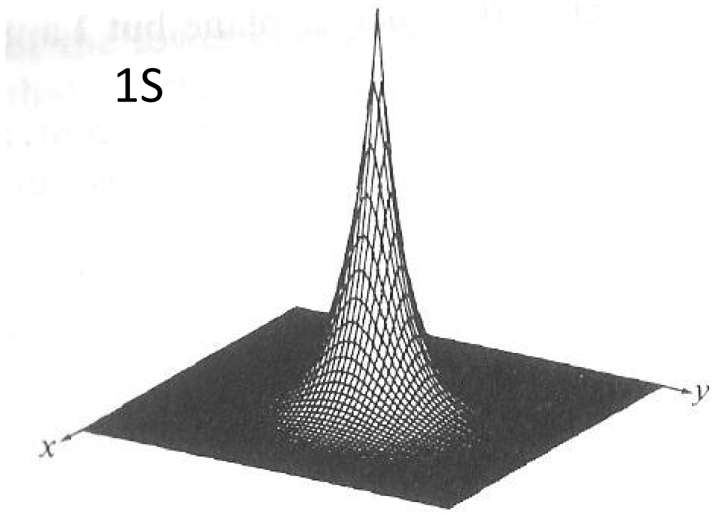
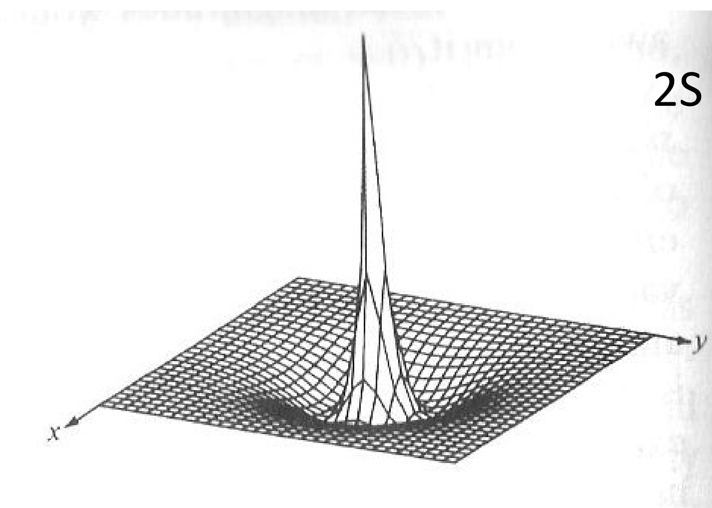
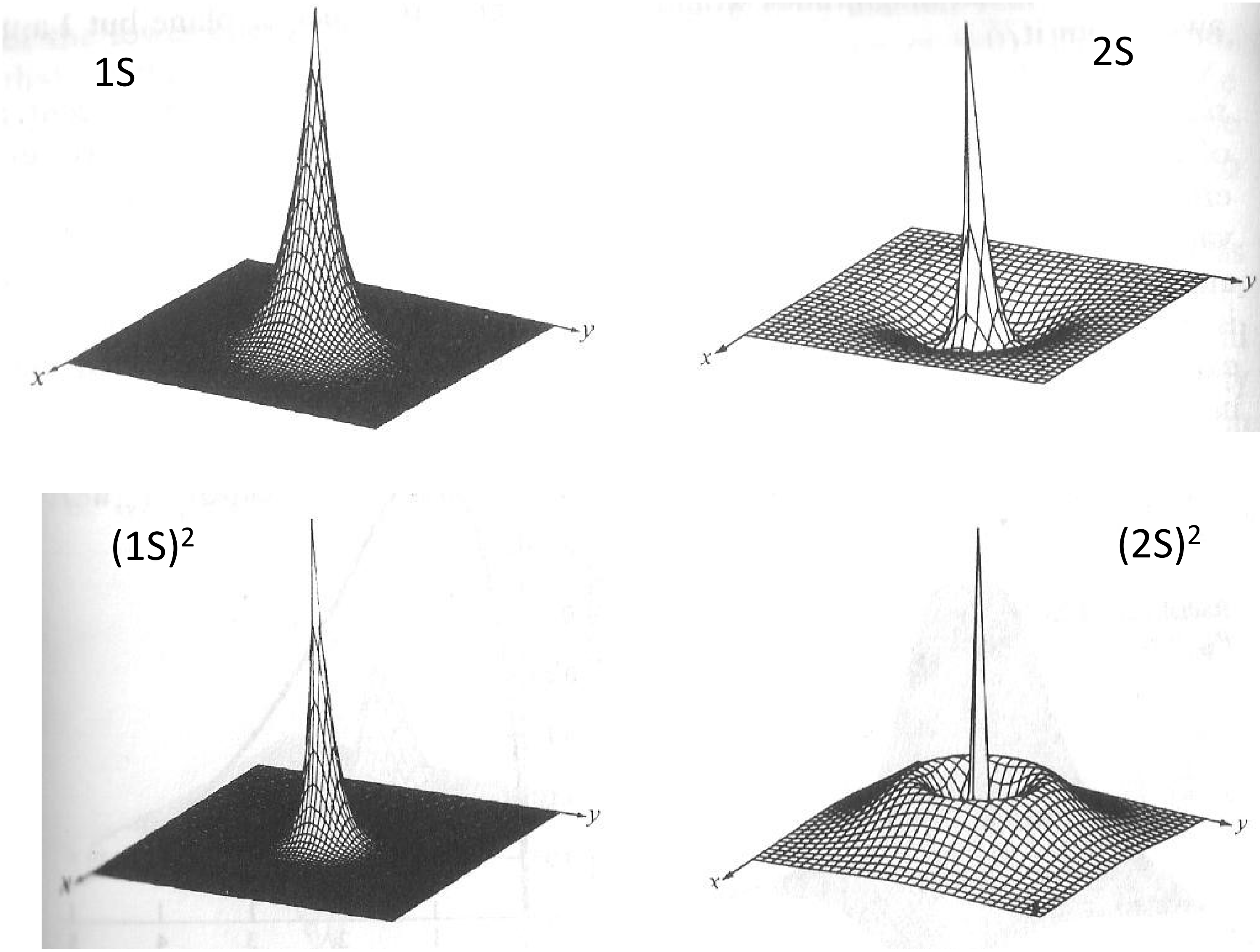
Surface plot of Ψ for S



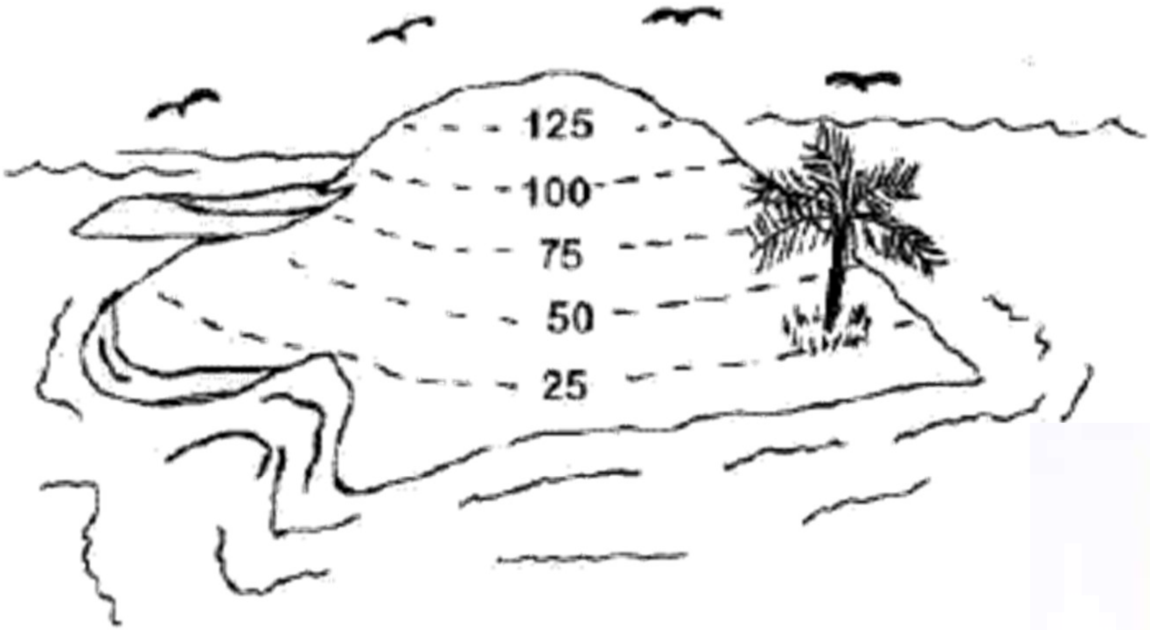


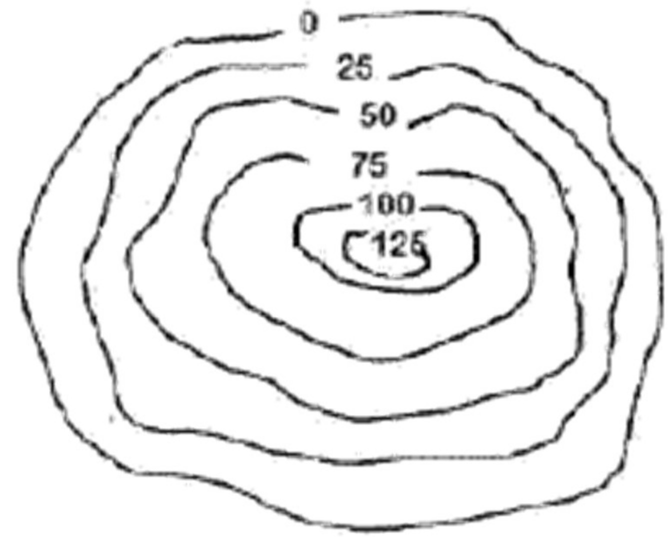
Surface plot of Ψ^2 for S

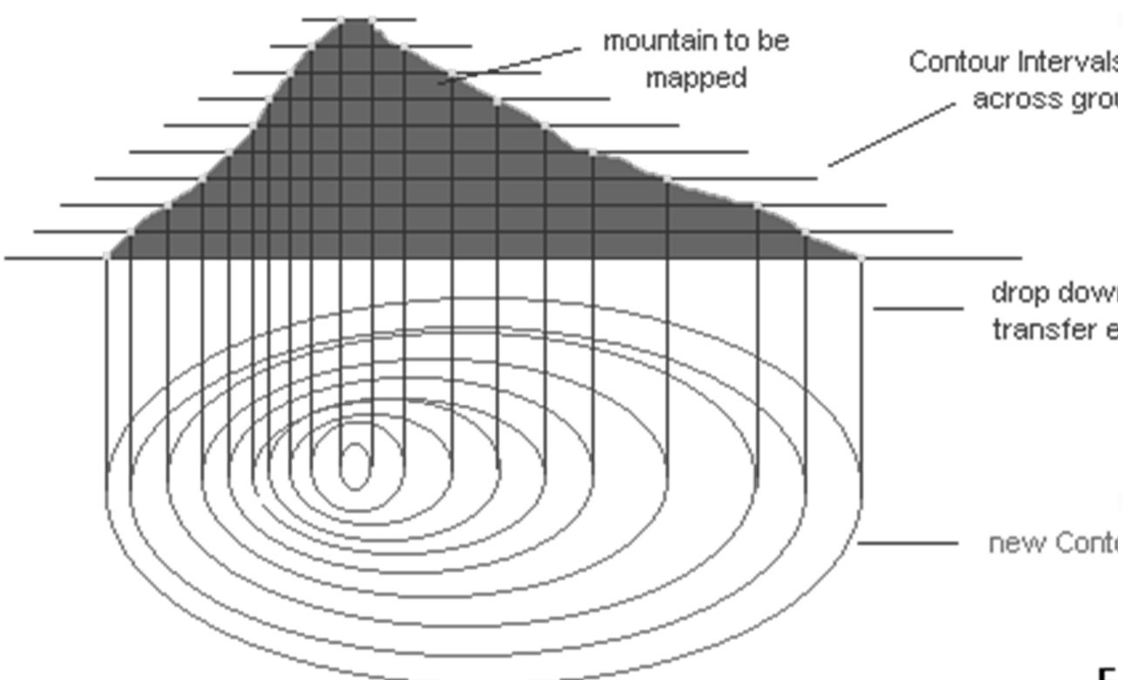


Maximum probability density of finding the electron?

