Development of the Optical Feedback System of an Atomic Force Microscope

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Outline

Thin Films

Cantilever Operation

The Houghton AFM

Current Status of Optical Feedback System

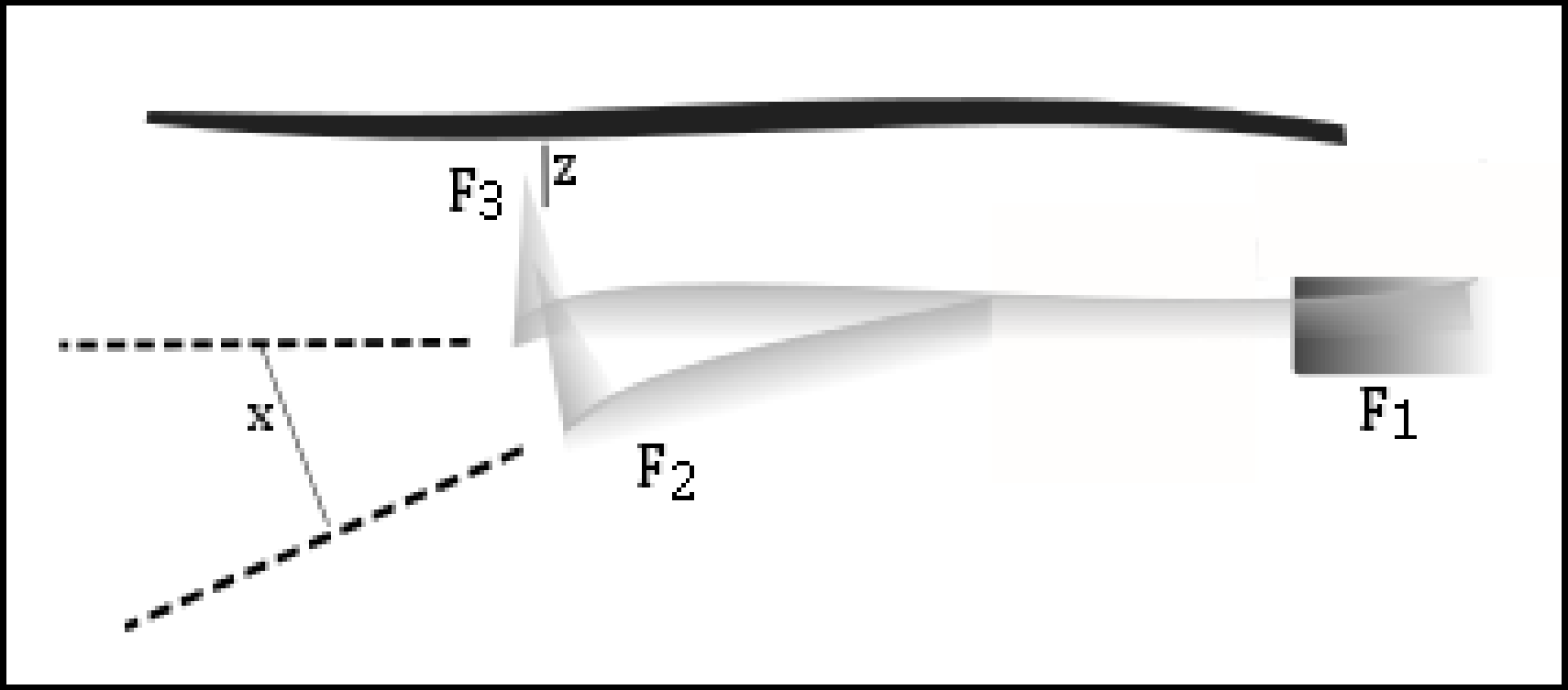
