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Supporting Information for

Thermal Pressure in the Laser Heated Diamond Anvil Cell: A Quantitative Study and Implications for Thermoelastic Properties of the Mantle

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This gives a derivation for the Maxwell relation of P_{th}

1 Thermal pressure in isochorically heated volume is equal to αKdT:

Thermal pressure in a fully constrained volume heated to temperature T is by definition given as Equation 1.

Equation 1

$$P_{th} = \left(\frac{\partial P}{\partial T}\right)_V dT$$

This can be rewritten using the chain rule as Equation 2.

Equation 2

$$\left(\frac{\partial P}{\partial T}\right)_V = \left(\frac{\partial P}{\partial V}\right)_T \cdot \left(\frac{\partial V}{\partial T}\right)_P$$

Since by definition $\left(\frac{\partial P}{\partial V}\right)_T = K_T$ and $\left(\frac{\partial V}{\partial T}\right)_P = \alpha_P$, it follows that in the thermodynamic limit thermal pressure.

$$\left(\frac{\partial P}{\partial T}\right)_V dT = K_T \alpha_P dT$$