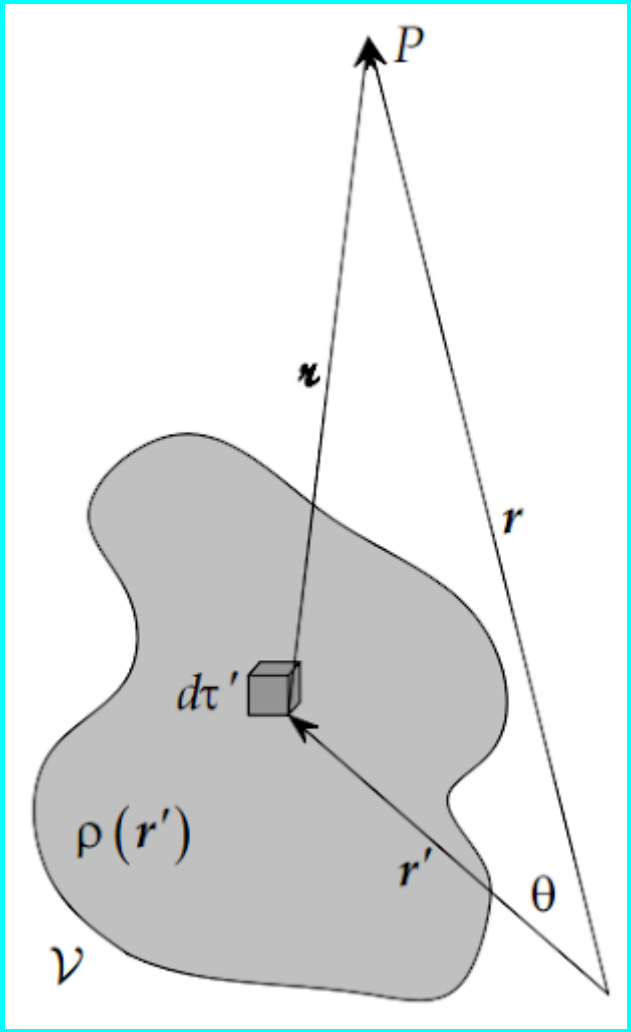
Lecture 24 outline: 10/12/2020

- Multipole expansion
  - Vector form of dipole term
  - Origin independence

- Application
  - Conducting sphere in uniform E-field

What is the potential at P which is “far” outside of an arbitrary continuous charge distribution?
Does distance make the problem simpler?



Legendre Polynomials

$$P_0(x)=1 \qquad P_0(\cos\theta)=1$$

$$P_1(x)=x \qquad P_1(\cos\theta)=\cos\theta$$

$$P_2(x)=\frac{(3x^2-1)}{2} \qquad P_2(\cos\theta)=\frac{(3\cos^2\theta-1)}{2}$$

$$P_3(x)=\frac{(5x^3-3x)}{2} \qquad P_3(\cos\theta)=\frac{(5\cos^3\theta-3\cos\theta)}{2}$$

$$P_4(x)=\frac{(35x^4-30x^2+3)}{8}$$

$$\int_{-1}^{1} P_L(x)P_{L'}(x)dx=\frac{2}{2L+1}\delta_{LL'}$$

A conducting sphere of radius R is placed in a uniform electric field $\vec{E} = E_0 \hat{z}$.

What is the potential inside and outside the sphere?