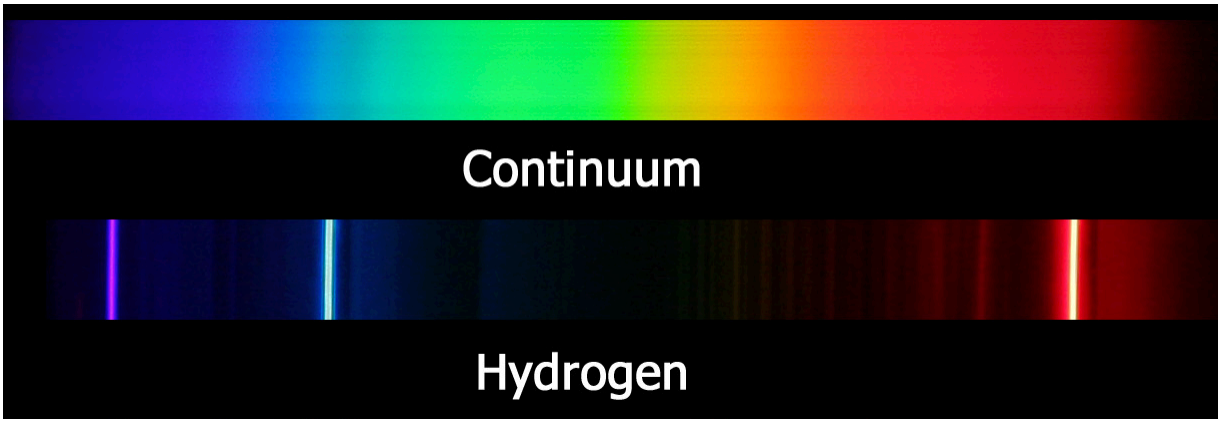
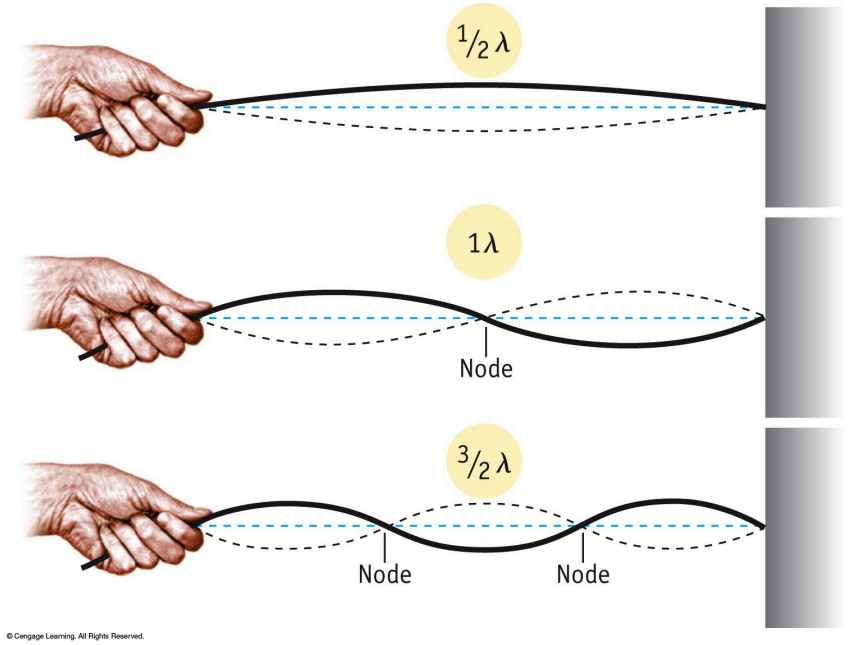
Atomic Line Spectrum from Hydrogen Discharge Lamp

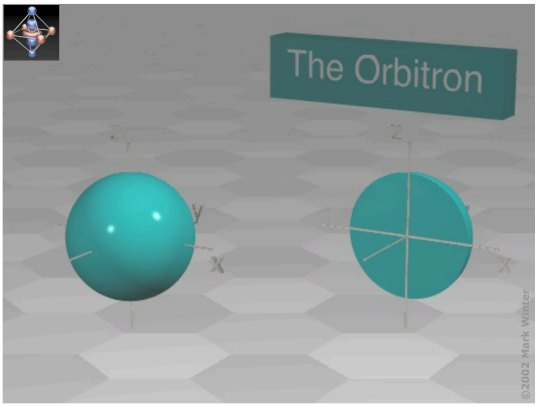




Wave motion: wave length and nodes
"Quantization" in a standing wave

1s orbital

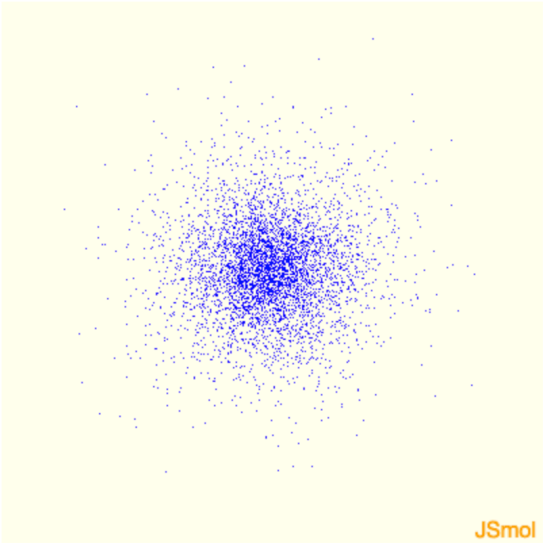
Atomic orbitals: 1*s*



The shape of the 1s orbital.

