

GRÜNEISEN SCALING

$$\alpha = -\frac{1}{V} \frac{\partial S}{\partial p}$$

$$C_p = T \frac{\partial S}{\partial T}$$

Supposition: 1 energy scale $E(p)$
 $\Rightarrow S(T, E) = S\left(\frac{T}{E(p)}\right)$

$S(f(E(p)))$
↙

$$\alpha = -\frac{1}{V} \frac{\partial}{\partial p} \left(S\left(\frac{T}{E(p)}\right) \right)$$

$$= -\frac{1}{V} S'\left(\frac{T}{E(p)}\right) \cdot \frac{\partial}{\partial p} \frac{T}{E(p)}$$

$$= +\frac{1}{V} S'\left(\frac{T}{E(p)}\right) \cdot \frac{T}{E^2(p)} \cdot \frac{\partial E}{\partial p}$$

$$= \frac{S' T}{V E^2} \cdot \frac{\partial E}{\partial p} = \frac{1}{V E} \cdot \frac{\partial E}{\partial p} \cdot C_p$$

$$C_p = T \cdot \frac{\partial}{\partial T} S\left(\frac{T}{E(p)}\right) = T \cdot S' \cdot \frac{1}{E(p)}$$

\Rightarrow

$$\frac{\alpha}{C_p} = \frac{1}{V} \frac{\partial \ln E(p)}{\partial p}$$