$n = \gamma - d$

Si $\xi(r) = \left(\frac{r}{r_0}\right)^{-\gamma}$; $\xi(r_0) = 1$

$\hookrightarrow P(k) = A^2 \left(\frac{k}{k_p}\right)^{n}$ o $\mathcal{P}(k) = A^2 \left(\frac{k}{k_p}\right)^{n+d}$; $k_p \to$ escala pivote

y $A = \sqrt{P(k_p)} = \sqrt{\mathcal{P}(k_p)}$

$$\Rightarrow P(k) = \int_0^\infty \left(\frac{r}{r_0}\right)^{-\gamma} \frac{\sin(kr)}{kr} 4\pi r^2 \, dr = \frac{r_0^\gamma 4\pi}{k} \int_0^\infty r^{-\gamma+1} \sin(kr) \, dr$$

$$= \frac{r_0^\gamma 4\pi}{k} \int_0^\infty r^{(2-\gamma)-1} \sin(kr) \, dr$$

$$= \frac{r^\gamma 4\pi}{k} \int_0^\infty r^{(2-\gamma)-1} \left(\frac{e^{ikr} - e^{-ikr}}{2i}\right) dr$$

$$\Gamma(z) = \int_0^\infty t^{z-1} e^{-t} \, dt$$

$$\int_0^\infty t^b e^{-at} \, dt = \frac{\Gamma(b+1)}{a^{b+1}}$$

$$\Rightarrow \frac{1}{2i} \int_0^\infty r^{(2-\gamma)-1} e^{-ikr} \, dr$$

si $b = (2-\gamma) - 1$ y $a = ik$

$$\Rightarrow \frac{1}{2i} \int_0^\infty r^b e^{-ar} \, dr = \frac{1}{2i} \frac{\Gamma((2-\gamma)-1+1)}{(ik)^{(2-\gamma)-1+1}} = \frac{1}{2i} \frac{\Gamma(2-\gamma)}{(ik)^{2-\gamma}}$$

ahora para

$$\frac{1}{2i} \int_0^\infty r^{(2-\gamma)-1} e^{ikr} \, dr = \frac{1}{2i} \int_0^\infty r^b e^{-ar} \, dr \; ; \text{ con } b = (2-\gamma)-1$$

$$a = -ik$$

$$= \frac{1}{2i} \frac{\Gamma((2-\gamma)-1+1)}{(-ik)^{(2-\gamma)-1+1}}$$

$$\sin\frac{(\gamma-2)\pi}{2} = \frac{e^{i\frac{(\gamma-2)}{2}\pi} - e^{-i\frac{(\gamma-2)}{2}\pi}}{2\pi}$$

pero $e^{i\left(\frac{\gamma-2}{2}\pi\right)} = \cos\left(\left(\frac{\gamma}{2}-1\right)\pi\right) + i \sin\left(\left(\frac{\gamma}{2}-1\right)\pi\right)$

$$= \frac{1}{2i} \frac{\Gamma(2-\gamma)}{(-ik)^{2-\gamma}}$$

$$\Rightarrow P(k) = \frac{4\pi r_0^\gamma}{k} \frac{1}{2i} \left[\frac{\Gamma(2-\gamma)}{(-ik)^{2-\gamma}} - \frac{\Gamma(2-\gamma)}{(ik)^{2-\gamma}} \right]$$

$= \cos\left(\frac{\gamma\pi}{2}\right)\cos(\pi) + \sin(\pi)\sin\frac{\gamma\pi}{2}$

$= -\cos\left(\frac{\gamma\pi}{2}\right) + i \sin\left(\frac{\gamma}{2}\pi\right)$

$$\Rightarrow P(k) = \frac{4\pi r_0^\gamma}{k} \Gamma(2-\gamma) \frac{1}{2i} \left[\frac{1}{(-ik)^{2-\gamma}} - \frac{1}{(ik)^{2-\gamma}} \right]$$

$$= \frac{4\pi r_0^\gamma}{k} \Gamma(2-\gamma) \frac{1}{k^{2-\gamma}} \frac{1}{2i} \left[\frac{1}{(-i)^{2-\gamma}} - \frac{1}{i^{2-\gamma}} \right]$$

$$= \frac{4\pi (k r_0)^\gamma}{k^3} \Gamma(2-\gamma) \frac{1}{2i} \left[\frac{1}{(e^{-i\frac{\pi}{2}})^{2-\gamma}} - \frac{1}{(e^{i\frac{\pi}{2}})^{2-\gamma}} \right]$$

$$\Rightarrow P(k) = \frac{4\pi (kr_0)^{\gamma}}{k^3} \Gamma(2-\gamma)\frac{1}{2i}\left[\frac{e^{i(2-\gamma)\frac{\pi}{2}} - e^{-i(2-\gamma)\frac{\pi}{2}}}{e^{-i(2-\gamma)\frac{\pi}{2}}\, e^{i(2-\gamma)\frac{\pi}{2}} \to 1}\right]$$

$$\boxed{P(k) = \frac{4\pi (kr_0)^{\gamma}}{k^3} \Gamma(2-\gamma) \sin\left((2-\gamma)\frac{\pi}{2}\right)}$$ para $1 < \gamma < 3$

$\Rightarrow -2 < n < 0$

como $n = \gamma - d$

como $d = 3$

y tomando $\gamma = 1.8 \Rightarrow n = -1.2$

$$\Rightarrow \gamma = n + 3$$

$$\Rightarrow P(k) = \frac{4\pi}{k^3} (kr_0)^n (kr_0)^3 \Gamma(2-\gamma) \sin\left[(2-\gamma)\frac{\pi}{2}\right]$$

$$\Rightarrow P(k) = 4\pi\, r_0^3 r_0^n k^n \Gamma(2-\gamma) \sin\left[(2-\gamma)\frac{\pi}{2}\right]$$

sea $A^2 = 4\pi\, \Gamma(2-\gamma) \sin\left[(2-\gamma)\frac{\pi}{2}\right]$

$k_p^n = \frac{1}{(r_0)^{n+3}}$

$$\Rightarrow P(k) = A^2 \left(\frac{k}{k_p}\right)^n$$

o

$$\boxed{P(k) = A^2 \left(\frac{k}{k_p}\right)^{\gamma - d}}$$