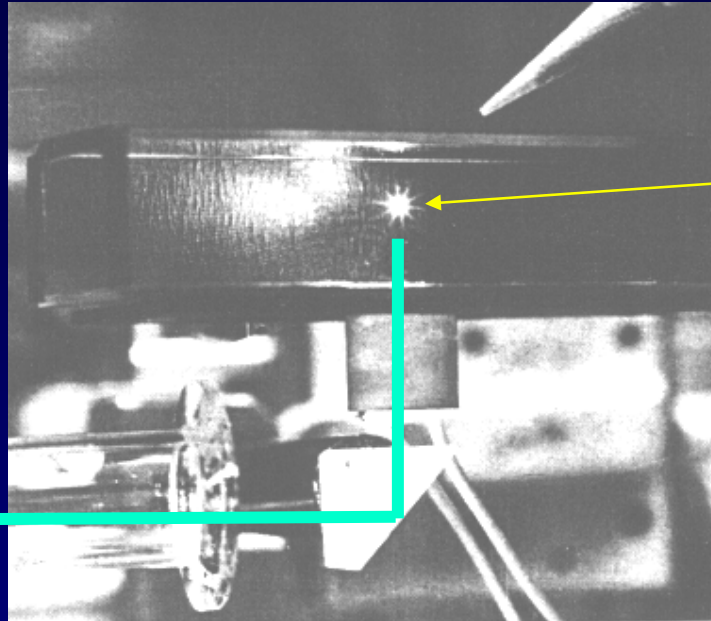# Exercise: Optical "Levitation"

What laser power is required to suspend a glass bead weighing 0.01 g?

Glass bead 'floating' on a laser beam!

(AT&T Bell Labs)

Assume the bead absorbs all the incident light.

Laser

P = ΔE/Δt = ?

$$F = mg = \frac{\Delta p}{\Delta t} = (\text{momentum for each absorbed photon}) \times (\text{\# photons/sec})$$

$$\therefore \#\text{photons/s} = \frac{F}{p} = \frac{mg}{h/\lambda}$$

$$Power = (\text{energy/photon}) \times (\text{\# photons/sec}) = \frac{hc}{\lambda} \frac{mg}{h/\lambda} = mg\,c$$

$$= \left(10^{-5}\,kg\right)\left(9.8\,m/s^2\right)\left(3 \times 10^8\,m/s\right) = 30kW$$