$$\mu_0 I_w = 2\pi\rho B$$

$$I_w = \int j \, dS = \int_0^\rho j_0 e^{-a\rho'} 2\pi\rho' \, d\rho' = 2\pi j_0 \int_0^\rho \rho' e^{-a\rho'} \, d\rho' =$$

D	I
$+ \ \rho'$	$e^{-a\rho'}$
$- \ 1$	$\frac{-1}{a} e^{-a\rho'}$
$+ \ 0$	$\frac{1}{a^2} e^{-a\rho}$

$$= 2\pi j_0 \left[\frac{-\rho'}{a} e^{-a\rho'} - \frac{1}{a^2} e^{-a\rho'} \right]_0^\rho =$$

$$= 2\pi j_0 \left[\frac{1}{a^2} - \frac{\rho}{a} e^{-a\rho} - \frac{1}{a^2} e^{-a\rho} \right]$$

$$= I \left[1 - a\rho e^{-a\rho} - e^{-a\rho} \right]$$

$$I = \int_0^\infty j \, dS = \frac{2\pi j_0}{a^2}$$

$$j_0 =$$

$$B = \frac{\mu_0 I}{2\pi} \left[\frac{1}{\rho} - a e^{-a\rho} - \frac{1}{\rho} e^{-a\rho} \right] \approx \frac{\mu_0 I}{2\pi} \left[\frac{1}{\rho} - a\left(1 - a\rho + \frac{a^2\rho^2}{2}\right) - \frac{1}{\rho}\left(1 - a\rho + \frac{a^2\rho^2}{2}\right) \right] =$$

$$= \frac{\mu_0 I}{2\pi} \left[\cancel{\frac{1}{\rho}} - \cancel{a} + a^2\rho - \underbrace{\frac{a^3\rho^2}{2}}_{\downarrow \, 0} - \cancel{\frac{1}{\rho}} + \cancel{a} - \underbrace{\frac{a^2\rho}{2}}_{\downarrow \, 0} \right] =$$

$$= \frac{\mu_0 I}{2\pi} \frac{a^2\rho}{2}$$

$$\frac{1}{a} \ll \rho \qquad B(\rho) = \frac{I\mu_0}{2\pi\rho}$$

$$\rho a \to \infty$$

$$\frac{1}{a} \gg \rho \qquad B(\rho) = \frac{\mu_0 I}{2\pi} \frac{a^2\rho}{2}$$

$$\rho a \to 0$$