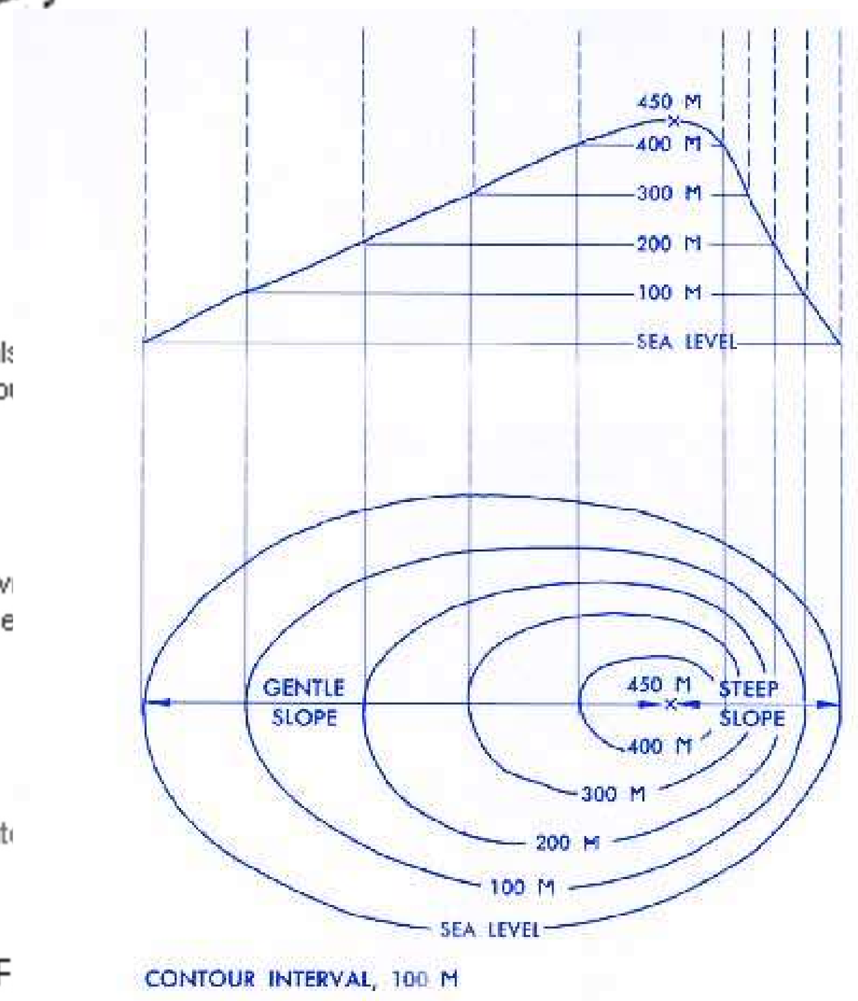

N
27.15 S
109.40 W
EASTER ISLAND
1:100,000 Contour Intervals - 20 meters
Other Precision Map - Base Image from DigitalGlobe
Peter Minton @ EVS Islands 06-27-2008


125
100
75
50
25

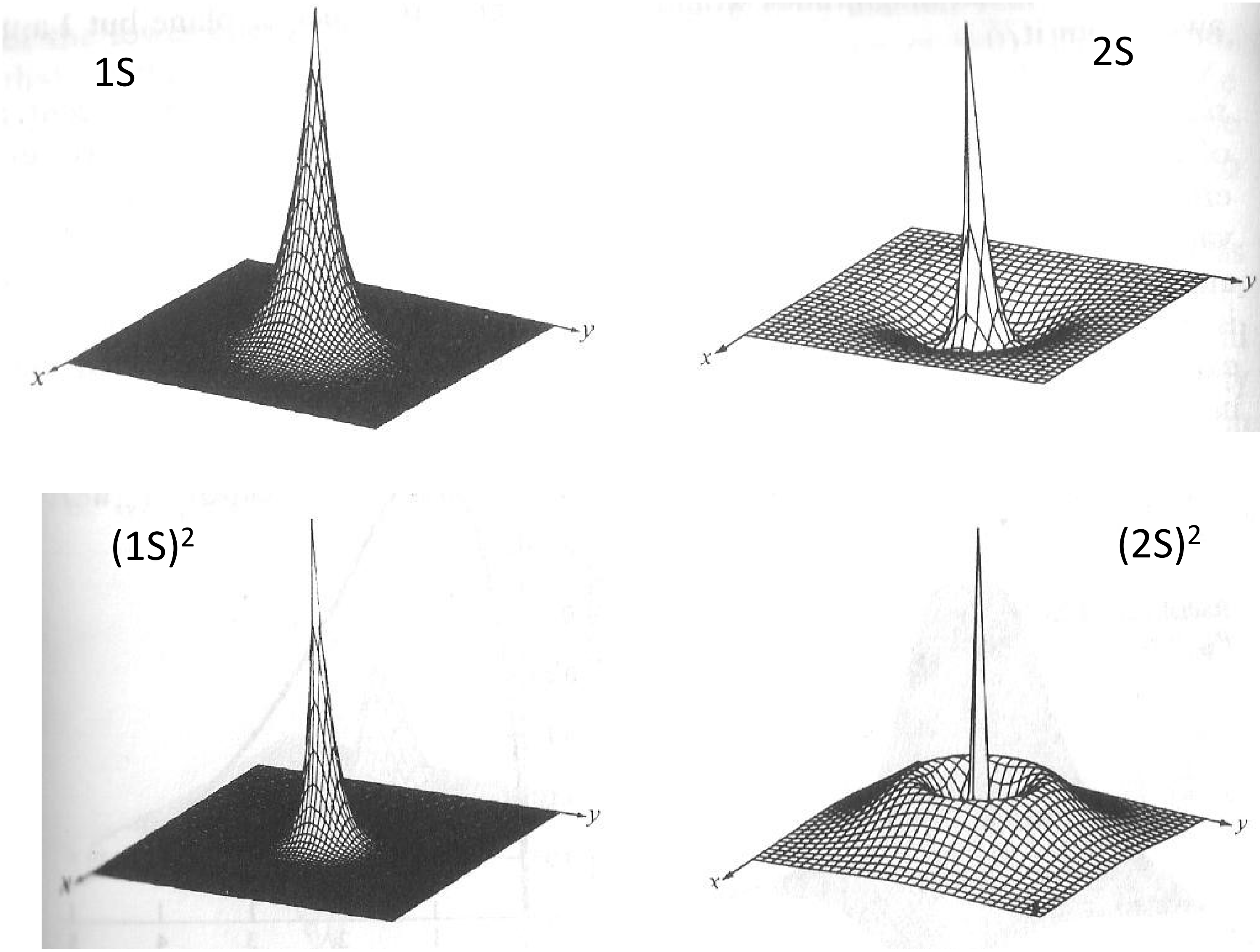

0
25
50
75
100
125


mountain to be mapped
Contour Intervals across grou
drop dow transfer e
new Cont

F

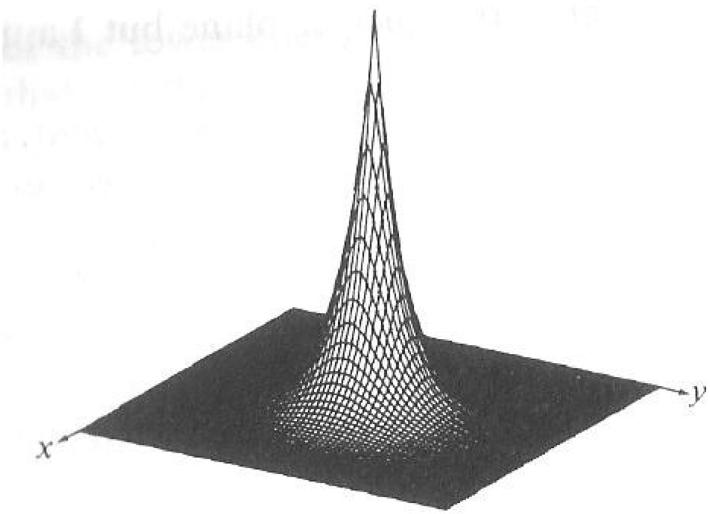

450 M
400 M
300 M
200 M
100 M
SEA LEVEL
GENTLE SLOPE
450 M
STEEP SLOPE
400 M
300 M
200 M
100 M
SEA LEVEL
CONTOUR INTERVAL, 100 M

