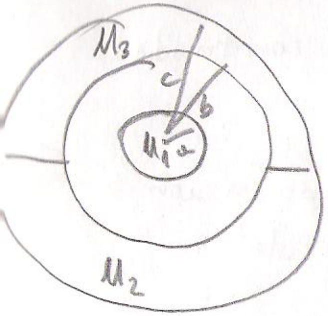

(a) Corriente homogénea

$$\Rightarrow I = \iint J \cdot ds$$

$$J = cte$$

$$\Rightarrow I_0 = \iint J \cdot ds = J.2\pi \int_0^a \rho \, d\rho = J.2\pi . \frac{\rho^2}{2} \Big|_0^a$$

$$= \frac{J.\cancel{2}\pi . a^2}{\cancel{2}}$$

$$I_0 = J \pi . a^2$$

$$I = J . \pi . r^2$$

$$\Rightarrow \cancel{I_0 . \pi} \quad \frac{I_0}{\cancel{\pi} a^2} = \frac{I}{\cancel{\pi} r^2} \Rightarrow \boxed{I_1 = I_0 . \frac{r^2}{a^2}}$$

$$= I_0$$

Para I_3, no temos que

$$-I_0 = \iint J \cdot ds = J.2\pi \int_b^c \rho \, d\rho = J.2\pi \frac{\rho^2}{2} \Big|_b^c$$

$$= \frac{J.\cancel{2}\pi}{\cancel{2}} (c^2 - b^2)$$

$$-I_0 = J.\pi (c^2 - b^2)$$

$$\frac{I_3'}{(r^2-b^2)} = \frac{-I_0}{\pi(c^2-b^2)}$$

$$I_3' = J.\pi (r^2 - b^2) \quad \Rightarrow I_3' = \frac{-I_0 (r^2-b^2)}{(c^2-b^2)}$$

$$\Rightarrow I_3 = I_0 - I_3' = I_0 - \frac{I_0 (r^2-b^2)}{c^2-b^2}$$

$\mu B = H$

$\mu H = B$

$$= I_0 \left(1 - \frac{r^2-b^2}{c^2-b^2} \right) = I_0 \left(\frac{c^2-b^2-r^2+b^2}{c^2-b^2} \right)$$

$$= \boxed{I_0 \left(\frac{c^2-r^2}{c^2-b^2} \right)}$$

Resumen

$$I(r) = \begin{cases} I_0 r^2/a^2 & 0<r<a \\ I_0 & a<r<b \\ I_0 \left(\frac{c^2-r^2}{c^2-b^2}\right) & b<r<c \\ 0 & r>c \end{cases}$$

(b) $0 < r < a$

$$\oint \vec{H} \cdot \vec{dl} = I_{enc} \Rightarrow H.2\pi r = \frac{I_0 r^2}{a^2} \Rightarrow \boxed{\vec{H} = \frac{I_0 r}{2\pi a^2} \hat{\phi}}$$

$a < r < b$

$$\oint \vec{H} \cdot \vec{dl} = I_0 = \boxed{\vec{H} = \frac{I_0}{2\pi r} \hat{\phi}}$$

$b<r<c$

se combina $B_{\phi_1} = B_{\phi_2}$ con ley de Gauss

$$\oint \vec{H} \cdot \vec{dl} = \int_0^\pi H_{\phi_1} \rho \, d\rho + \int_\pi^{2\pi} H_{\phi_2} \rho \, d\rho = I_{enc}$$

$$\pi \rho (H_{\phi_1} + H_{\phi_2}) = I_0 \left(\frac{c^2-r^2}{c^2-b^2} \right)$$

$$\Rightarrow \pi \ell (H_{\phi_1} + H_{\phi_2}) = I_0 \left(\frac{c^2-r^2}{c^2-b^2}\right)$$

$$y \quad H_3 \mu_3 = H_2 \mu_2$$

$$\Leftrightarrow \pi \ell (H_3 + H_2) = I_0 \left(\frac{c^2-r^2}{c^2-b^2}\right)$$

$$H_3 = \frac{H_2 \mu_2}{\cancel{H}\mu_3}$$

$$\Rightarrow \pi \ell \left(\frac{H_2 \mu_2}{\mu_3} + H_2\right) = I_0 \left(\frac{c^2-r^2}{c^2-b^2}\right)$$