Future Goals

Thin Films

Islands

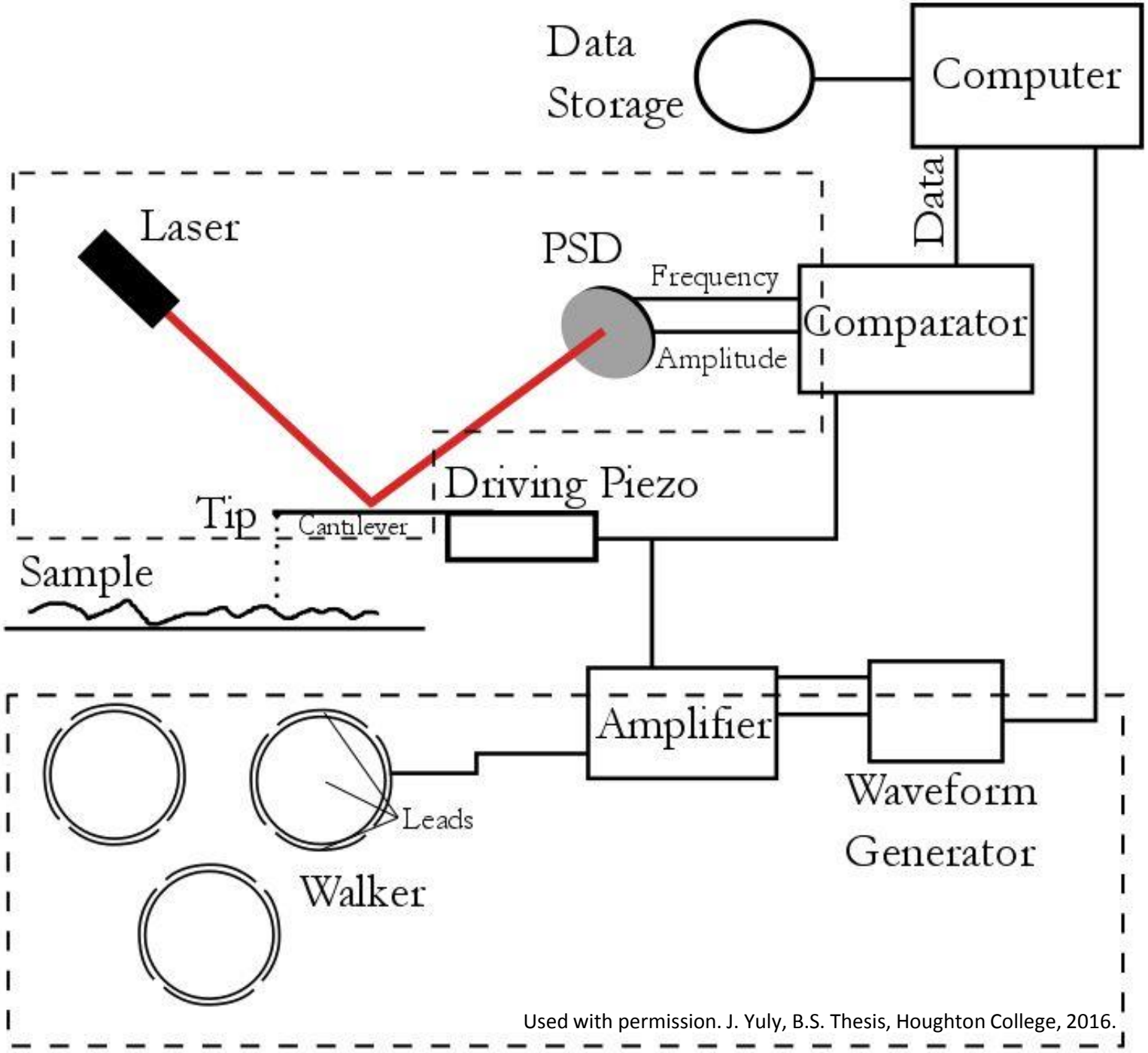
Grain Growth

Image surface at atomic level



$$F_1 + F_2 + F_3 = ma$$

$$A \sin \omega_0 t - \frac{{\omega_0}^2}{m} \mathrm{x} - \frac{\pi C p_1 \rho_2 R}{6D^2} = ma$$



