# *Charge Density*

"What exactly is Lambda? Q/L ?? Charge density??."

Linear $(\lambda = Q/L)$   Coulombs/meter

Surface $(\sigma = Q/A)$  Coulombs/meter²

Volume $(\rho = Q/V)$ Coulombs/meter³

### Some Geometry

$$A_{sphere} = 4\pi R^2 \qquad A_{cylinder} = 2\pi R L$$

$$V_{sphere} = \tfrac{4}{3}\pi R^3 \qquad V_{cylinder} = \pi R^2 L$$

## What has more net charge?.

A) A sphere w/ radius 4 meters and volume charge density ρ = 2 C/m³

B) A sphere w/ radius 4 meters and surface charge density σ = 2 C/m²

C) Both A) and B) have the same net charge.

$$Q_A = \rho V = \rho \tfrac{4}{3}\pi R^3$$

$$Q_B = \sigma A = \sigma 4\pi R^2$$

$$\frac{Q_A}{Q_B} = \frac{\rho \tfrac{4}{3}\pi R^3}{\sigma 4\pi R^2} = \frac{1}{3}\frac{\rho}{\sigma}R = \frac{1}{3}\frac{2}{2}4 = \frac{4}{3}$$