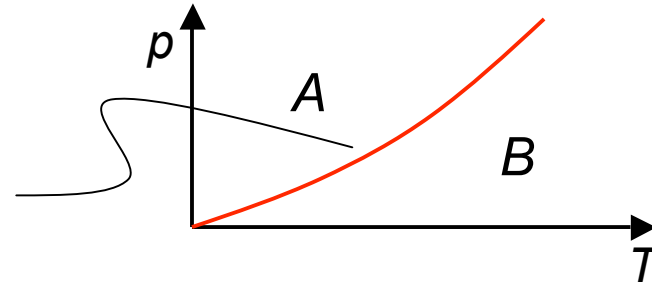


Ehrenfest relation for 2nd order phase transition

transition between phase A and B

$$\left. \begin{aligned} S_A(T, p) &= S_B(T, p) \\ V_A(T, p) &= V_B(T, p) \end{aligned} \right\} \text{continuous}$$



differentials

$$\left\{ \begin{aligned} \left(\frac{\partial S_A}{\partial T} \right)_p dT + \left(\frac{\partial S_A}{\partial p} \right)_T dp &= \left(\frac{\partial S_B}{\partial T} \right)_p dT + \left(\frac{\partial S_B}{\partial p} \right)_T dp, \\ \left(\frac{\partial V_A}{\partial T} \right)_p dT + \left(\frac{\partial V_A}{\partial p} \right)_T dp &= \left(\frac{\partial V_B}{\partial T} \right)_p dT + \left(\frac{\partial V_B}{\partial p} \right)_T dp. \end{aligned} \right.$$

Maxwell relation

$$\left(\frac{\partial S}{\partial p} \right)_T = - \left(\frac{\partial V}{\partial T} \right)_p = -V\alpha$$

thermal expansion
coefficient

**Ehrenfest
relations**

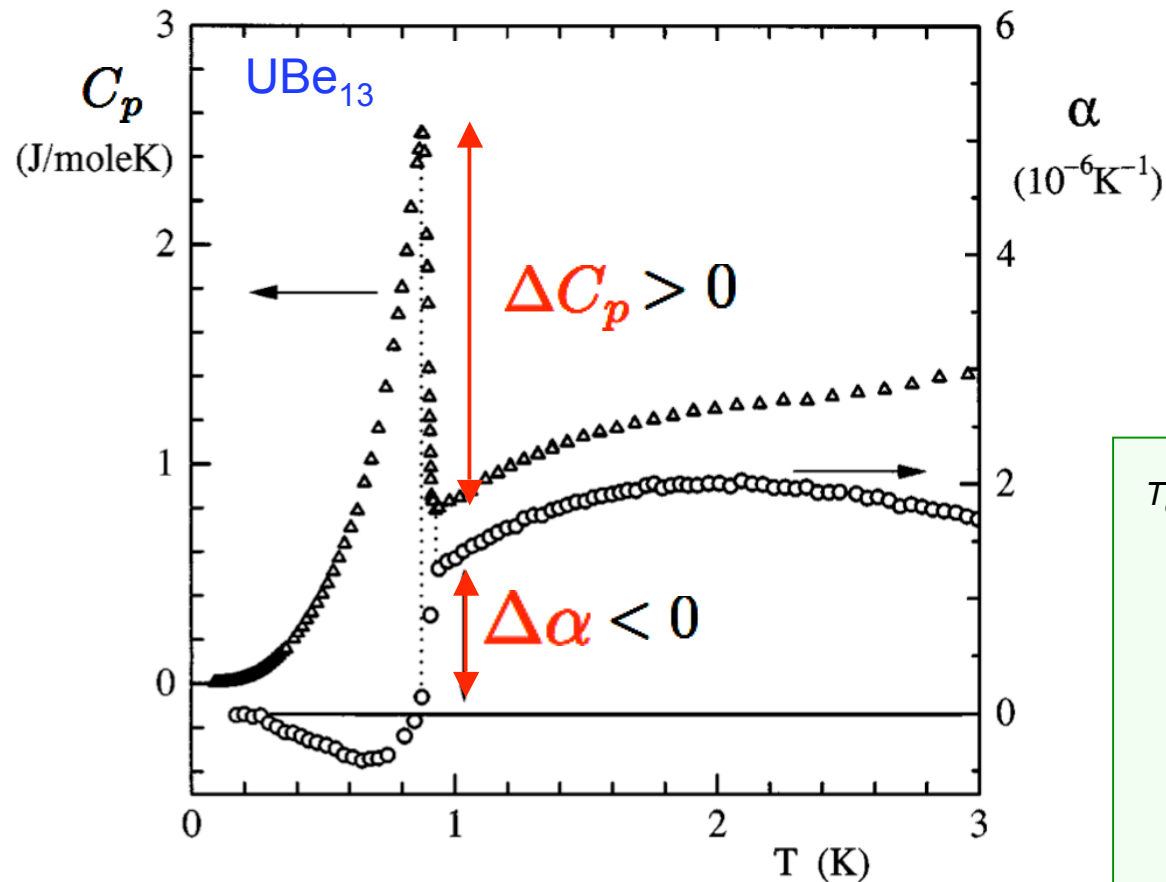
experimentally
testable

$$\frac{dp}{dT} = - \frac{\left(\frac{\partial S_B}{\partial T} \right)_p - \left(\frac{\partial S_A}{\partial T} \right)_p}{\left(\frac{\partial S_B}{\partial p} \right)_T - \left(\frac{\partial S_A}{\partial p} \right)_T} = \frac{\Delta C_p}{TV \Delta \alpha}$$

$$\frac{dp}{dT} = - \frac{\left(\frac{\partial V_B}{\partial T} \right)_p - \left(\frac{\partial V_A}{\partial T} \right)_p}{\left(\frac{\partial V_B}{\partial p} \right)_T - \left(\frac{\partial V_A}{\partial p} \right)_T} = \frac{\Delta \alpha}{\Delta \kappa_T}$$

Ehrenfest relation for 2nd order phase transition

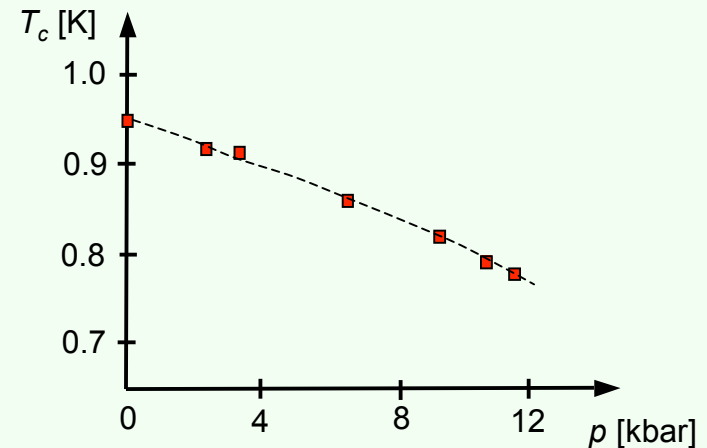
superconductor



F. Kromer et al., Phys. Rev. Lett. 81, 4476 (1998)

pressure dependence of T_c

$$\frac{dT_c}{dp} = \frac{TV\Delta\alpha}{\Delta C_p} < 0$$



S.E. Lambert et al.
Phys. Rev. Lett. 57, 1619 (1986)