

Up to now we have only discussed classical mechanics. "Nano" has had no part in our discussions.

However, from static deformation of beams, we found that

$$k = \frac{E}{4} \cdot \frac{w^3}{l^3}$$

spring const.

From dynamic equations, we found

$$\omega_n = \sqrt{\frac{EI_y}{\rho A}} \beta_n^2 \quad \text{Recall: } k = m \omega_n^2$$

$$\beta_n = \frac{a_n}{l}$$

$$\therefore \left[k \propto \frac{w^3}{l^3} \right]$$

$a_n = \text{some numbers}$

Sensitivity to small forces improves with longer, thinner beams — more "nano-scale" beams.

As sizes shrink we will become sensitive to thermal and the ultimately quantum fluctuations of force.