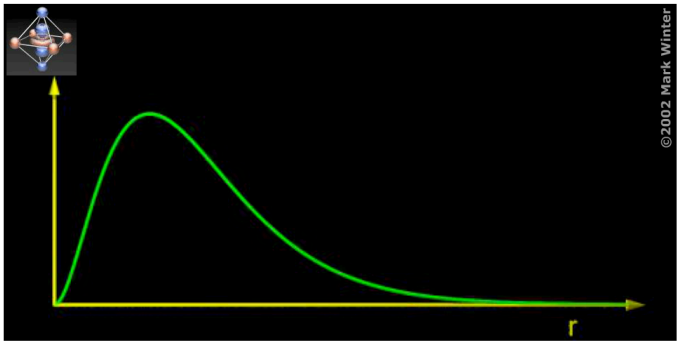
For any atom there is just one 1*s* orbital. Consider the shape on the left. The surface of

Atomic orbitals: 1*s* electron density



"Dot-density" plot of the 1s electron density function ψ_{1s}^2.

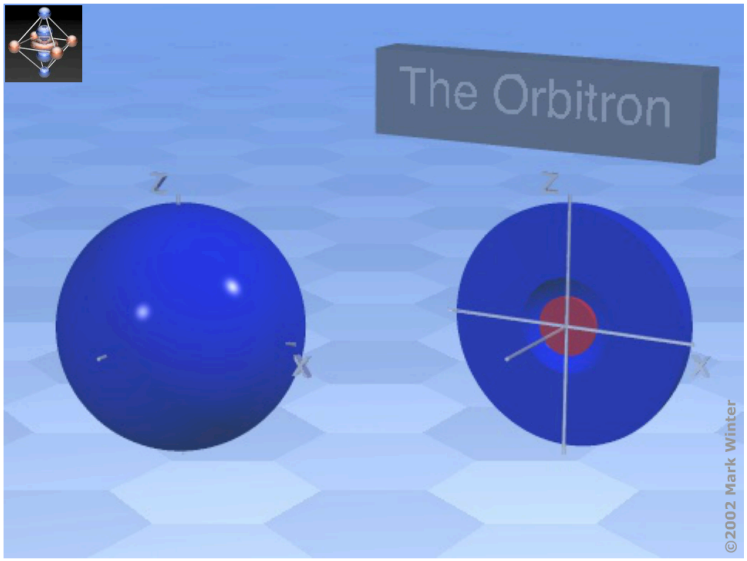
Atomic orbitals: 1*s* radial distribution function



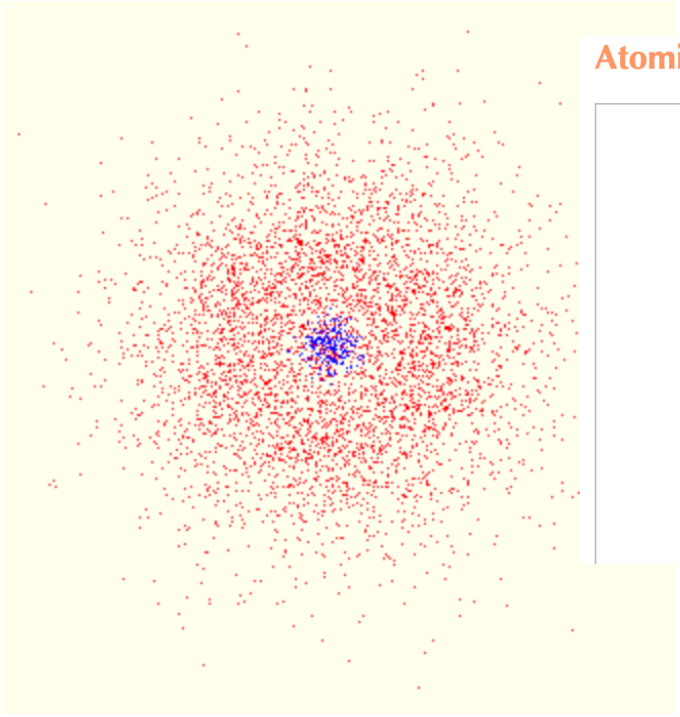
Schematic plot of the 1s radial distribution function $4\pi r^2\psi_{1s}^2$