Surface plot of Ψ and Ψ^2 for S

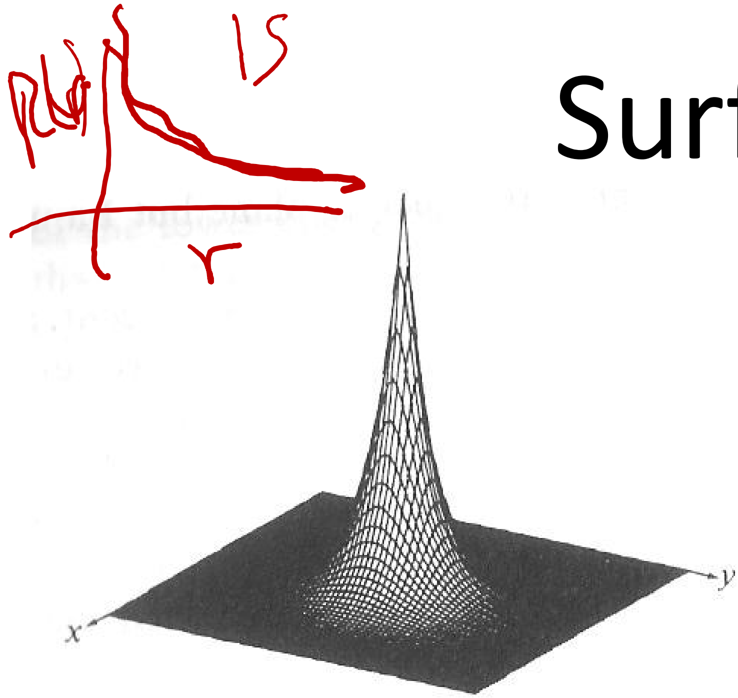


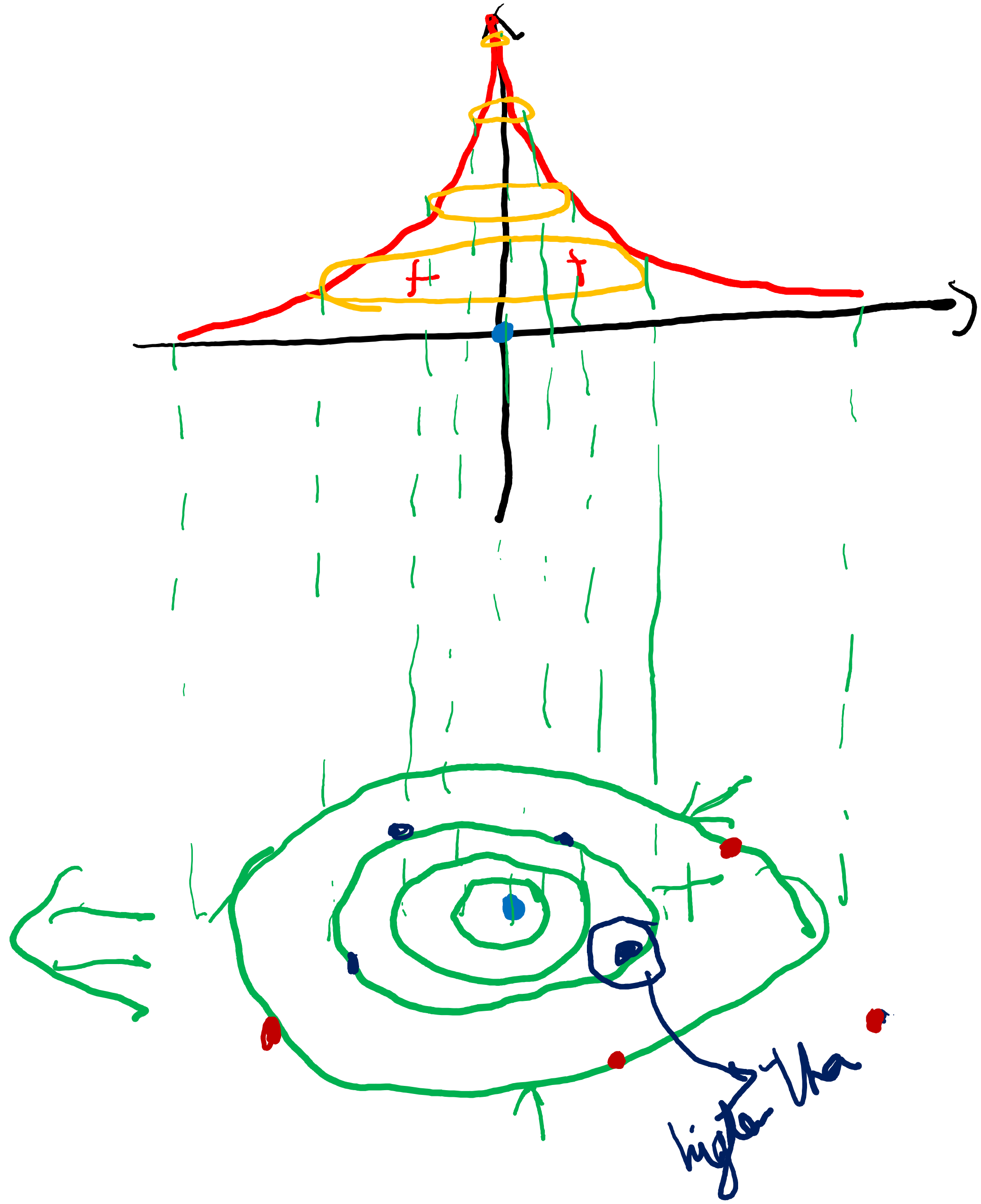
Maximum probability of finding the electron?

Surface plot of 1s

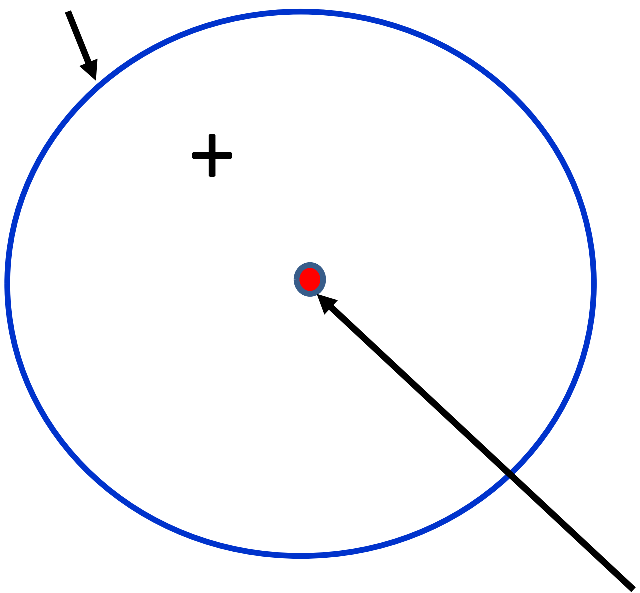


Surface plot of 1s



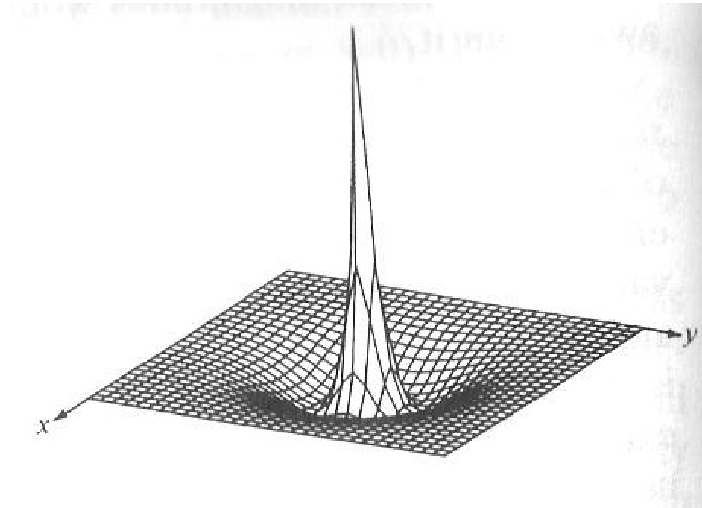


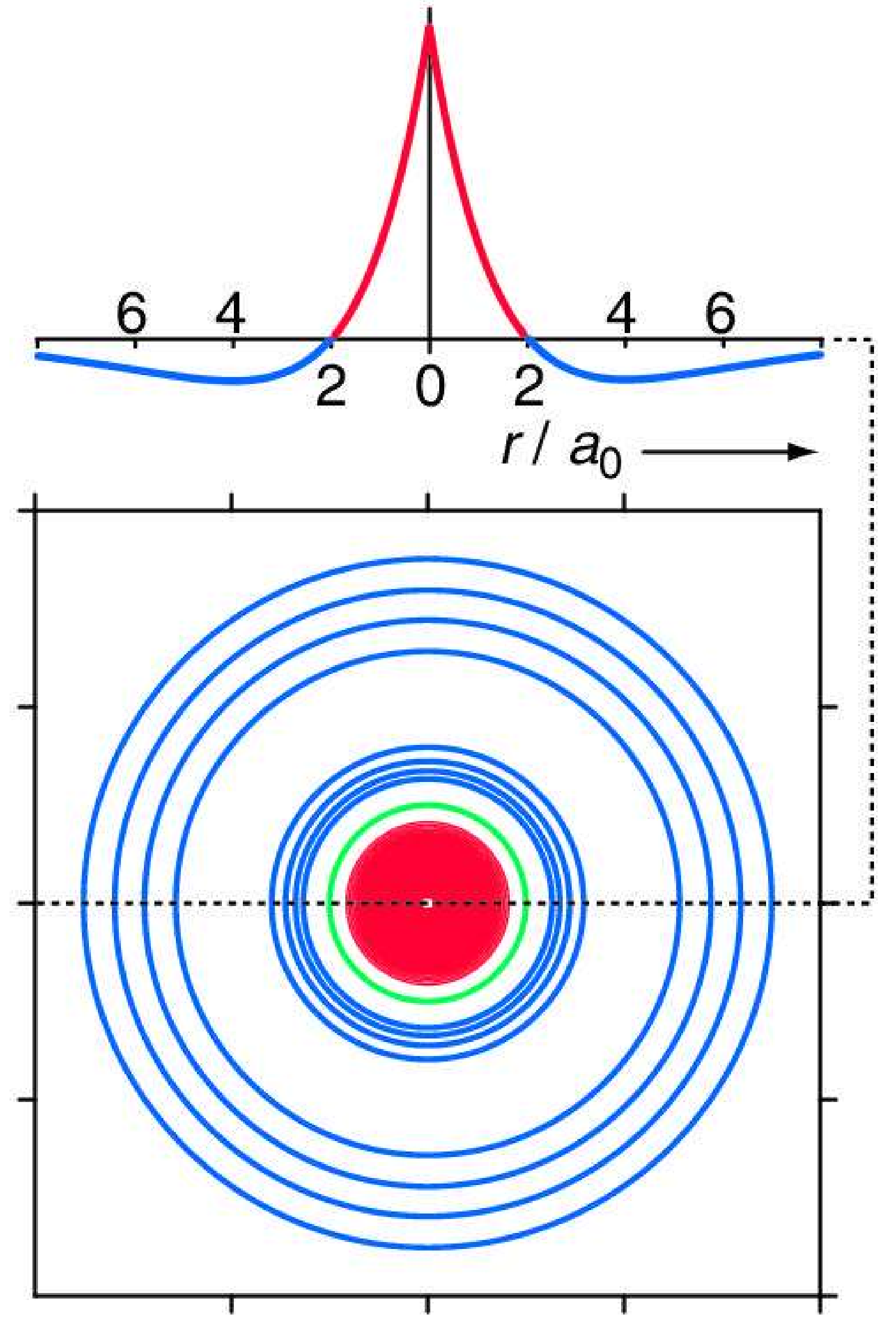
Equal Probability Iso-surface

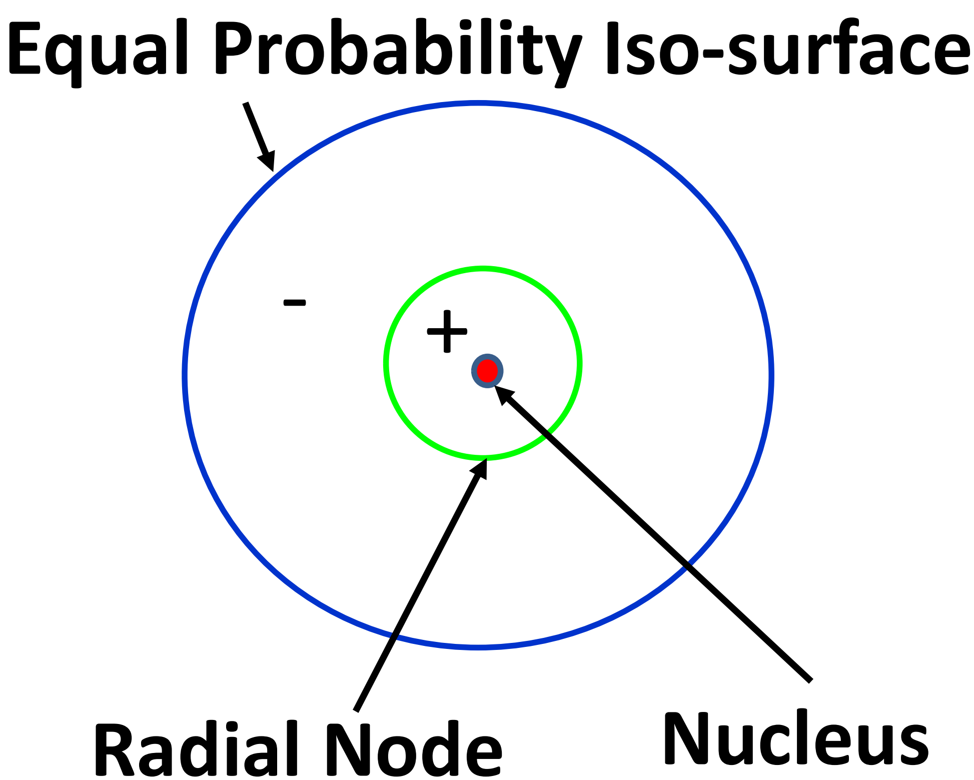


Nucleus

Surface plot of 2s







P ORBITALS: wavefunctions

"Shapes" of orbitals depend on Orbital quantum number l and Magnetic quantum no. m_l