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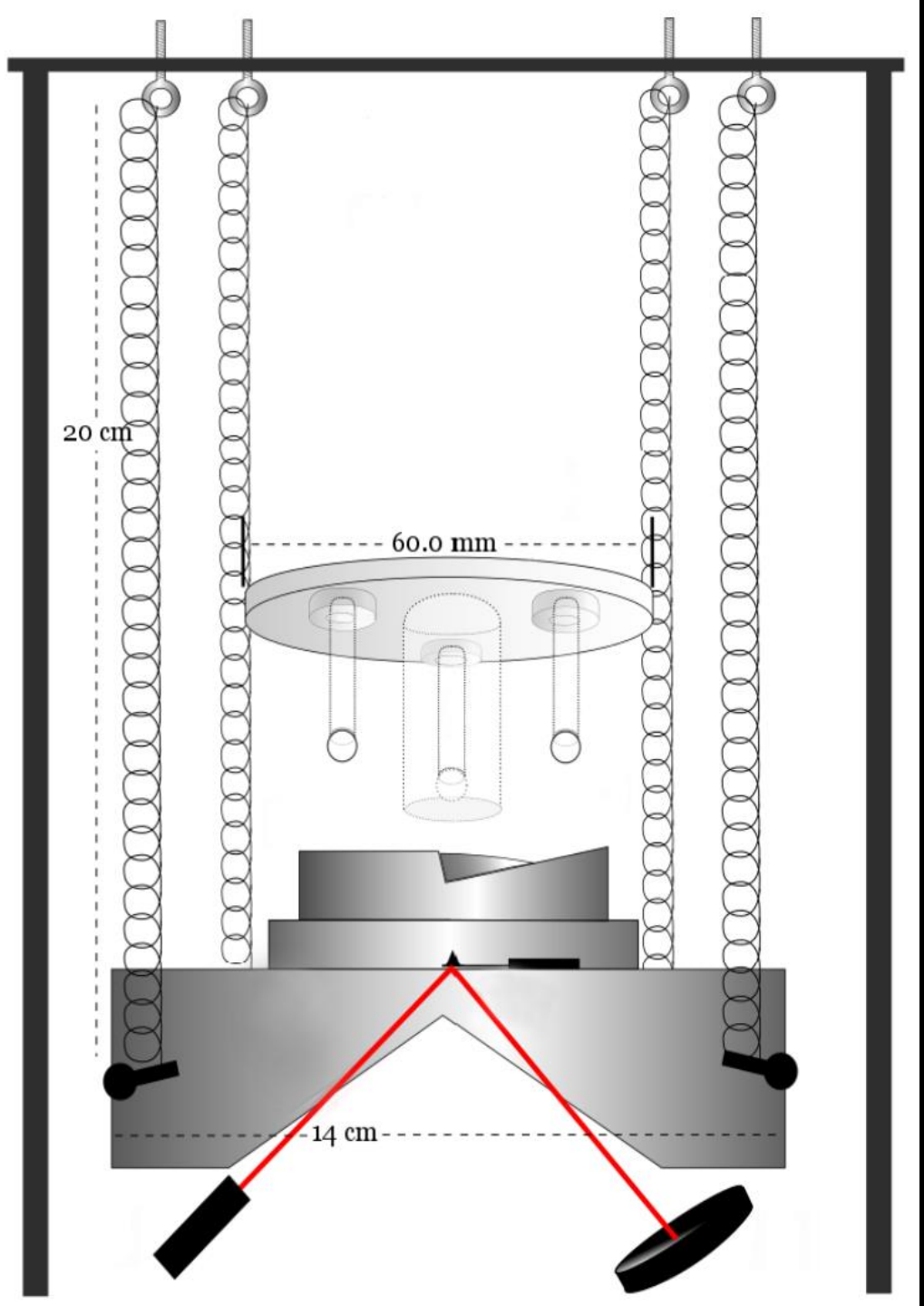
