

Lab 2: STM

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we are calibrating the params including the `set_init`, and `C_i`, `C_p`. in order to do this, we started with small values for both and we increased them until we found the resonance point. once we identified them, we brought the values back down to eliminate the resonance.

we first got an error (too many steps when approaching the surface) when tried to approach the sample and set $(C_i, C_p) = (1,1)$ which crashed the sample into the surface. we changed the tip and more carefully approached the surface

500pa

Task 1: z-limit and Vertical Resolution

vertical resolution is $z_limit / 2^{16}$

$z_limit = 500 \text{ nm}$, $res = 500 \text{ nm} / 65536 \approx \mathbf{0.0763 \text{ angstrom}}$

smaller z_limit -> noise decrease

We found that $z_limit = 500 \text{ nm}$ was a good value and allowed us to identify the atomic steps terraces in the sample. we could corroborate that some of them were of the size of one atom. we could find interesting areas by moving in the xy plane and zoomed in on places where we could identify these steps. we use scan size =
After this, we looked for areas with NO STEPS so that we could do atomic resolution.

Task 2: Atomic Steps on HOPG

Task 3: Atomic Resolution & Lattice Constant

2D FFT filter to removes noise -> shows the periodic lattice

we could see that when we spoke, it increased the noise in the measured image, which was immediatly visible in the

Task 4: Moiré Pattern & Layer Rotation Angle

theta

using $D = d / (2 \cdot \sin(\theta/2))$

Sources of Error:

Tip Quality: The sharpness and stability of the tip is the largest factor affecting image quality. A dull or "double" tip can create artifacts.

Vibrational or acoustic Noise: External vibrations can cause streaks or noise in the image.

Thermal Drift: Slow changes in temperature can cause the image to distort or "drift" over the course of a long scan.

Software Artifacts: Image processing steps, like flattening or filtering, can sometimes introduce features that are not real

This is the description of which file is what

000 is the first one, we used to calibrate the Cp and Ci parameters

001 is when we changes the $z_limit = 500$ nm to see the atomic steps properly

002 we zoomed on a region with 2 terraces, in

changed scan size to 10 nm

003 we spoke a bit so it has some noise

004 fullll silent

008 is good one, we see the atoms. we can mark them clearly in channel 2