2s orbital

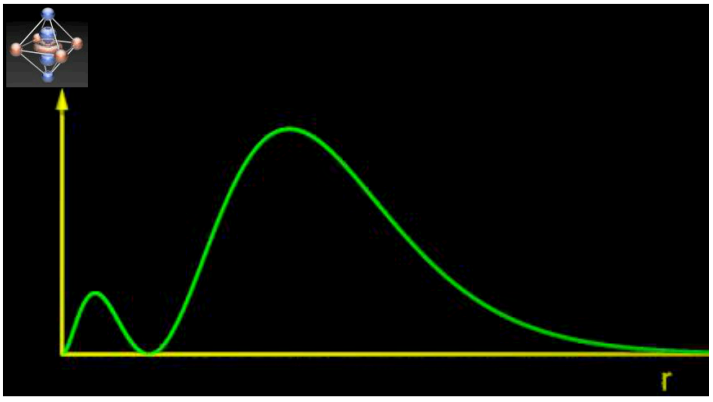
Atomic orbitals: 2*s*



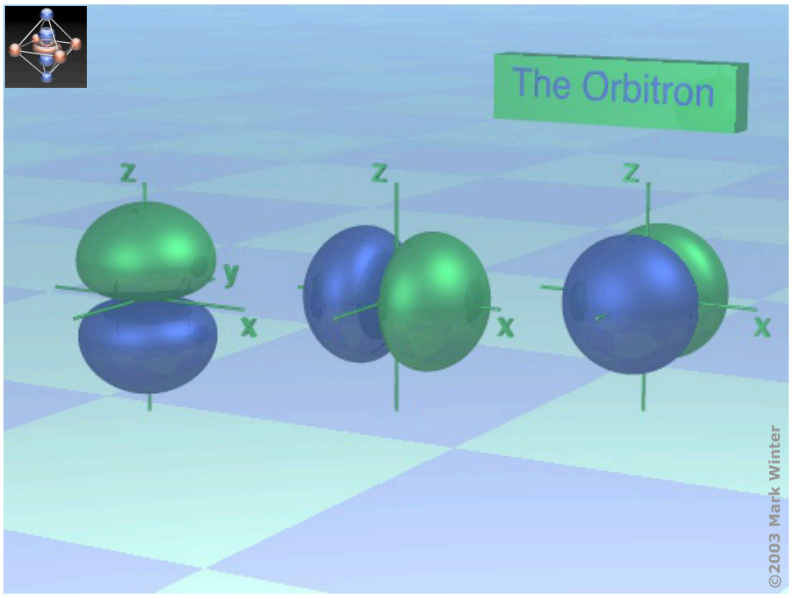
The shape of the 2s orbital. *The blue zone is where the wave function has negative values while the red zone is where values are positive.*



