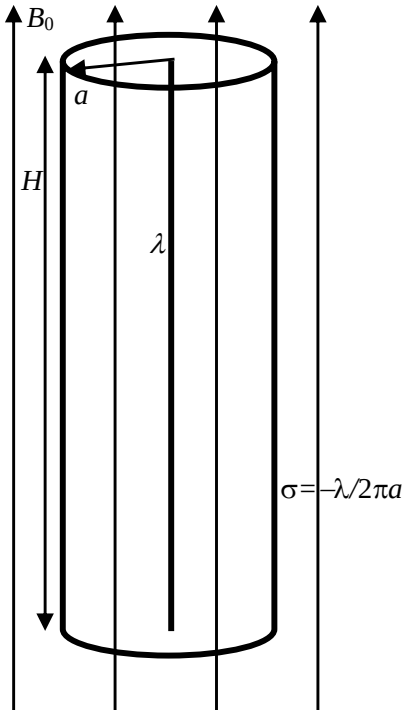
3. **Spinning Cylinder**



A cylindrical capacitor consists of a line of charge with linear charge density λ and a concentric insulating tube of radius a with a compensating uniform surface charge density $\sigma = -\lambda/2\pi a$ on its surface (fixed, not free to move). The height of the capacitor $H \gg a$ so that you can ignore edge effects. The capacitor is placed in a uniform external magnetic field of strength B_0 parallel to the cylinder axis and pointing up. The insulating tube is free to rotate around its axis and its mass is all concentrated on the rim.

(a) Find the magnitude and direction of the electromagnetic angular momentum stored in the EM field.

(b) The external magnetic field B_0 is very slowly ramped down. Show that this will cause the tube to rotate and find the angular velocity of rotation when the *e*xternal B field is completely turned off.