Not spherically symmetric: depend on θ,ϕ

m = 0 case: $\psi_{210} = \psi_{2p_z} = \left(32\pi a_0^3\right)^{-1/2}\left(r/a_0\right)e^{-r/2a_0}\cos\theta$

ψ_{2p_z} independent of ϕ symmetric about z axis

No ϕ dependence: symmetric around z axis

radial nodes $n - l - 1 = 0$ (note difference from 2s: $R_{nl}\left(r\right)$ depends on l as well as n)

angular nodes $l = 1$

total nodes $n - 1 = 1$

xy nodal plane - zero amplitude at nucleus

Number of Angular Nodes = l

What are we up to?

$$\Psi_{2pz} = (re^{-r}) \times (Cos\theta)$$

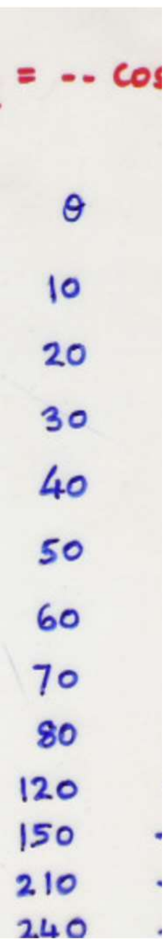
Angular part of Wave Functions

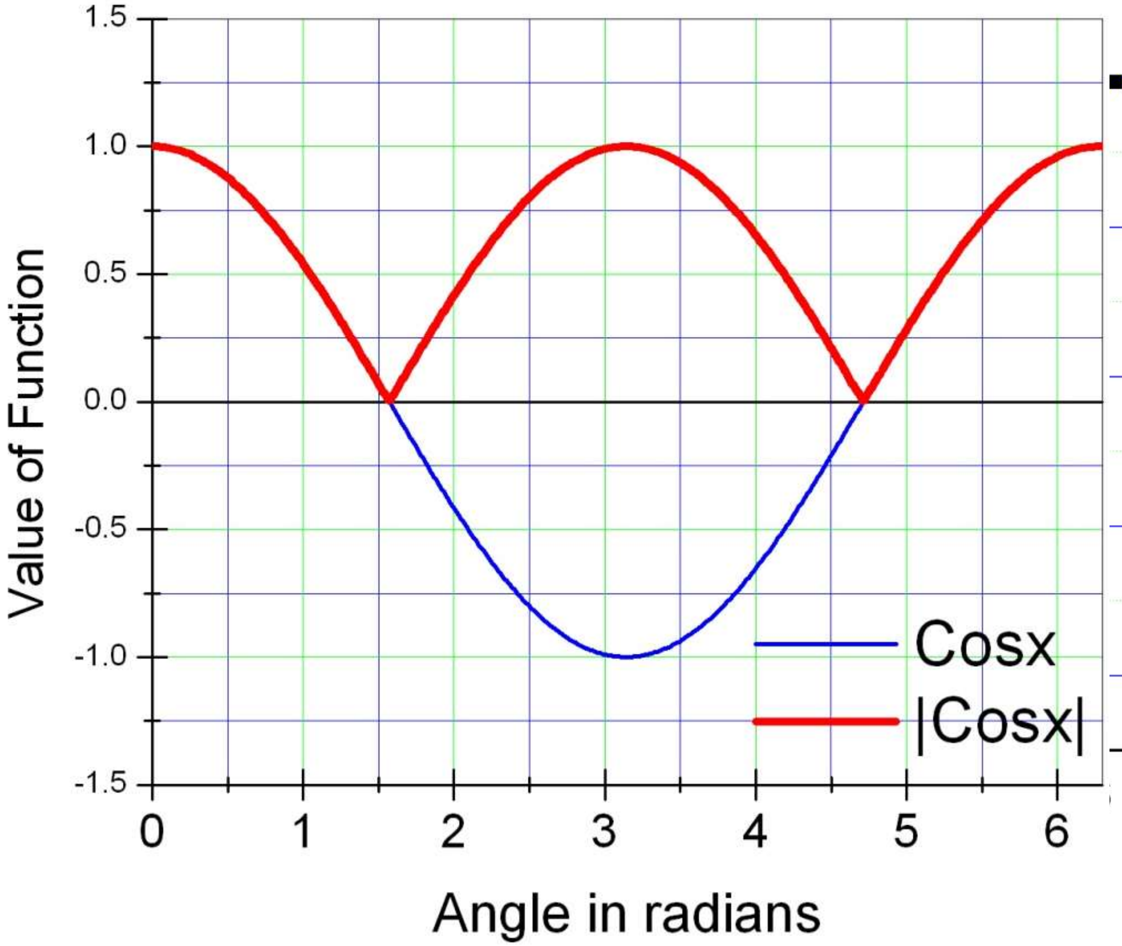
m = 0 case: $\psi_{210} = \psi_{2p_z} = \left(32\pi a_0^3\right)^{-1/2}\left(r/a_0\right)e^{-r/2a_0}\cos\theta$

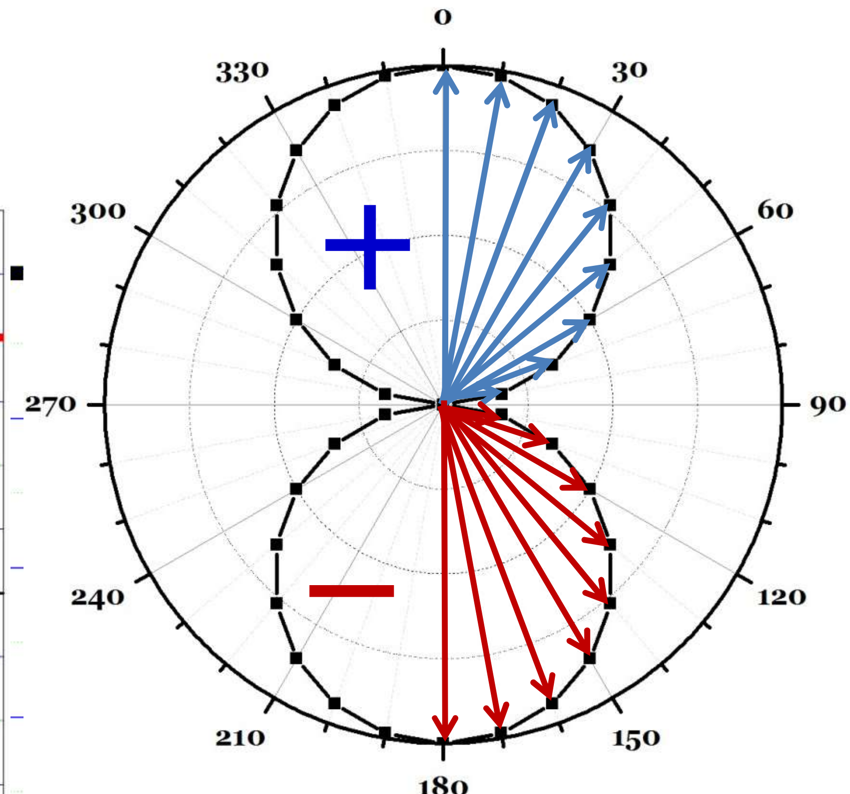
ψ_{2p_z} independent of ϕ symmetric about z axis

$\Psi_{210}(2p_z) = N\rho e^{-\rho/2}.\cos\theta$

$\left|\Psi_{2p_z}(\theta)\right| = Const.\times\left|\cos\theta\right|$







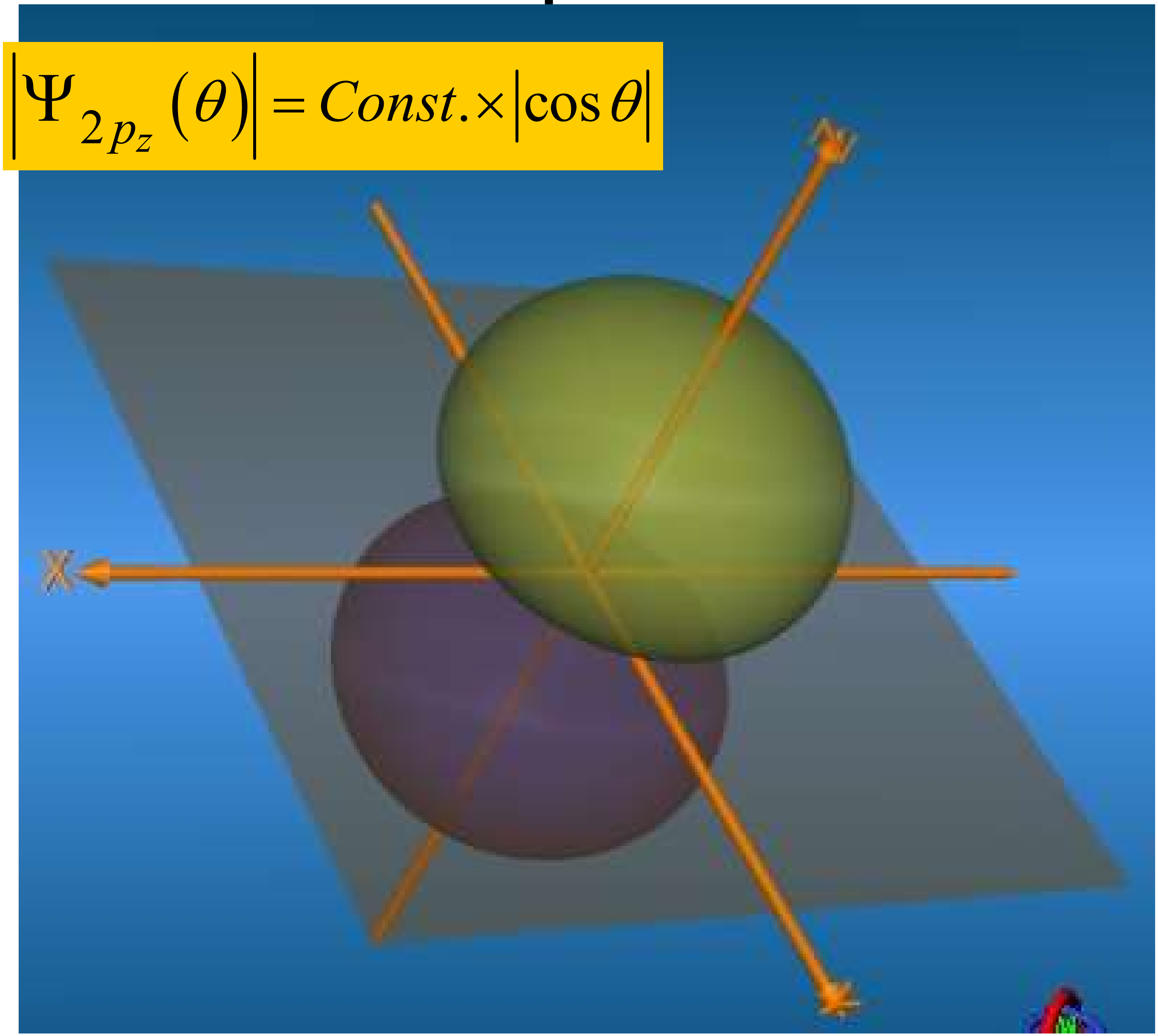
Same logic for p_x and p_y

$\Psi(2p_x) = N\rho e^{-\rho/2}.\sin\theta.\cos\phi$

$\Psi(2p_y) = N\rho e^{-\rho/2}.\sin\theta.\sin\phi$

Is this a “p” orbital?