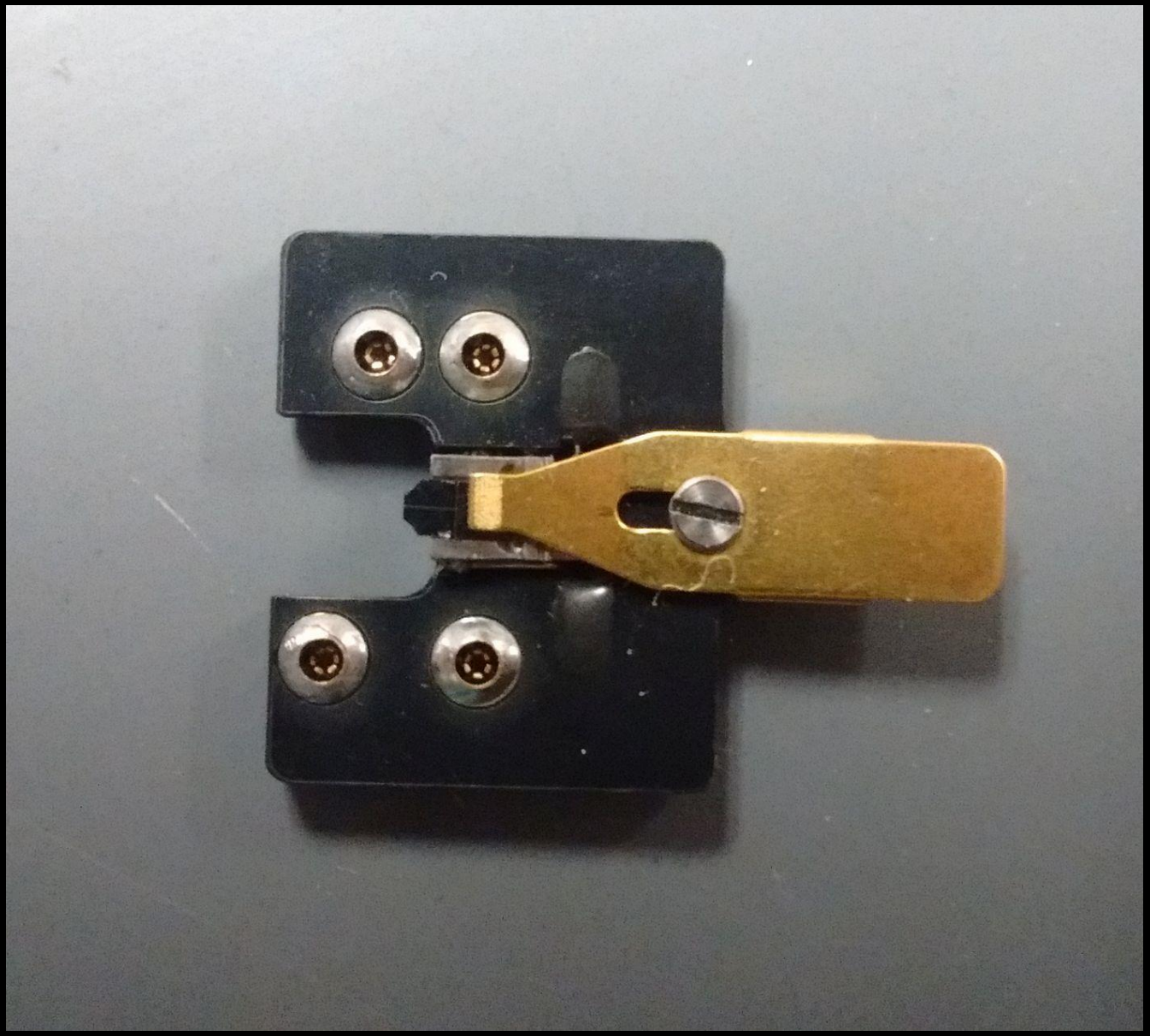