Atomic orbitals: 2*s* radial distribution function

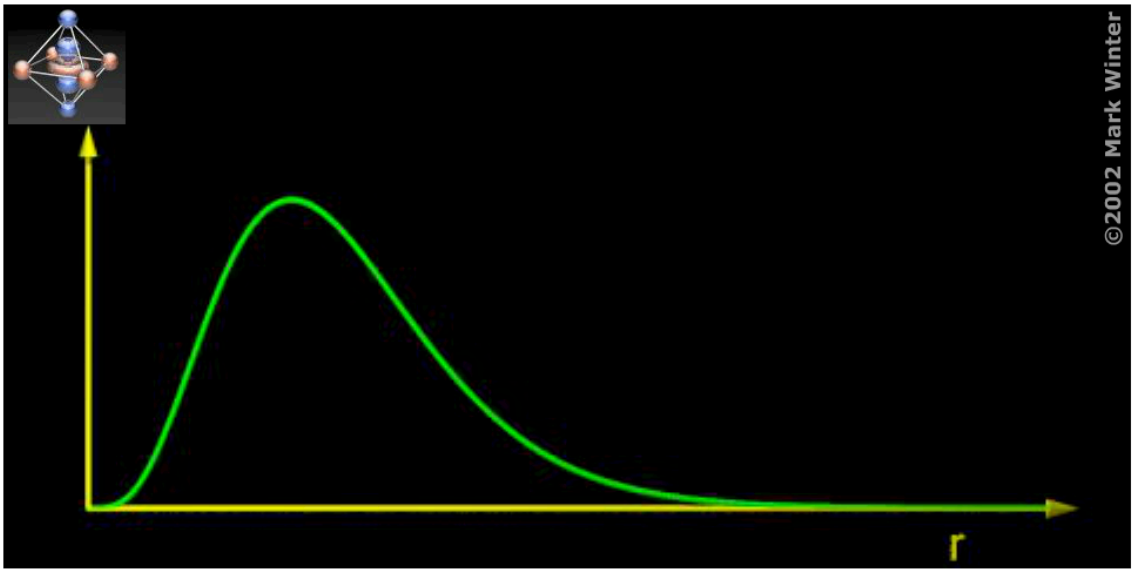


2p orbital



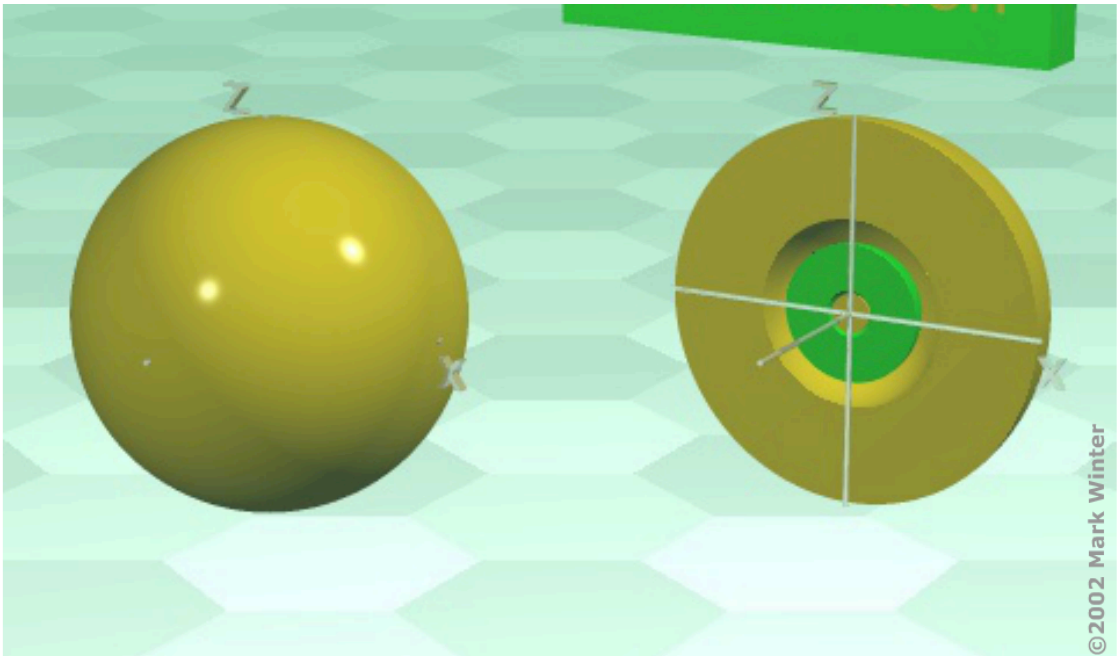
The shape of the three 2p orbitals. *From left to right: $2p_z$, $2p_x$, and $2p_y$. For each, the blue zones are where the wave functions have negative values and the green zones denote positive values.*

Atomic orbitals: 2*p* radial distribution function

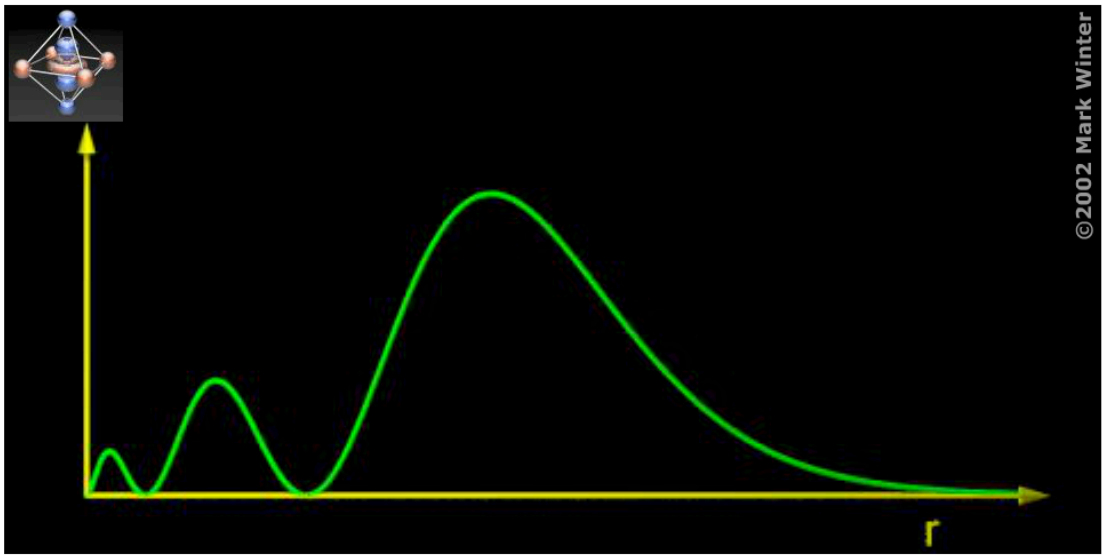


Schematic plot of the 2p radial distribution function $r^2R_{2p}{}^2$ *(R_{2p} = radial wave function).*