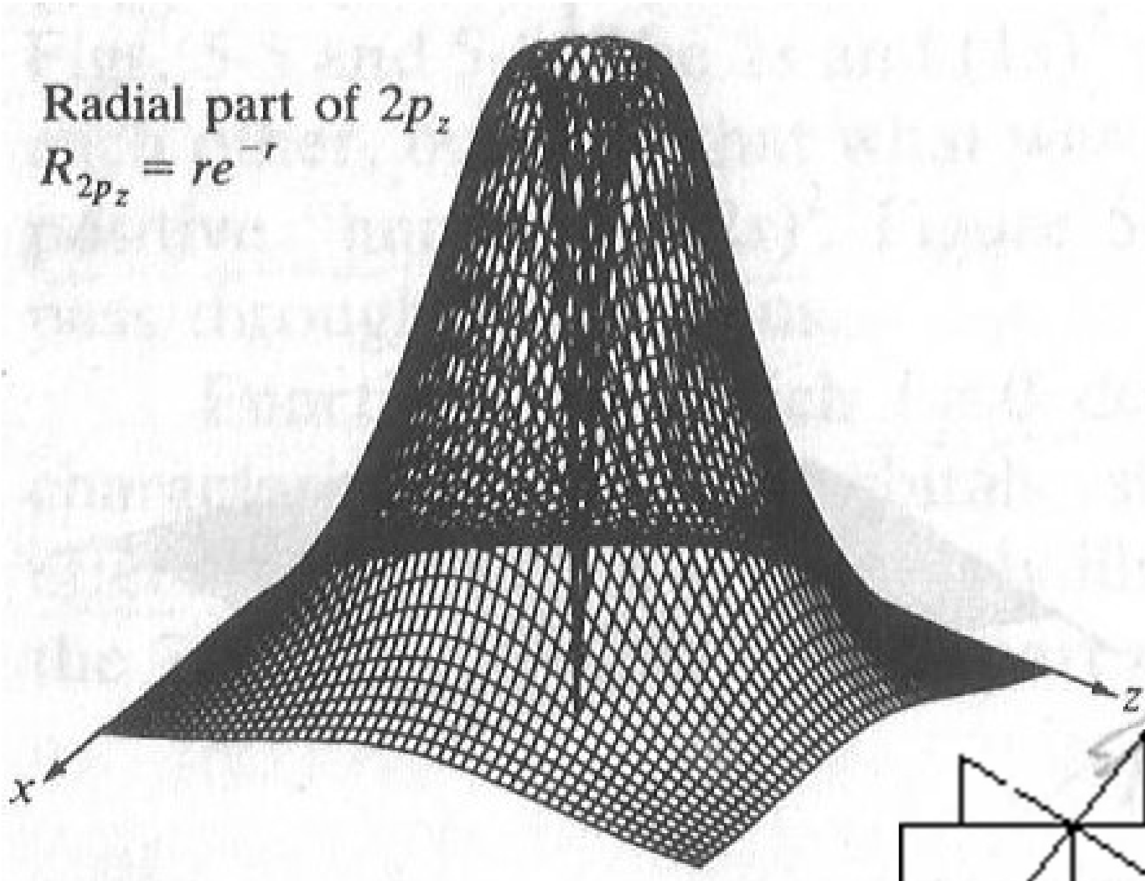
$$\left|\Psi_{2p_z}(\theta)\right| = Const. \times \left|\cos\theta\right|$$

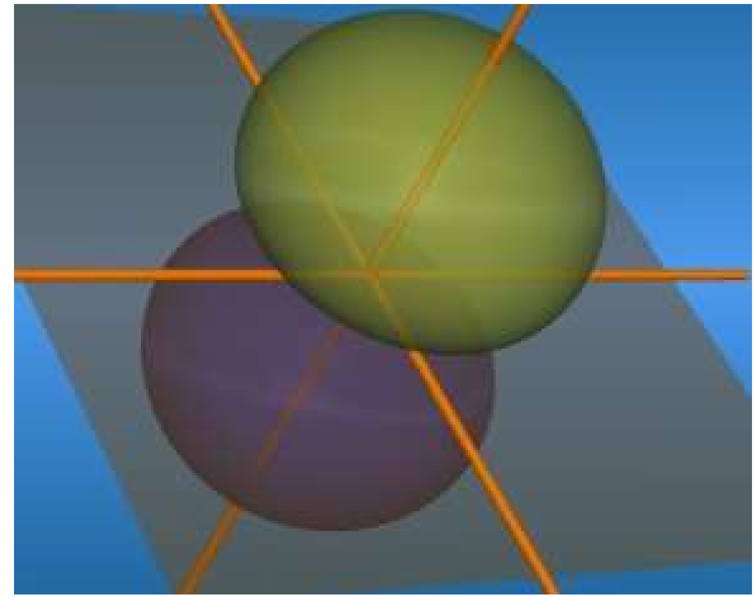


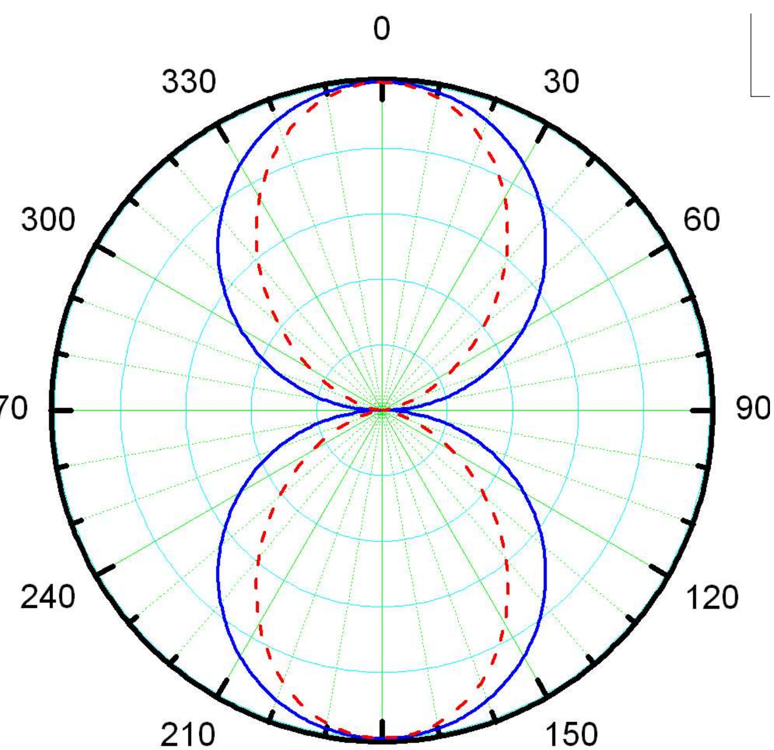
What are we up to?

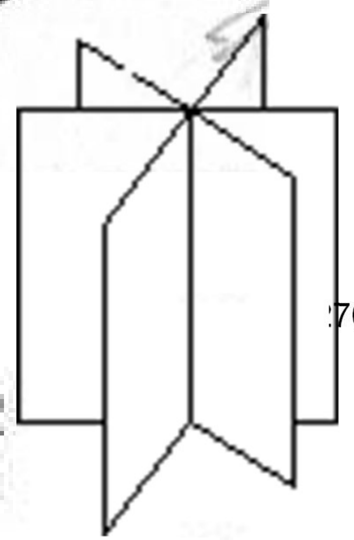
$$\Psi_{2pz} = (re^{-r})x(Cos\theta)$$

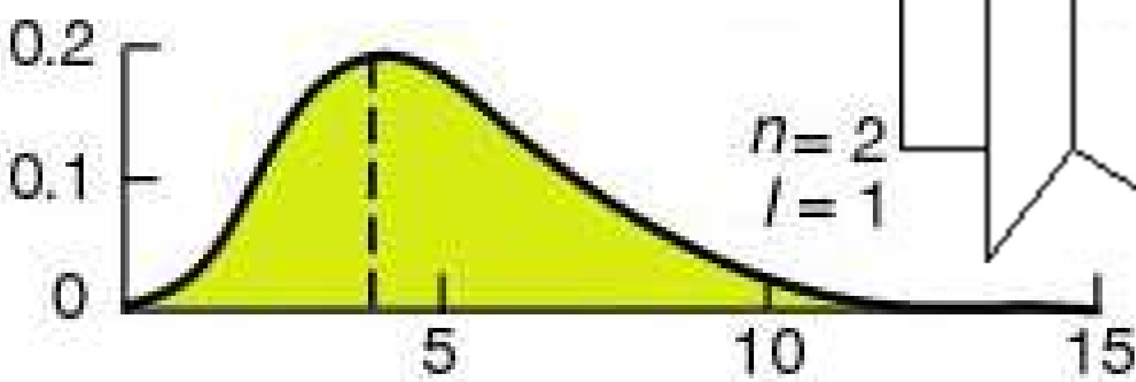
Surface plot of re^{-r} & Cosθ for all Φ