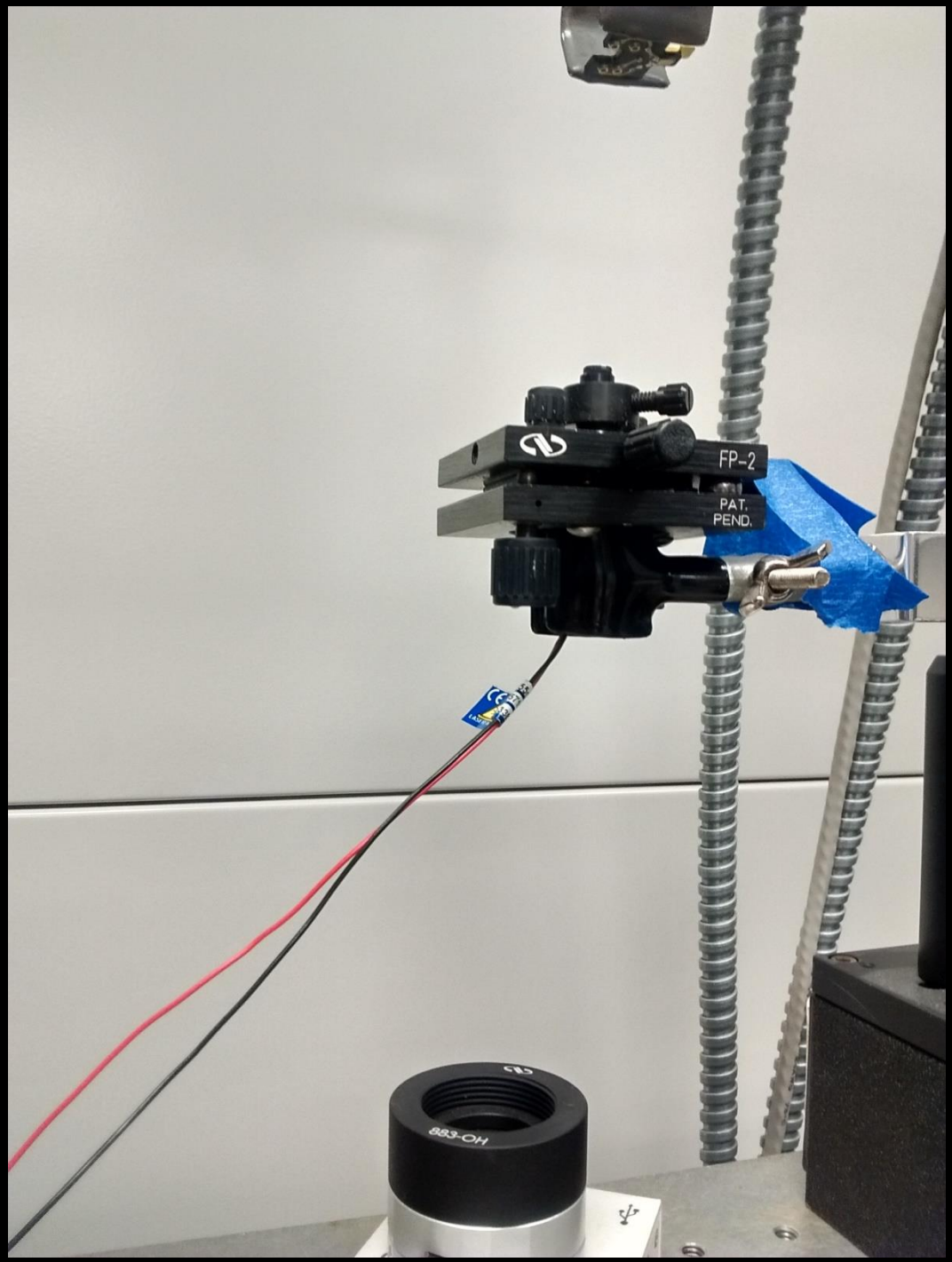
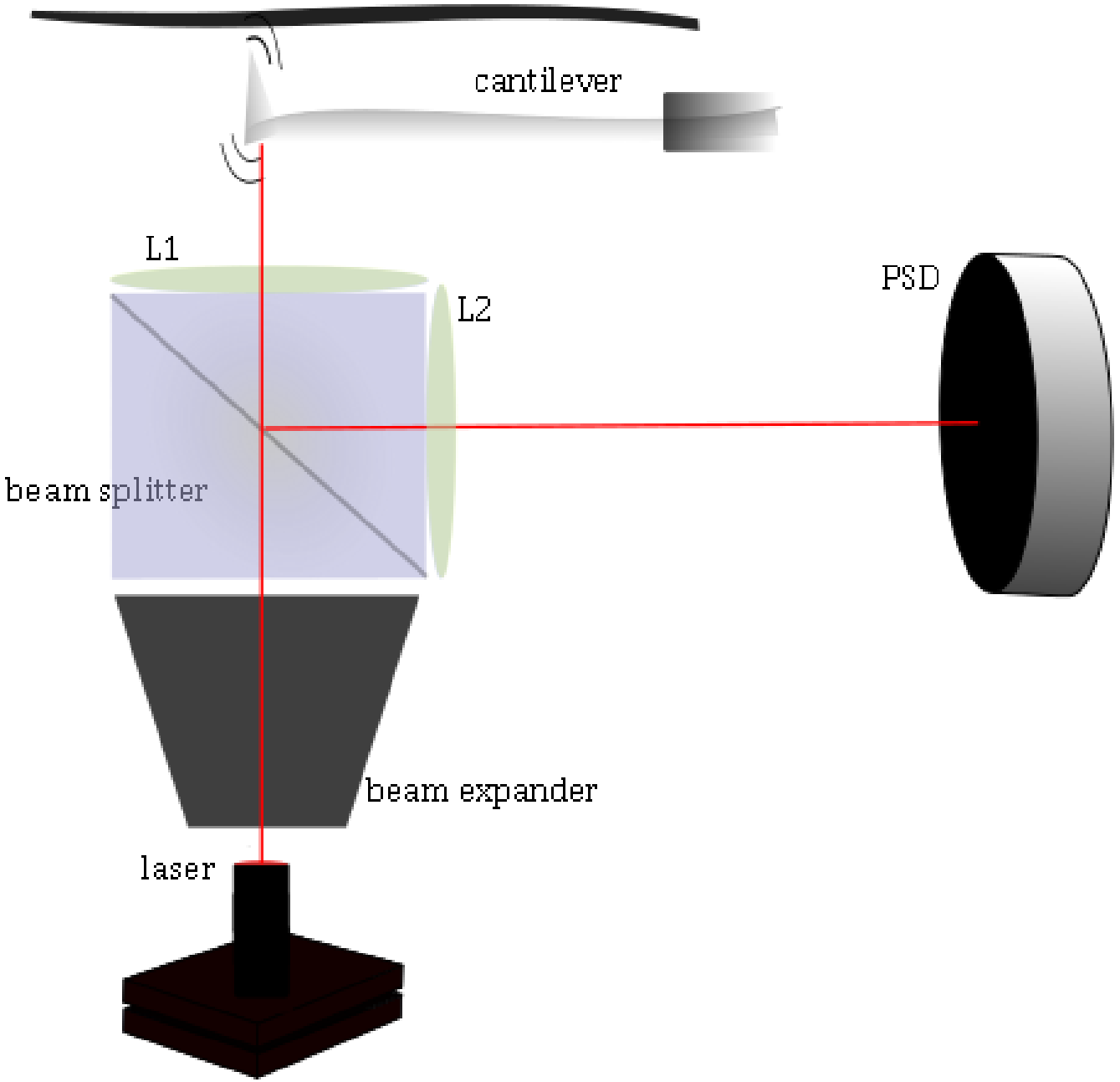