3s orbital

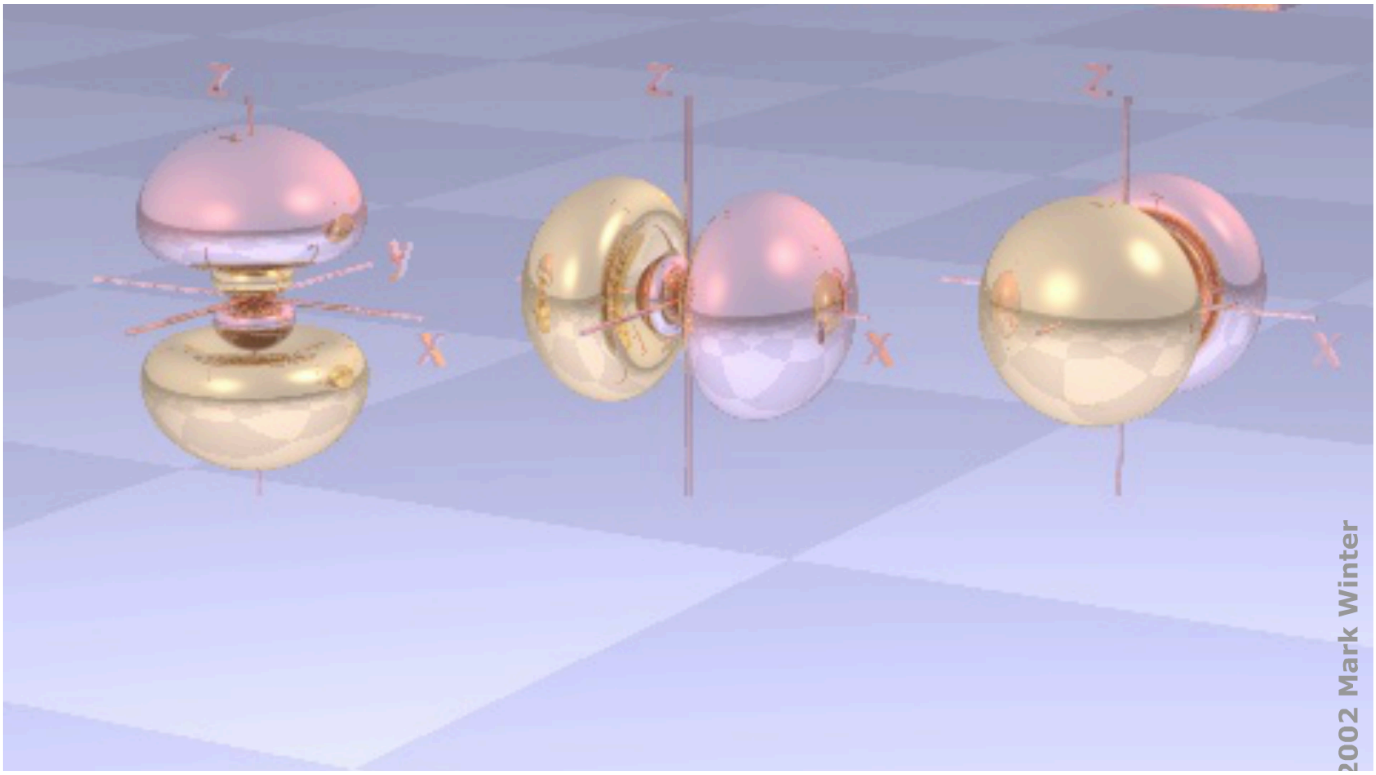


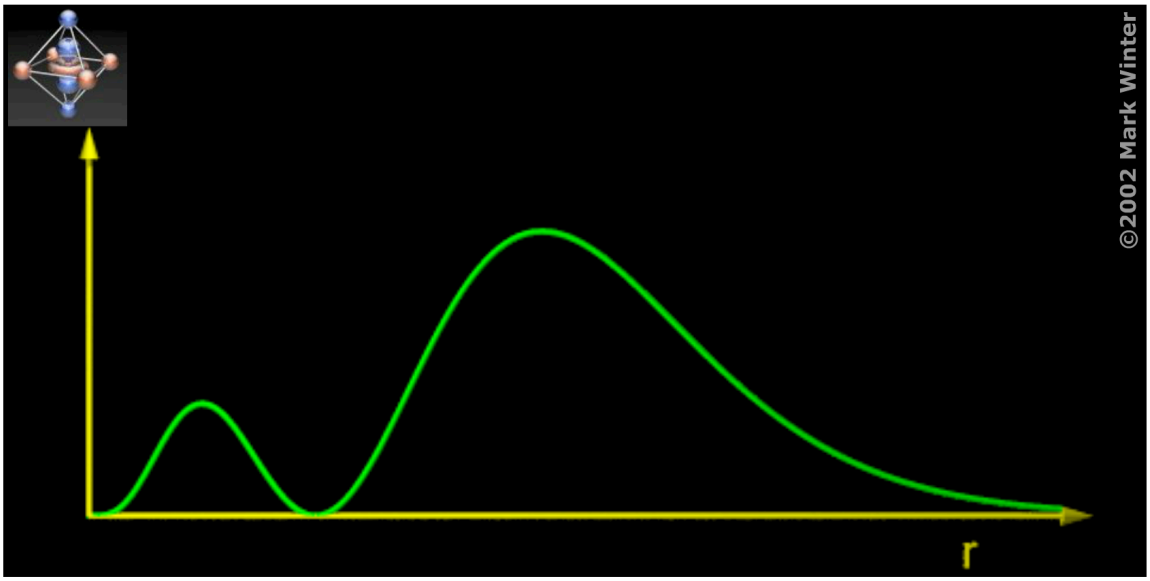
Atomic orbitals: 3*s* radial distribution function



Schematic plot of the 3s radial distribution function $4\pi r^2 \psi_{3s}^2$. *Blue represents regions within which the wave function is negative and red represents regions where the wave function is positive.*

