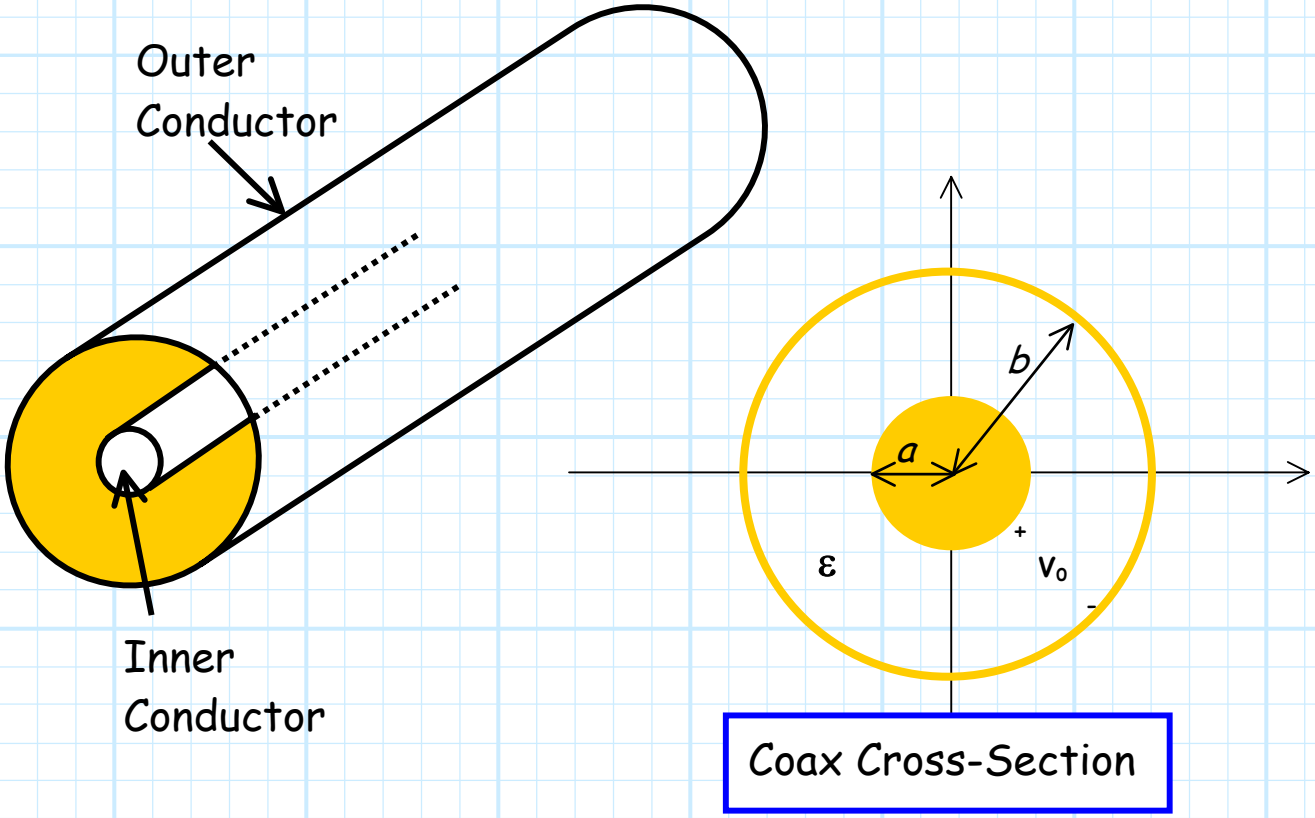
Coaxial Transmission Lines

The most **common** type of transmission line!



The **electric field** points in the direction $\hat{a}_\rho$.

The **magnetic field** points in the direction $\hat{a}_\phi$.

E. M. **Power** flows in the direction $\hat{a}_z$.

➡ A TEM wave!

Recall from EECS 220 that the capacitance per/unit length of a coaxial transmission line is:

$$C = \frac{2\pi\varepsilon}{\ln[b/a]} \qquad \left[\frac{\text{farads}}{\text{meter}}\right]$$

And that the inductance per unit length is :

$$L = \frac{\mu}{2\pi}\ln\left[\frac{b}{a}\right] \qquad \left[\frac{\text{Henries}}{\text{m}}\right]$$

Were of course the characteristic impedance is:

$$Z_o = \sqrt{\frac{L}{C}}$$

and:

$$\beta = \omega\sqrt{LC}$$