

# Ideal Bose-Einstein gas: isotherms [tsl40]

For  $\mathcal{D} > 2$  we must again distinguish two regimes. At  $v > v_c$ , all bosons are in the gas phase. At  $v < v_c$ , a BEC is present. Only the bosons in the gas phase contribute to the pressure.

Isotherm at  $v \geq v_c = \lambda_T^{\mathcal{D}}/\zeta(\mathcal{D}/2)$ :

$$\frac{p}{p_T} = g_{\mathcal{D}/2+1}(z), \quad \frac{v}{v_T} = [g_{\mathcal{D}/2}(z)]^{-1}.$$

Isotherm at  $v \leq v_c$ :

$$\frac{p}{p_T} = \frac{p_c}{p_T} = \zeta(\mathcal{D}/2 + 1) = \begin{cases} 2.612 & \mathcal{D} = 1 \\ 1.645 & \mathcal{D} = 2 \\ 1.341 & \mathcal{D} = 3 \\ 1 & \mathcal{D} = \infty \end{cases}$$

Critical (reduced) volume:

$$\frac{v_c}{v_T} = [\zeta(\mathcal{D}/2)]^{-1} = \begin{cases} 0 & \mathcal{D} = 1 \\ 0 & \mathcal{D} = 2 \\ 0.383 & \mathcal{D} = 3 \\ 1 & \mathcal{D} = \infty \end{cases}$$

