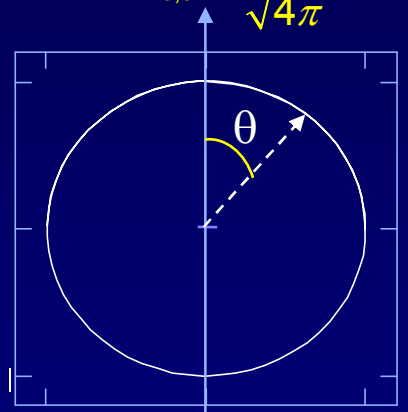
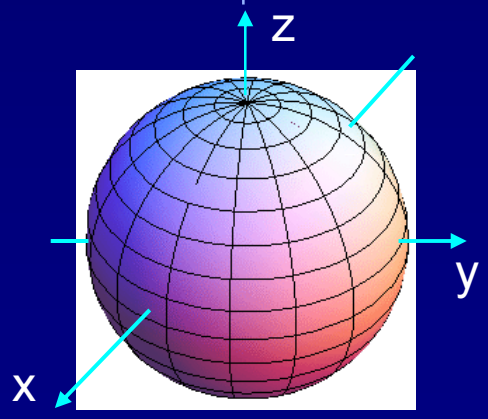
The Angular Wave Function, $Y_{lm}(\theta,\varphi)$

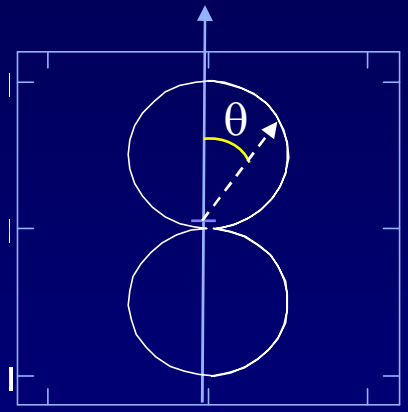
The angular wave function may be written: $Y_{lm}(\theta,\phi) = P(\theta)e^{im\phi}$
where $P(\theta)$ are polynomial functions of $\cos(\theta)$ and $\sin(\theta)$.
To get some feeling for these angular distributions, we make polar plots of the θ-dependent part of $|Y_{lm}(\theta, \phi)|$ (i.e., $P(\theta)$):

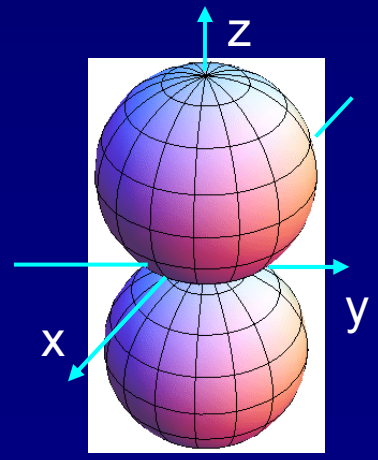
$l = 0$ $\quad Y_{0,0} = \frac{1}{\sqrt{4\pi}}$



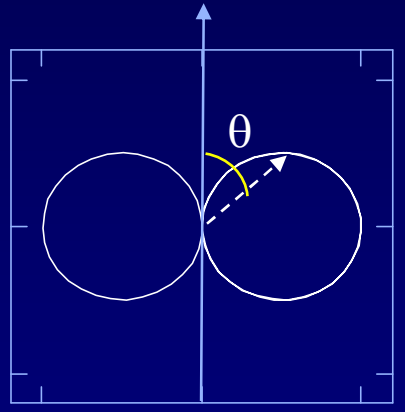


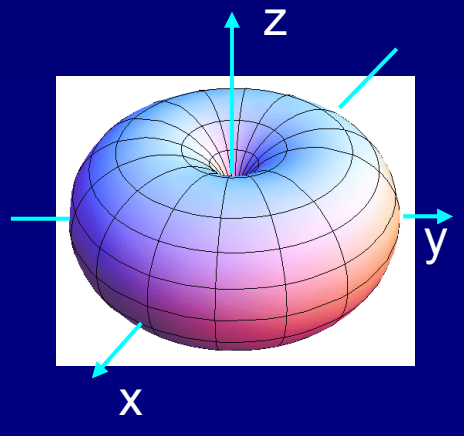
$l = 1$ $\quad |Y_{1,0}| \propto |\cos\theta|$





$|Y_{1,\pm1}| \propto |\sin\theta|$





Length of the dashed arrow is the magnitude of Y_{lm} as a function of θ.