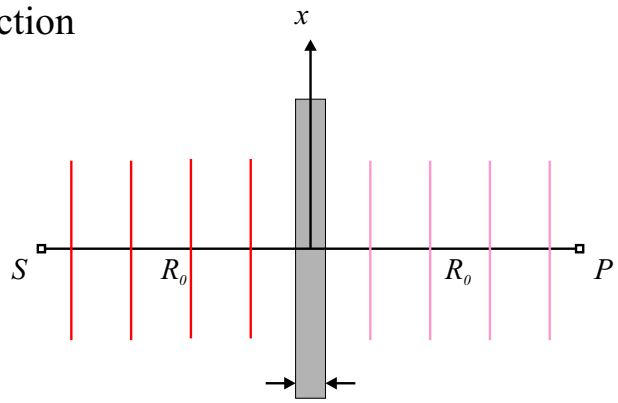
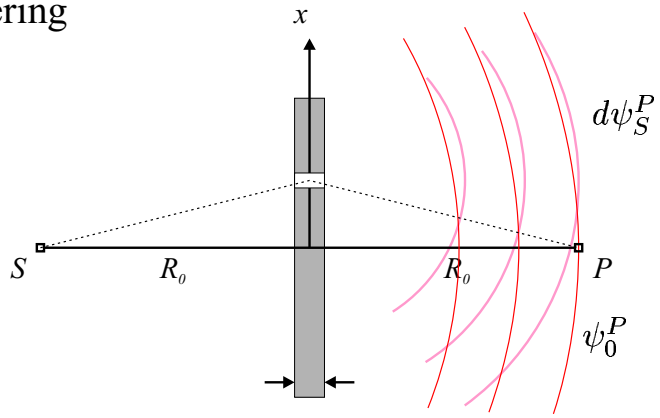
Refraction



$$\psi_{tot}^P = \psi_0^P \, \mathrm{e}^{i\,(n\mathrm{k}-\mathrm{k})\Delta} \approxeq \psi_0^P \, [1 + i\,(n-1)\mathrm{k}\Delta]$$

Scattering



$$\phi(x,y) = \mathrm{k}(2R - 2R_0) \approxeq \mathrm{k}(x^2 + y^2)/R_0$$

$d\psi_S^P = \left(\frac{\mathrm{e}^{i\,\mathrm{k}R_0}}{R_0}\right)$ incident wave

$(\rho\,\Delta\,dxdy)$ number of scatterers

$\left(-b\,\frac{\mathrm{e}^{i\,\mathrm{k}R_0}}{R_0}\right)$ spherical wave from one scatterer

$\mathrm{e}^{i\,\phi(x,y)}$ apart from this phase factor

$$\psi_{tot}^P = \psi_0^P + \int d\psi_s^P = \psi_0^P \left[1 - i\,\frac{2\pi\,\rho b\Delta}{\mathrm{k}}\right]$$