8th Period Multipole Expansion Problem

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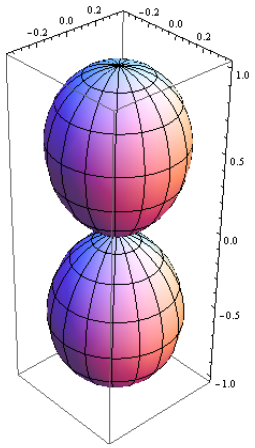
December 10, 2010

The surface in the image is defined in spherical coordinates by the function:

$$R(\theta, \phi) = r_0 \cos^2 \phi$$



where θ is the azimuthal coordinate and ϕ is the polar coordinate.

Given the charge density of the filled in solid as:

$$\rho(r, \theta, \phi) = k \frac{(r - r_0)^2}{r^2} \cos \phi$$

where k and r_0 are constants and $\phi$is still the polar angle.

Use Multipole Expansion to determine what the electric potential $V(z)$ is along the z-axis far from the source out to the quadrupole term. Before you begin what do you expect?