$$\pi \ell \cdot H_2 \left(\frac{\mu_2}{\mu_3} + 1\right) = I_0 \left(\frac{c^2-r^2}{c^2-b^2}\right)$$

$$\boxed{\begin{aligned} H_2 &= \frac{I_0}{\pi \ell} \cdot \frac{\mu_3}{\mu_2+\mu_3} \left(\frac{c^2-r^2}{c^2-b^2}\right) \\ H_3 &= \frac{I_0}{\pi \ell} \cdot \frac{\mu_2}{\mu_2+\mu_3} \left(\frac{c^2-r^2}{c^2-b^2}\right) \end{aligned}}$$

$r > c \qquad \vec{H} = 0$ no hay cargas encerrada

Resumen

$\vec{H}$	$\vec{B}$	zona	$\vec{H}$	$\vec{B}$
$\frac{I_0 r}{2\pi a^2} \hat{\phi}$	$\frac{\mu_1 I_0 r}{2\pi a^2} \hat{\phi}$	3	μ_3: $\frac{I_0}{\pi r} \frac{\mu_2}{\mu_2+\mu_3} \left(\frac{c^2-r^2}{c^2-b^2}\right) \hat{\phi}$ μ_2: $\frac{I_0}{\pi r} \frac{\mu_3}{\mu_2+\mu_3} \left(\frac{c^2-r^2}{c^2-b^2}\right) \hat{\phi}$	$\frac{I_0}{\pi r} \frac{\mu_2 \mu_3}{\mu_2+\mu_3} \left(\frac{c^2-r^2}{c^2-b^2}\right)$
$\frac{I_0}{2\pi r} \hat{\phi}$	$\frac{\mu_0 I_0}{2\pi r} \hat{\phi}$	4	0	0

(c) Magnetización Primero se calcula $\vec{M}$

$$k_m = \vec{M} \times \vec{n} \quad , \quad H = \frac{B}{\mu_0} - M$$

$$\Rightarrow \vec{M} = \frac{\vec{B}}{\mu_0} - \vec{H}$$

$$\Rightarrow \vec{M}_1 = \frac{\mu_1}{\mu_0} \cdot \frac{I_0 r}{2\pi a^2} - \frac{I_0 r}{2\pi a^2} = \frac{I_0 r}{2\pi a^2}\left(\frac{\mu_1}{\mu_0} - 1\right)$$

$$= \frac{I_0 r}{2\pi a^2} \left(\frac{\mu_1 - \mu_0}{\mu_1 \mu_0}\right) \hat{\phi}$$

$$\vec{M}_2 = 0$$

$$\vec{M}_3^{\uparrow} = \frac{I_0}{\pi r \mu_0} \frac{\mu_2 \mu_3}{\mu_2+\mu_3} \left(\frac{c^2-r^2}{c^2-b^2}\right) - \frac{I_0}{\pi r} \frac{\mu_2}{\mu_2+\mu_3} \left(\frac{c^2-r^2}{c^2-b^2}\right)$$

$$= \frac{I_0}{\pi r} \frac{\mu_2}{\mu_2+\mu_3} \left(\frac{c^2-r^2}{c^2-b^2}\right) \left(\frac{\mu_3}{\mu_0} - 1\right) = \frac{I_0}{\pi r} \frac{\mu_2}{\mu_2+\mu_3} \left(\frac{c^2-r^2}{c^2-b^2}\right) \left(\frac{\mu_3 - \mu_0}{\mu_3 \mu_0}\right)$$

$$\vec{M}_3^{\downarrow} = \frac{I_0}{\pi r \mu_0} \frac{\mu_2 \mu_3}{\mu_2+\mu_3} \left(\frac{c^2-r^2}{c^2-b^2}\right) - \frac{I_0}{\pi r} \frac{\mu_3}{\mu_2+\mu_3} \left(\frac{c^2-r^2}{c^2-b^2}\right)$$

$$= \frac{I_0}{\pi r} \frac{\mu_3}{\mu_2+\mu_3} \left(\frac{c^2-r^2}{c^2-b^2}\right) \left(\frac{\mu_2 - \mu_0}{\mu_2 \mu_0}\right)$$