Maxwell-Boltzmann Distribution

$$p(\vec{r})\,d^3\vec{r} = \frac{V}{Z_1}\exp\left(\frac{-\beta\vec{p}^2}{2m}\right)d^3\vec{p}$$

$$Z_1 = V\int d^3\vec{p}\,\exp\left(-\frac{\beta\vec{p}^2}{2m}\right) = V\left(\frac{2\pi m}{\beta}\right)^{3/2}$$

$$p(\vec{v}) = \left(\frac{2\pi K_B T}{2m}\right)^{-3/2}\exp\left(-\frac{\beta\vec{v}^2}{2K_BT}\right)$$

$$p(\vec{v}) \longrightarrow p(|\vec{v}|)$$

then,

$$\langle V_x\rangle = \langle V_y\rangle = \langle V_z\rangle = 0.$$

$$p(\vec{v})\,d^3\vec{v} = p(\vec{v})\,4\pi\,v^2\,dv = p_0(v)\,dv$$

$$p_0 = 4\pi\left(\frac{2\pi K_B T}{m}\right)^{-3/2} v^2\exp\left(\frac{-mv^2}{2K_BT}\right)$$