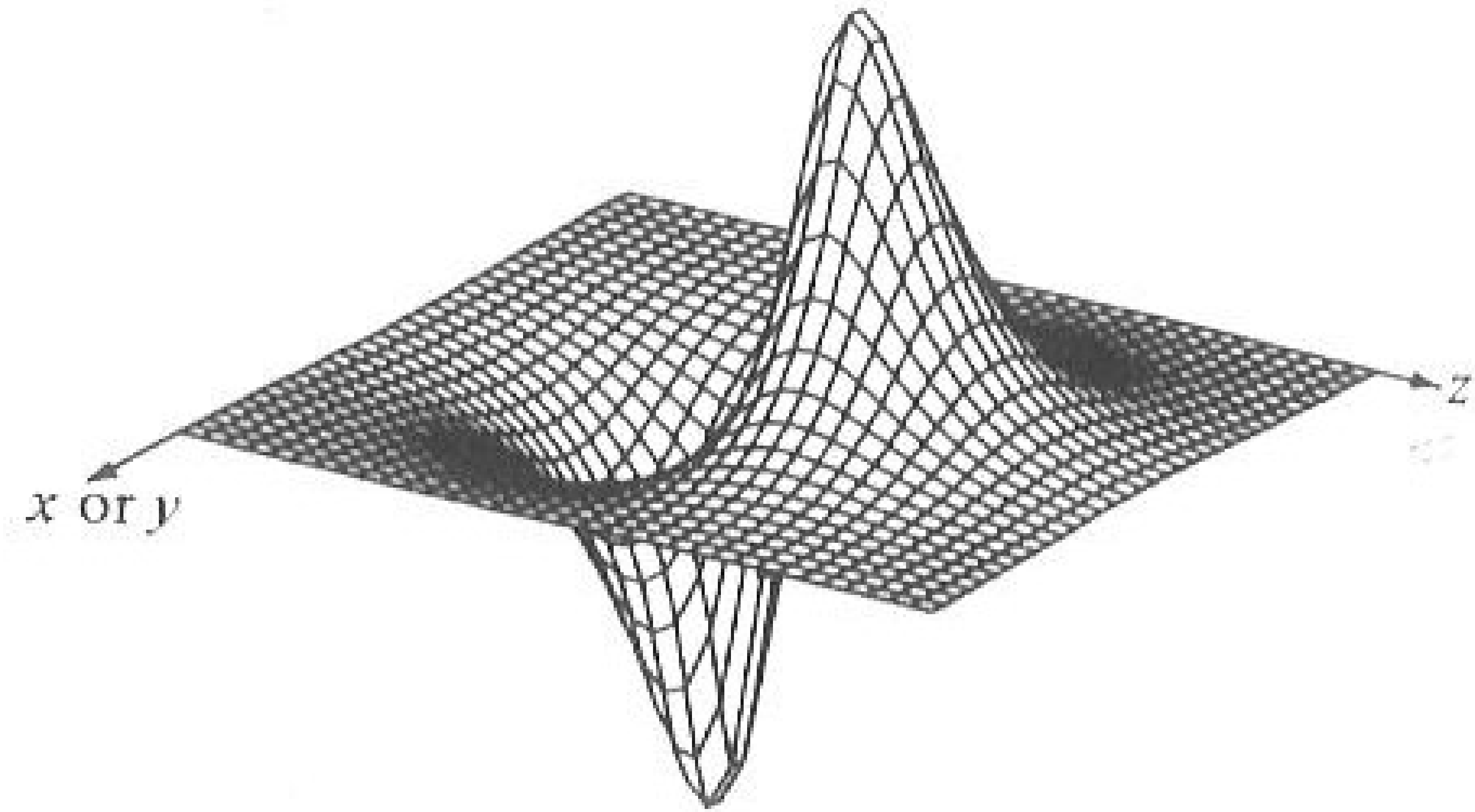




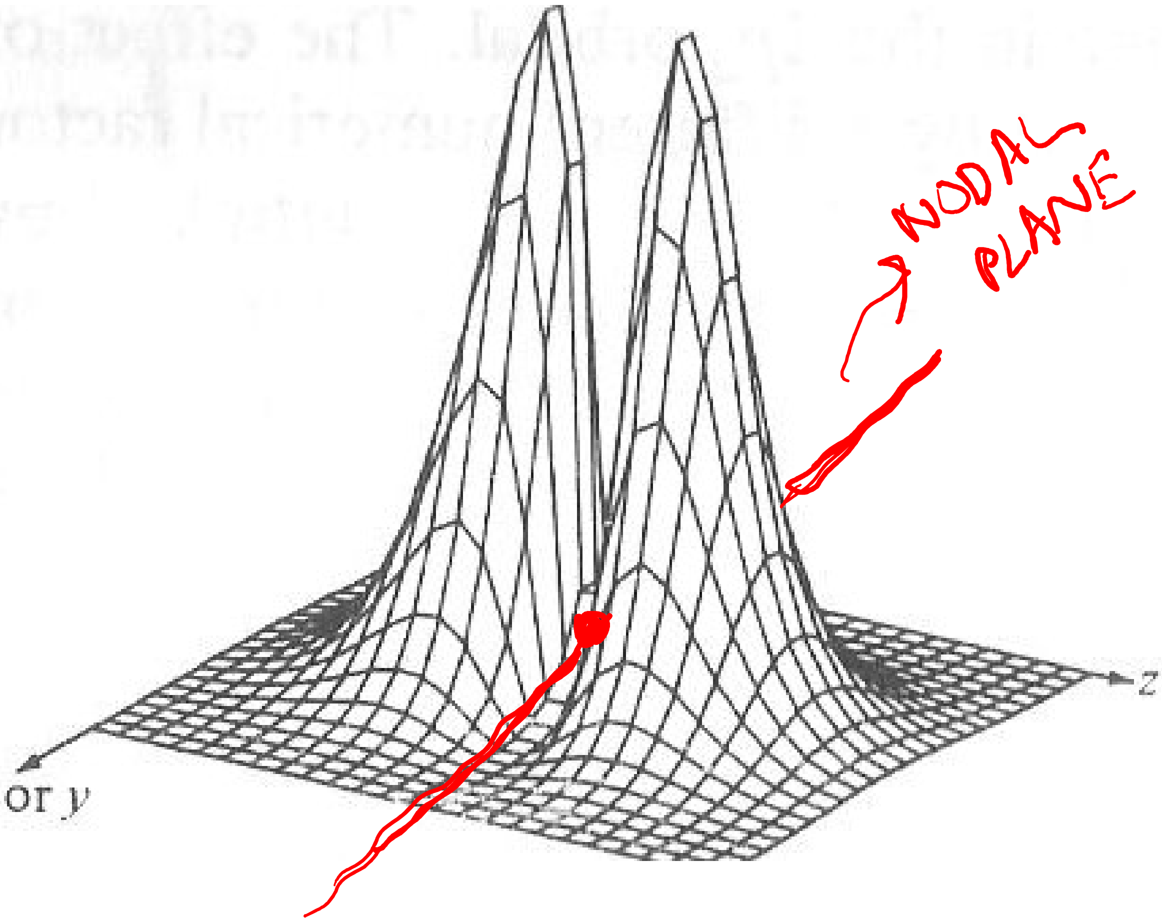


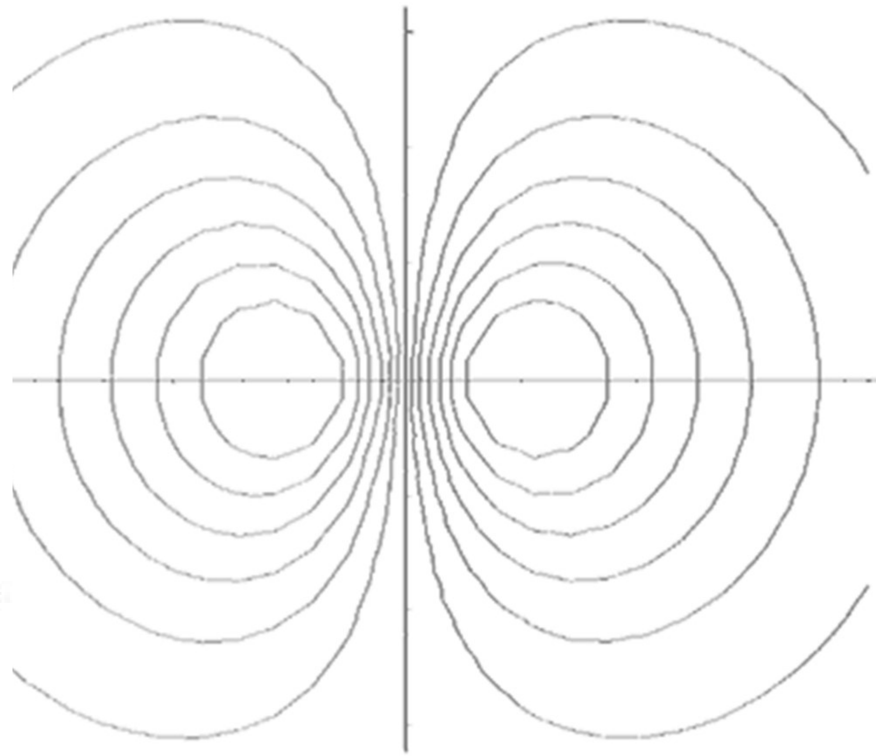


Surface plot of $\Psi_{2pz} = (re^{-r})x(Cos\theta)$



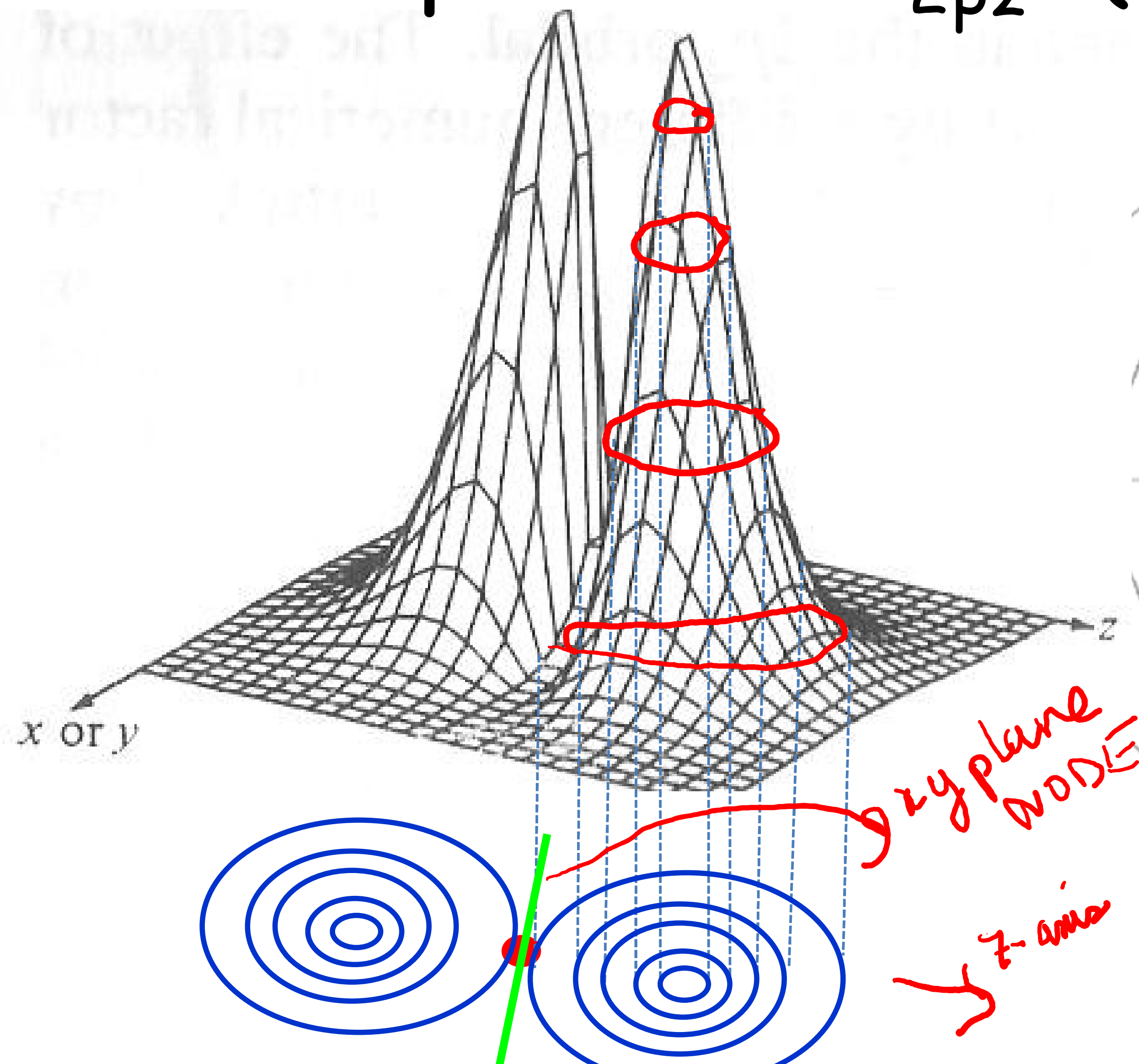
Surface plot of $\Psi^2_{2pz} \sim (r^2 e^{-2r}) x (\cos^2\theta)$