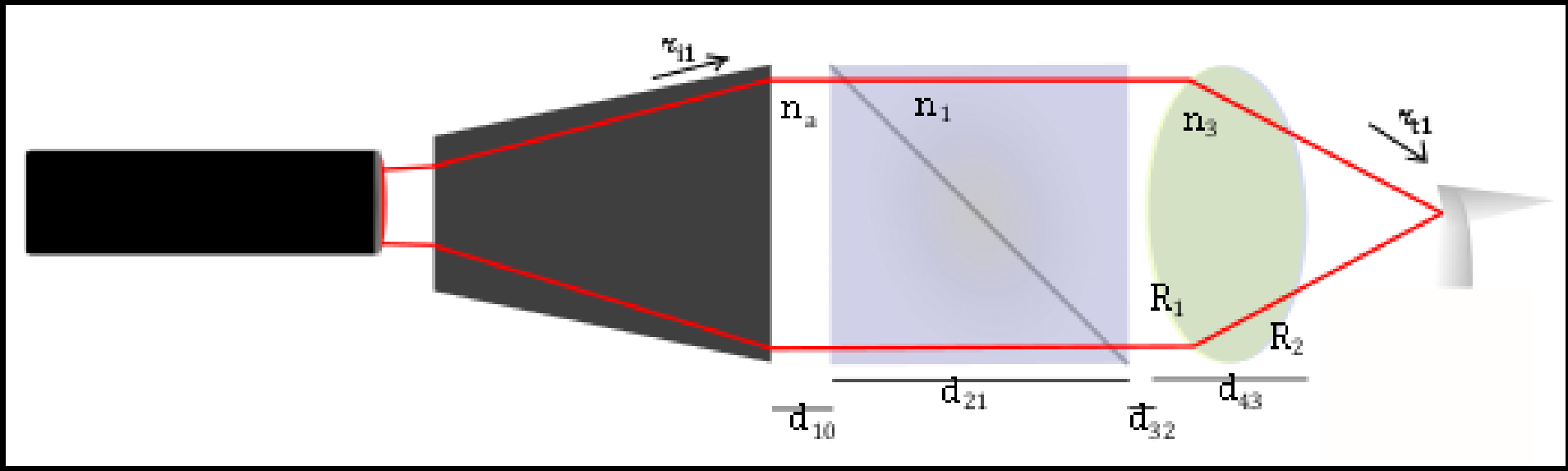