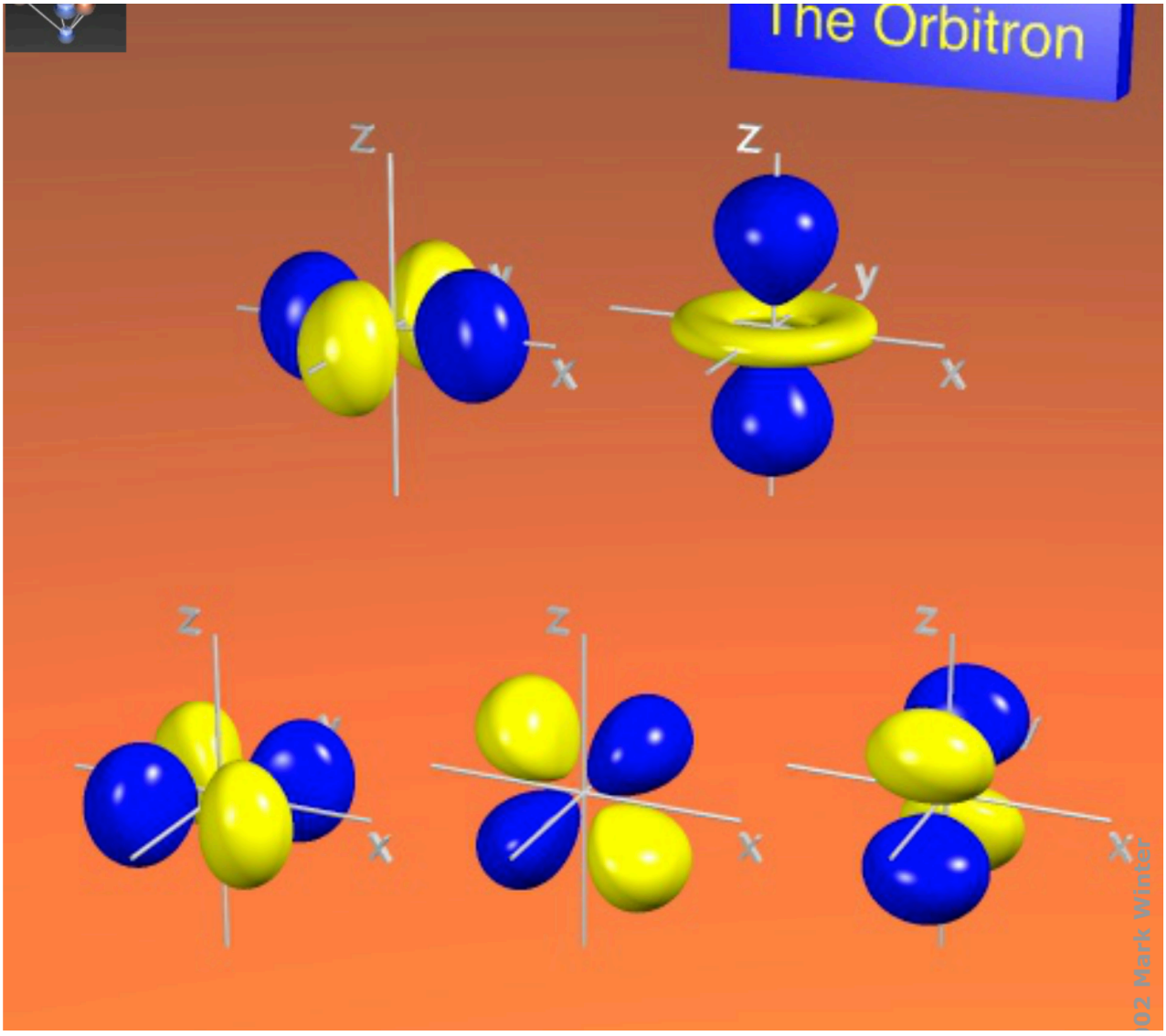
3p orbital

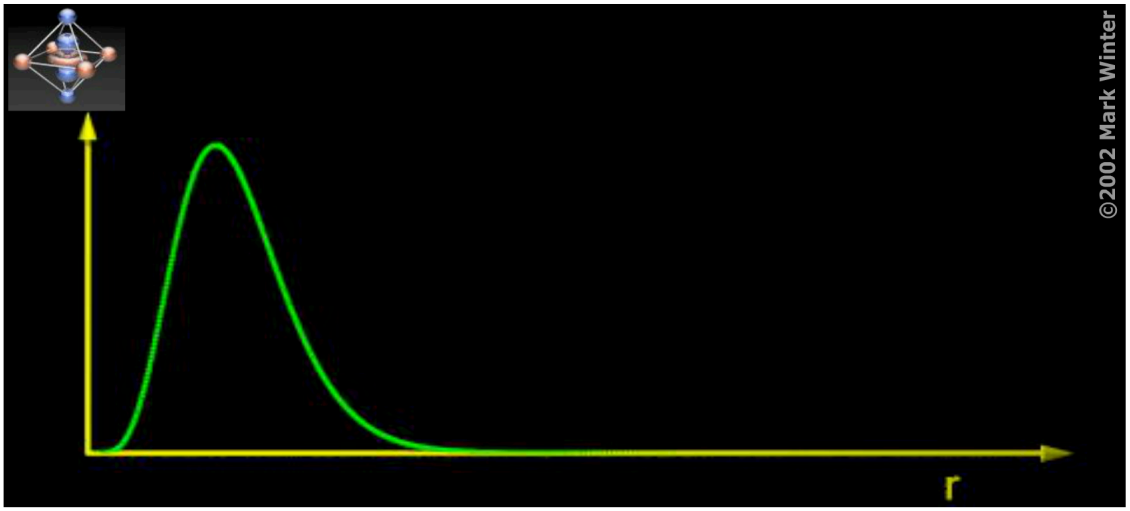




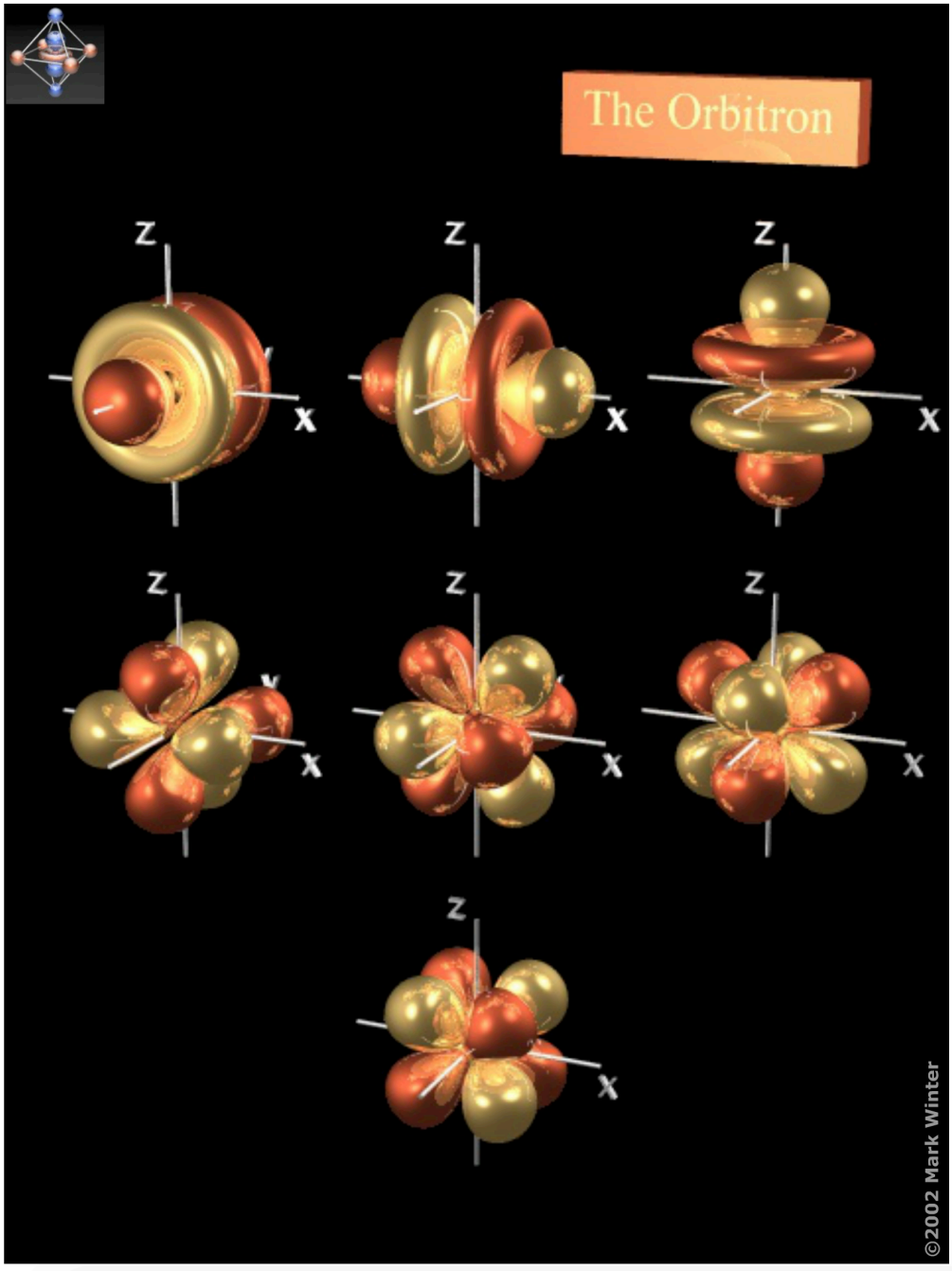
Schematic plot of the 3p radial distribution function $r^2R_{3p}^2$ *(*R_{3p} *= radial wave function).*