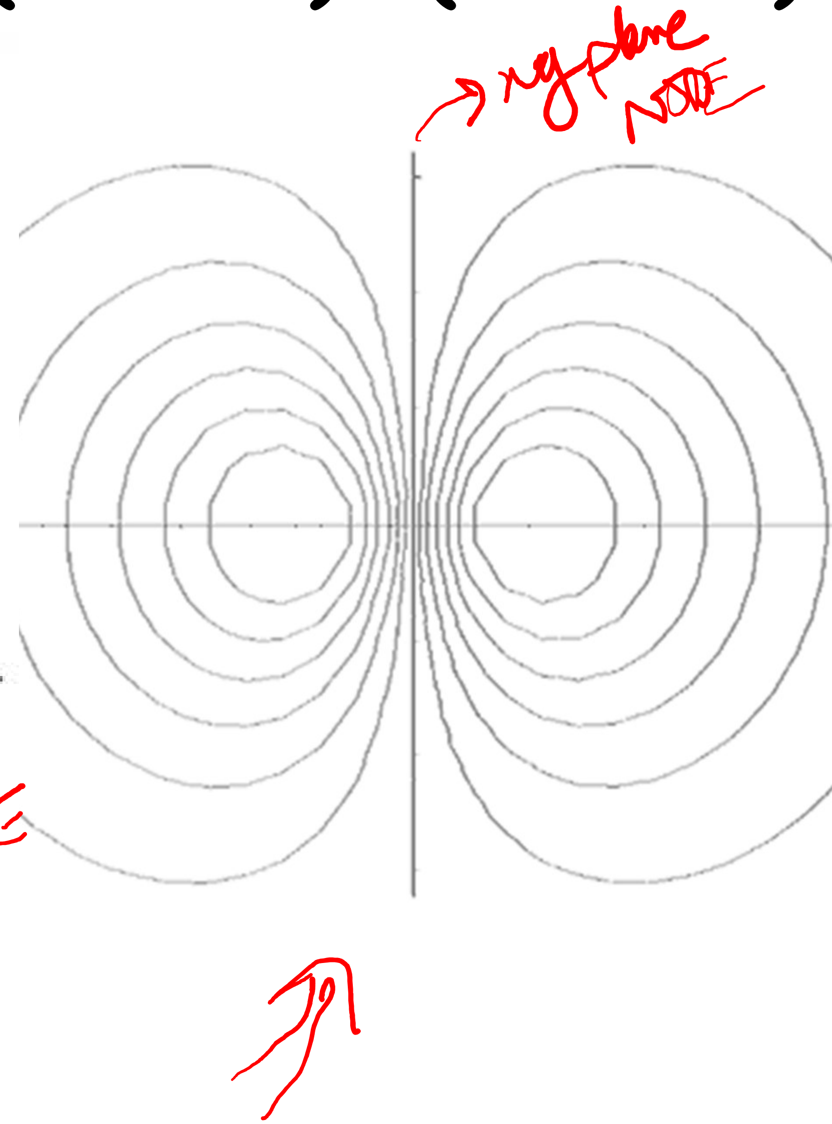




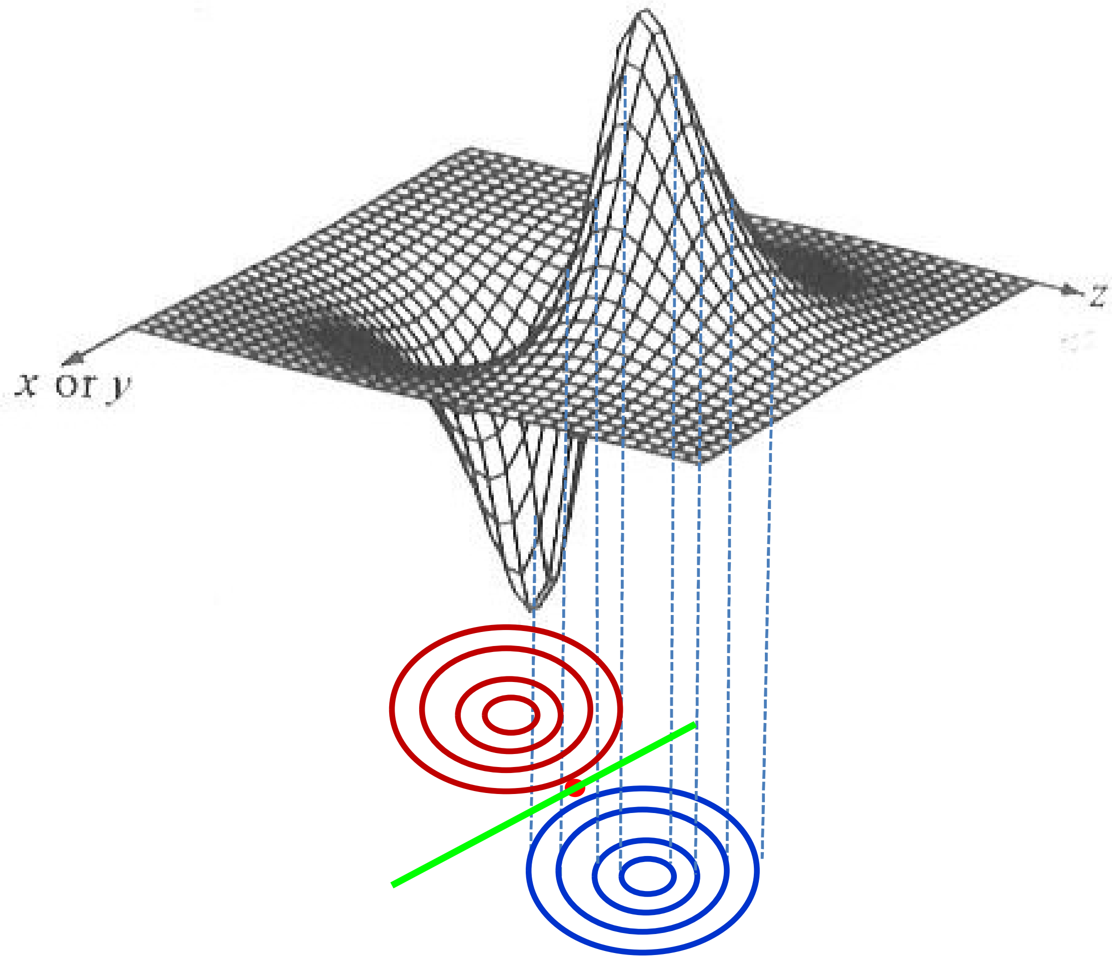
In books, or in class, one of the low valued probability density contour are shows as "Orbitals"

Surface plot of $\Psi^2_{2pz} \sim (r^2e^{-2r})x(Cos^2\theta)$





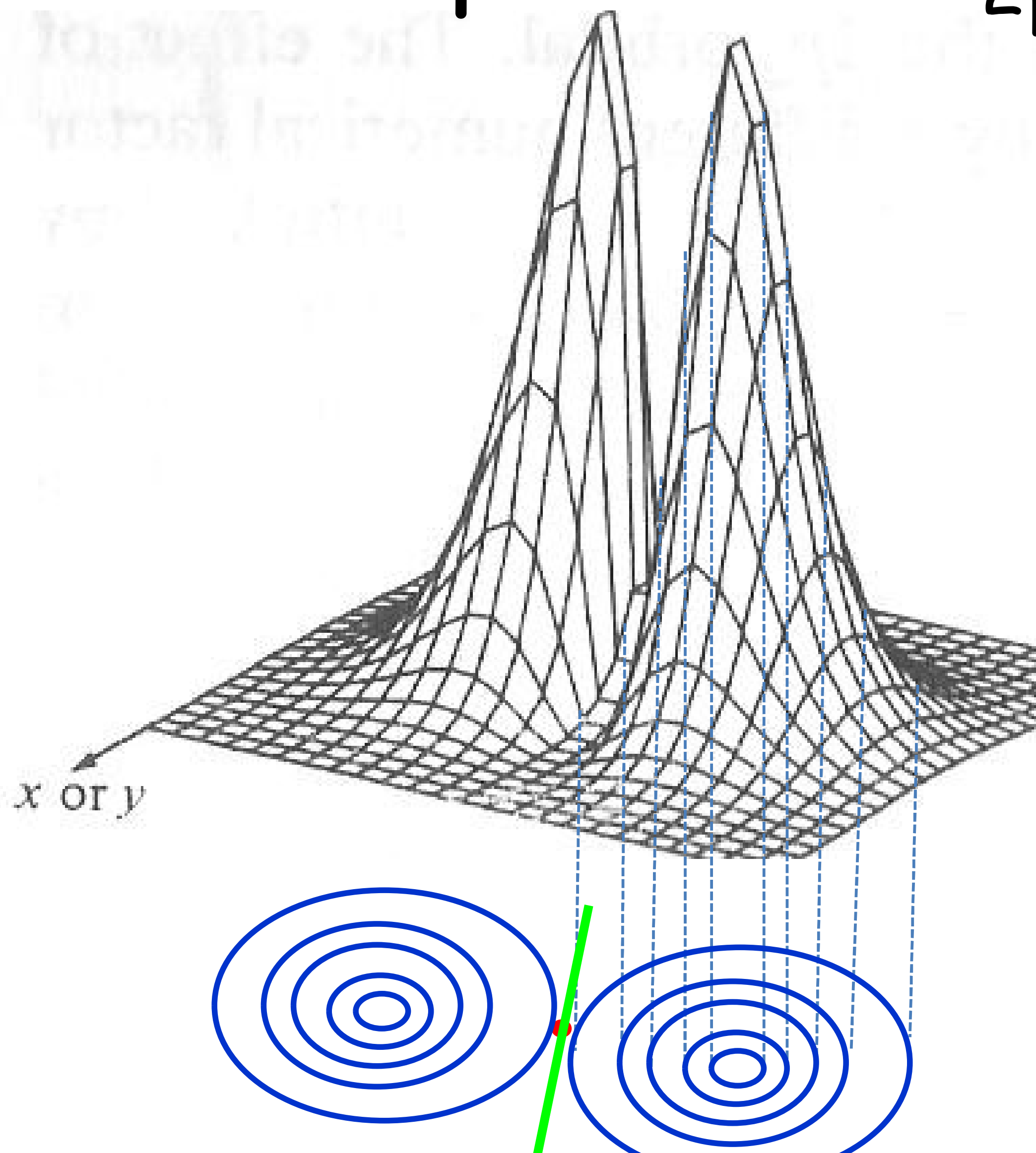
Review: Surface plot of $\Psi_{2pz} = (re^{-r})x(Cos\theta)$