20 cm
60.0 mm
14 cm




FP-2
PAT.
PEND.
883-OH

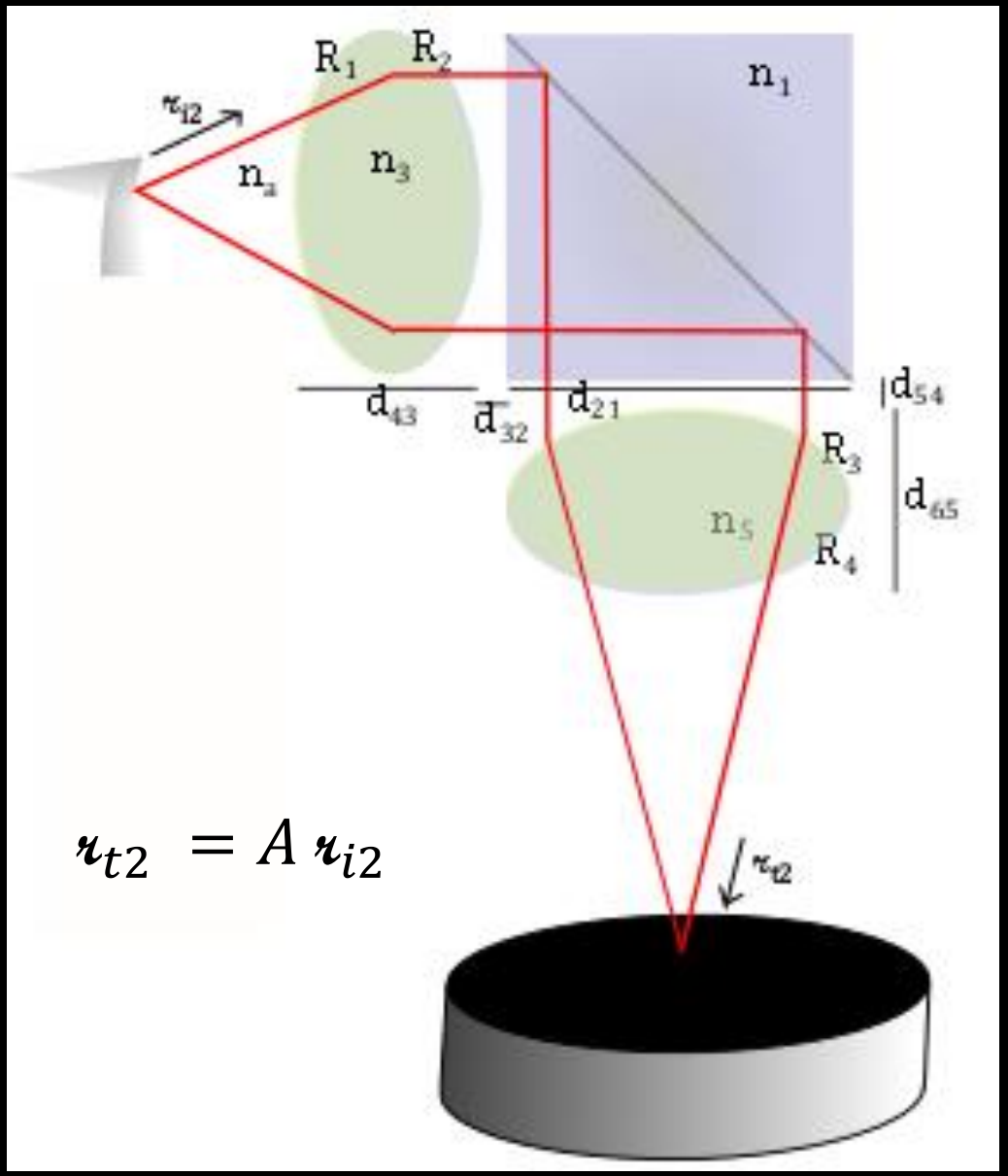

cantilever
L1
L2
PSD
beam splitter
beam expander
laser



$$A = \begin{bmatrix} 1 & -\left(\frac{n_a - n_3}{R_2}\right) \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ \frac{d_{43}}{n_3} & 1 \end{bmatrix} \begin{bmatrix} 1 & -\left(\frac{n_3 - n_a}{R_1}\right) \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ \frac{d_{32}}{n_a} & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ \frac{d_{21}}{n_1} & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ \frac{d_{10}}{n_a} & 1 \end{bmatrix}$$

$$r_{t1} = A\, r_{i1}$$

$$A = \begin{bmatrix} 1 & -\left(\frac{n_a - n_5}{R_4}\right) \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ \frac{d_{65}}{n_5} & 1 \end{bmatrix} \begin{bmatrix} 1 & -\left(\frac{n_5 - n_a}{R_3}\right) \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ \frac{d_{54}}{n_a} & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ \frac{d_{21}}{n_1} & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ \frac{d_{32}}{n_a} & 1 \end{bmatrix} \begin{bmatrix} 1 & -\left(\frac{n_a - n_3}{R_2}\right) \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ \frac{d_{43}}{n_3} & 1 \end{bmatrix} \begin{bmatrix} 1 & -\left(\frac{n_3 - n_a}{R_1}\right) \\ 0 & 1 \end{bmatrix}$$



$$r_{t2} = A\, r_{i2}$$

Future Goals

Movement of the walker

Cantilever driven to oscillate

Observation of the beam footprint on PSD

Redesign of stage

Obtaining topographical images