Phase transitions

Phases We can generalise the formalism introduced in statistical physics I to incorporate different coexisting phases.

Isolated systems

We begin with isolated systems, where the total volume, total energy, and the partical number per component is conserved. Let's assume that there are N_p coexisting phase, which we enumerate by ($\nu = 1, \ldots, N_p$) and α components, enumerated by ($j = 1, \ldots, \alpha$). The conditions for isolated systems are therefore subequationseq:constraints align $\sum_{\nu=1}^{N_p} V_\nu = V$

Closed system with $p = fixed$, $T = fixed$

Another important system is that where pressure and temperature are fixed experimentally. In this case the Free Enthalphy $G(p, T, N)$ is the relevant thermodynamic potential. The equilibrium condition is G has to be minimal, or rather $dG = 0$. Again G is extensive, i.e. additive w.r.t. the phases aligneq: G = $\sum_{\nu=1}^{N_p} G_\nu(T, p, N_\nu)$