Ideal Fermi-Dirac gas: isochores II [tln73]

Reference values for temperature and pressure:

$$k_B T_v = \frac{\Lambda}{v^{2/\mathcal{D}}}, \quad p_v = \frac{k_B T_v}{v}; \qquad \Lambda \doteq \frac{h^2}{2\pi m}, \quad v \doteq \frac{gV}{\mathcal{N}}.$$

Noncommuting limits $z \to \infty,\ \mathcal{D} \to \infty$:

- $z < \infty,\ \mathcal{D} \to \infty$:

  $$\frac{p}{p_v} = \frac{T}{T_v}\frac{f_{\mathcal{D}/2+1}(z)}{f_{\mathcal{D}/2}(z)} \overset{\mathcal{D}\to\infty}{\longrightarrow} \frac{T}{T_v} \qquad \text{(ideal MB gas)}.$$

- $\mathcal{D} \to \infty,\ z \to \infty$ with $\mathcal{D}/2 = r \ln z,\ r \geq 0$:

  $$\frac{p}{p_v} = \frac{f_{\mathcal{D}/2+1}(z)}{[f_{\mathcal{D}/2}(z)]^{1+2/\mathcal{D}}} \overset{\mathcal{D}\gg 1}{\rightsquigarrow} \frac{e^{-1}}{1+2/\mathcal{D}},$$

  $$\frac{T}{T_v} = \left[f_{\mathcal{D}/2}(z)\right]^{-2/\mathcal{D}} \overset{\mathcal{D}\gg 1}{\rightsquigarrow} \frac{\mathcal{D}}{2}\frac{e^{-1}}{\ln z} = \frac{r}{e} \qquad \text{(pure Fermi sea)}.$$