3d orbital

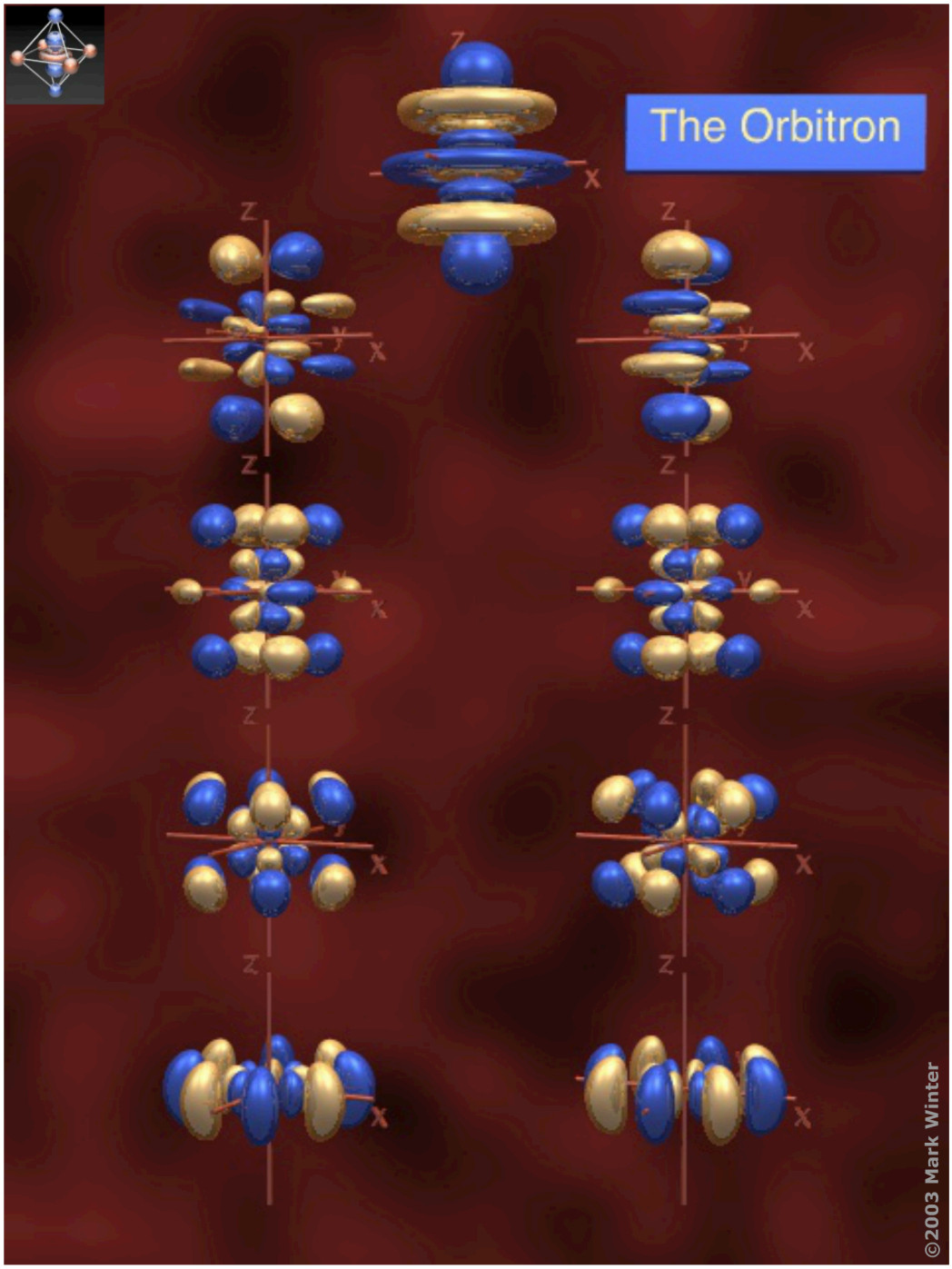




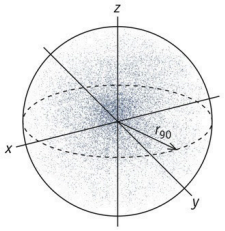
Crazy orbital (4f)

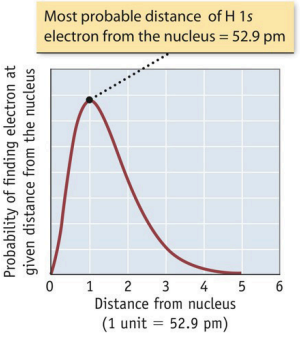


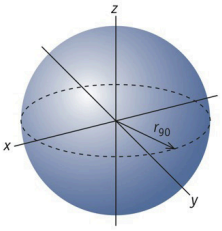
Bananas orbital (6g)



s-Orbitals

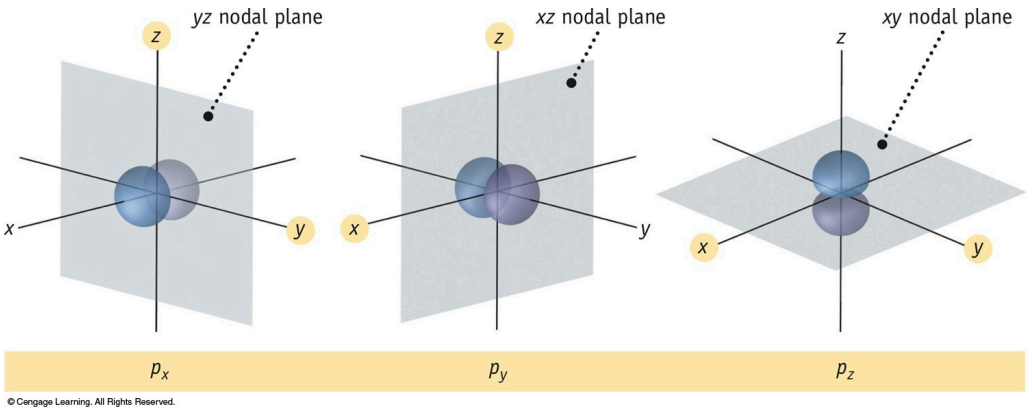






- $l = 0$, $m_l = 0$
- $2l+1 = 1$
- one *s*-orbital that extends in a radial manner from the nucleus forming a spherical shape.

p-Orbitals



The three degenerate *p*-orbitals spread out on the x, y & z axis, 90° apart in space.

d-Orbitals

s-orbitals have no nodal planes ($l = 0$)

p-orbitals have one nodal plane ($l = 1$)

d-orbitals therefore have two nodal planes ($l = 2$)