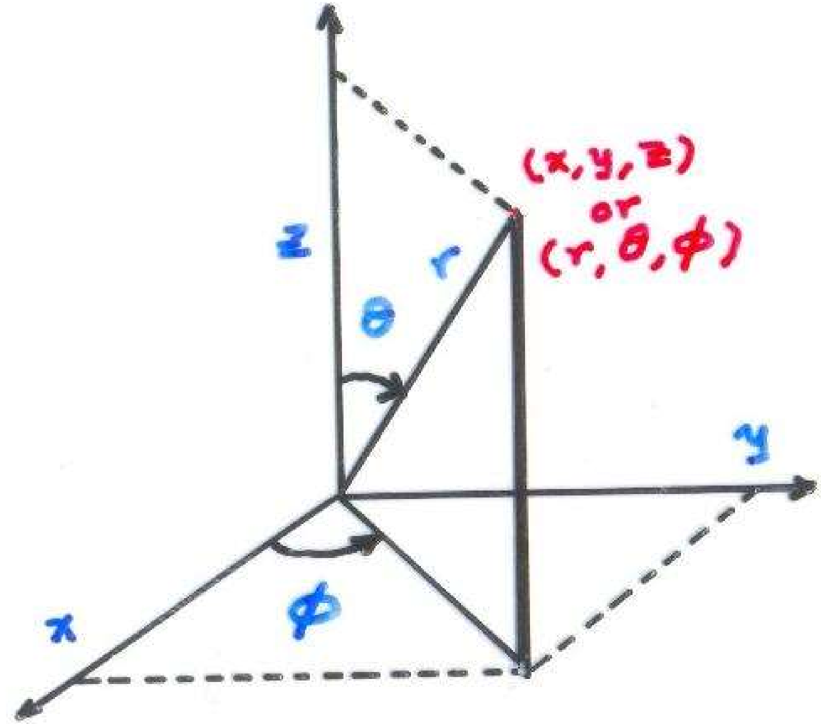


Nodal Plane is represented by a line in 2D plot

Radial node is represented by circle in 2D plot

Surface plot of Ψ^2_{2pz}~(r^2e^{-2r})x$(Cos^2\theta)$



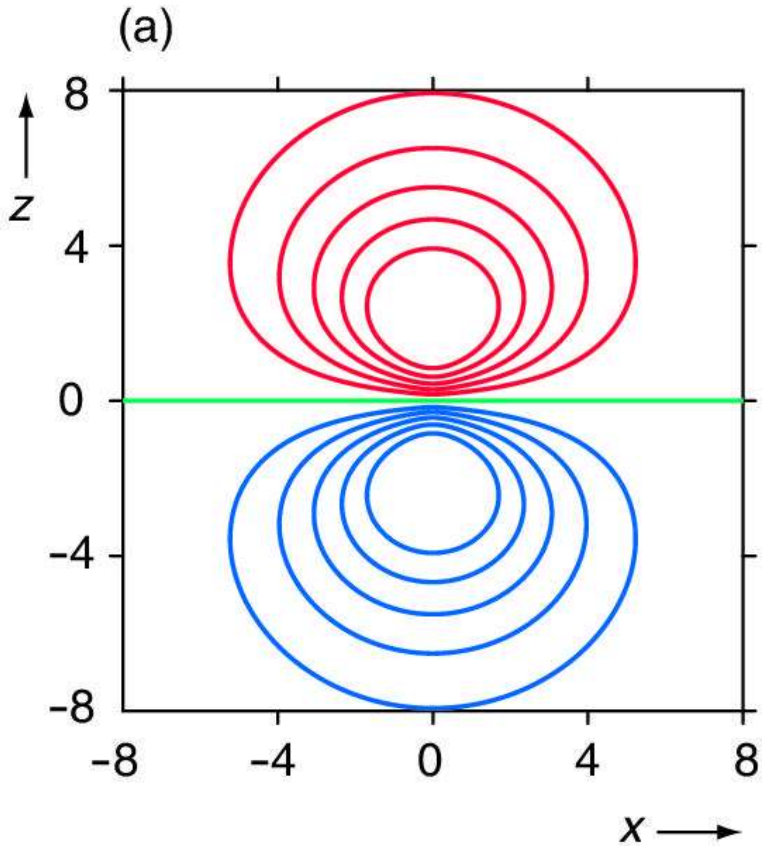


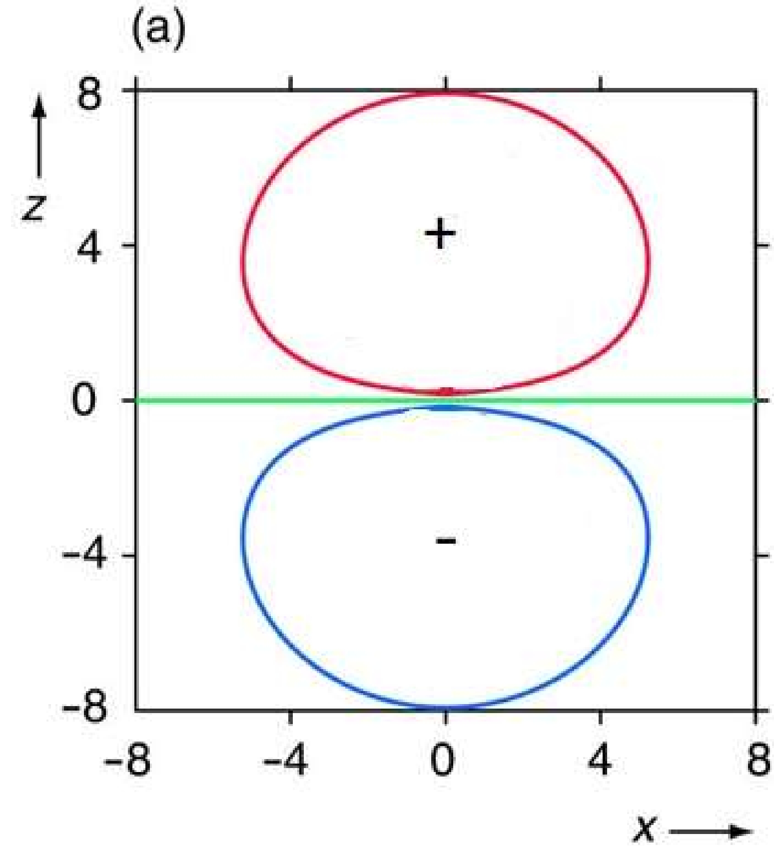
$p_z \propto \cos\theta$

$\theta = \frac{\pi}{2}$

At θ= π/2 we are in the xy plane regardless of the values of r and φ, so θ= π/2 describes the nodal plane in the 2pz orbital

Wavefunction/ Probability-density contours for $2p_z$

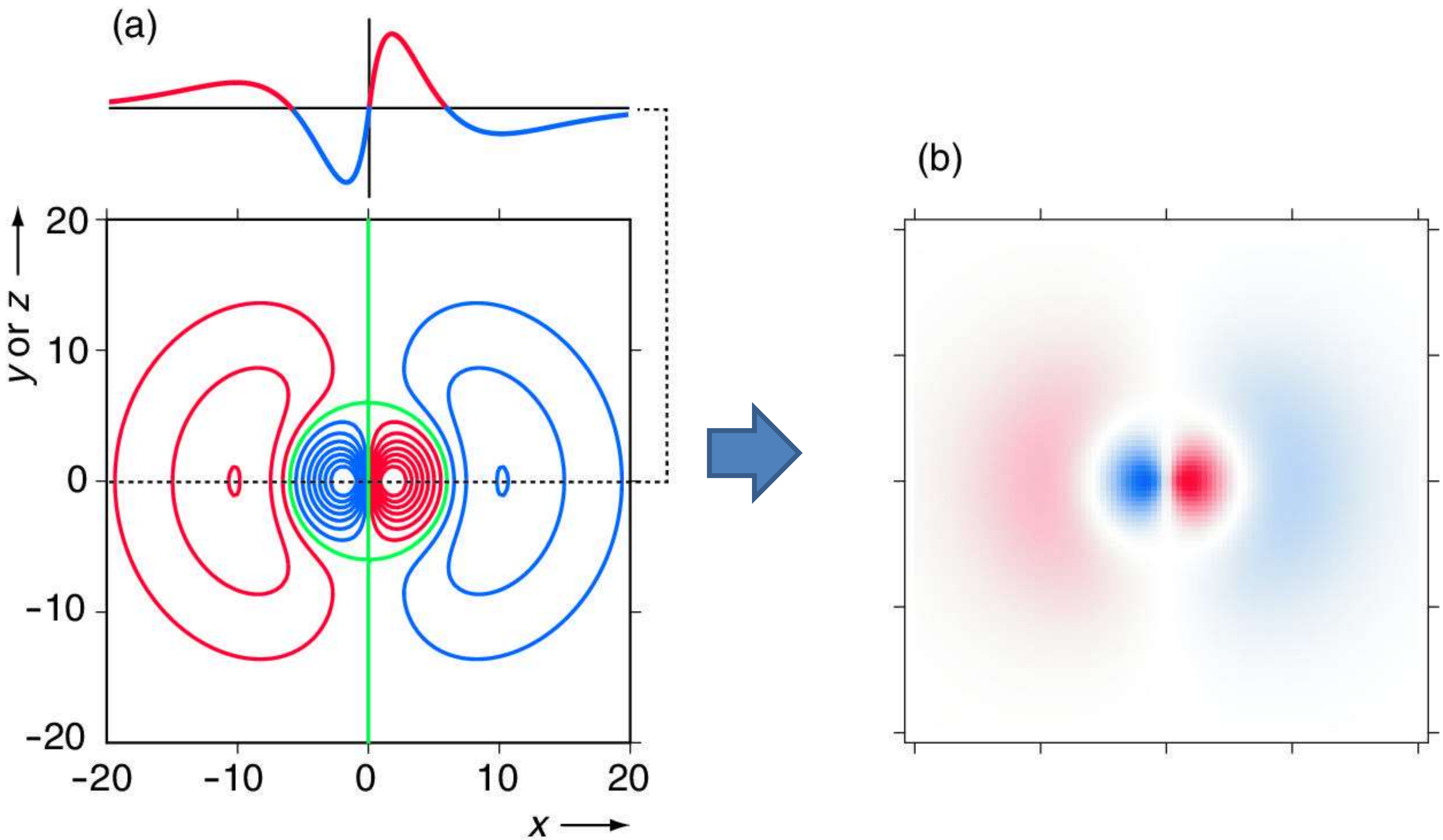




Each contour line is called "equal probability iso-surface"

A low probability contour is what is shown in your textbook as a "p" orbital

Wavefunction/Probability-density contours for $3p_x$



Probability-density contours for $3p_x$