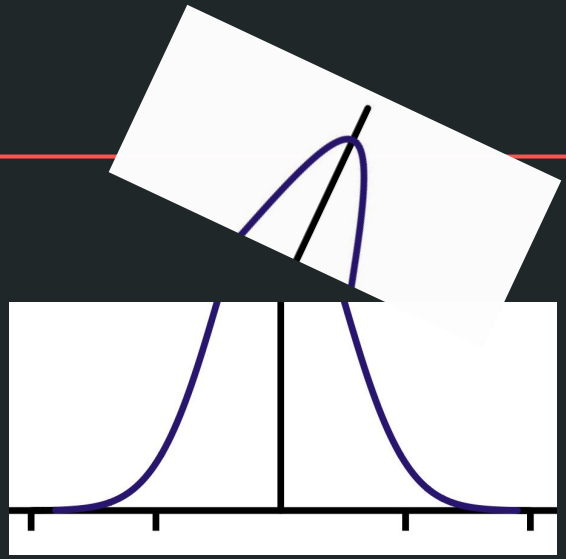
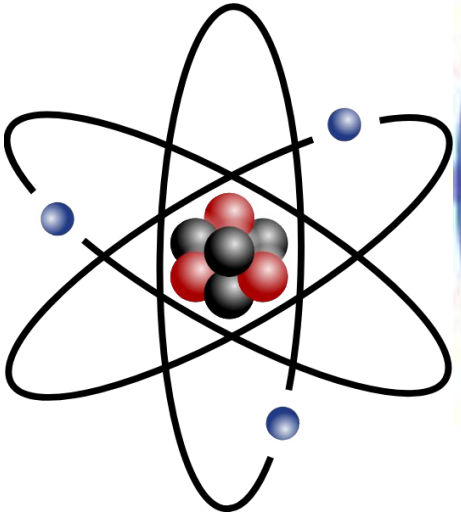
Isolating Iso-intensities of a Laser

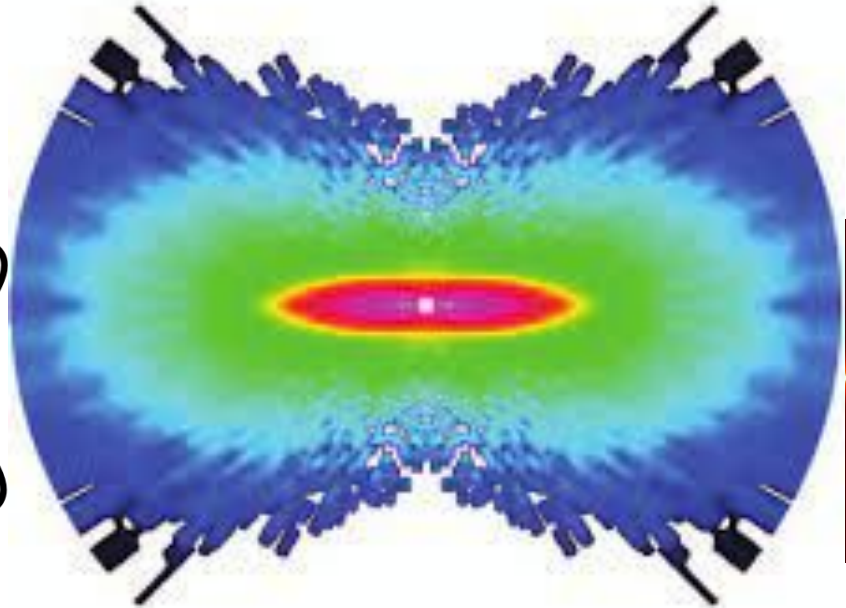
or, Chop Chop Gauss!

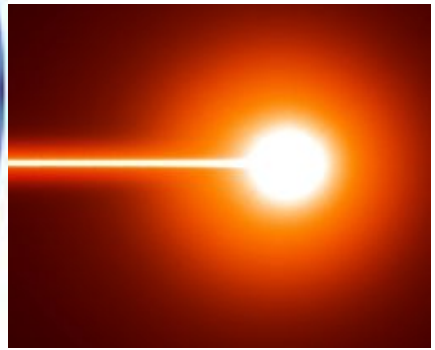
Maggie Liu
August 5th, 2022



What is AMO?







Blaga, C., Xu, J., DiChiara, A. *et al.* Imaging ultrafast molecular dynamics with laser-induced electron diffraction. *Nature* 483, 194–197 (2012). https://doi.org/10.1038/nature10820

Why project?

Only some intensities contribute to results

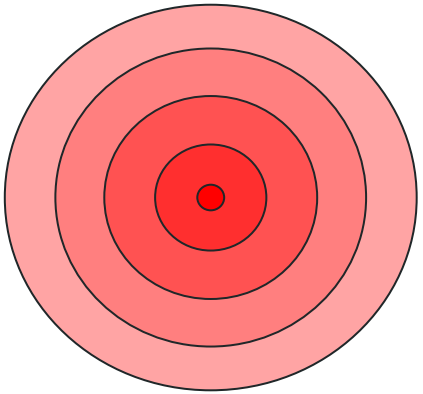
BUT

Focal averaging = average over all intensities

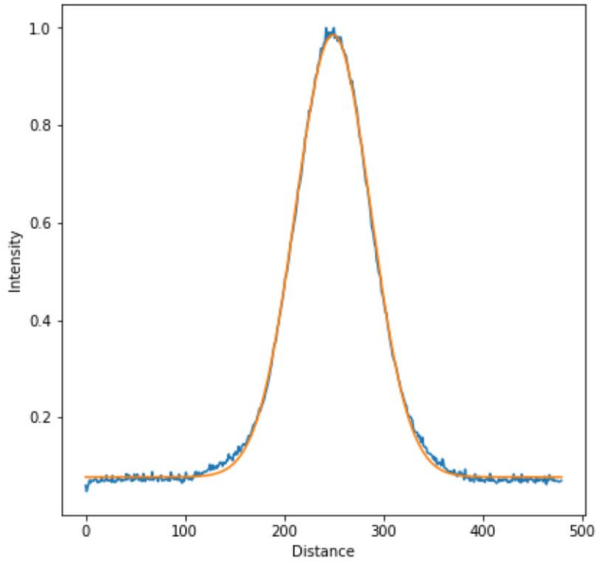
Usually use software to isolate needed intensities

BUT

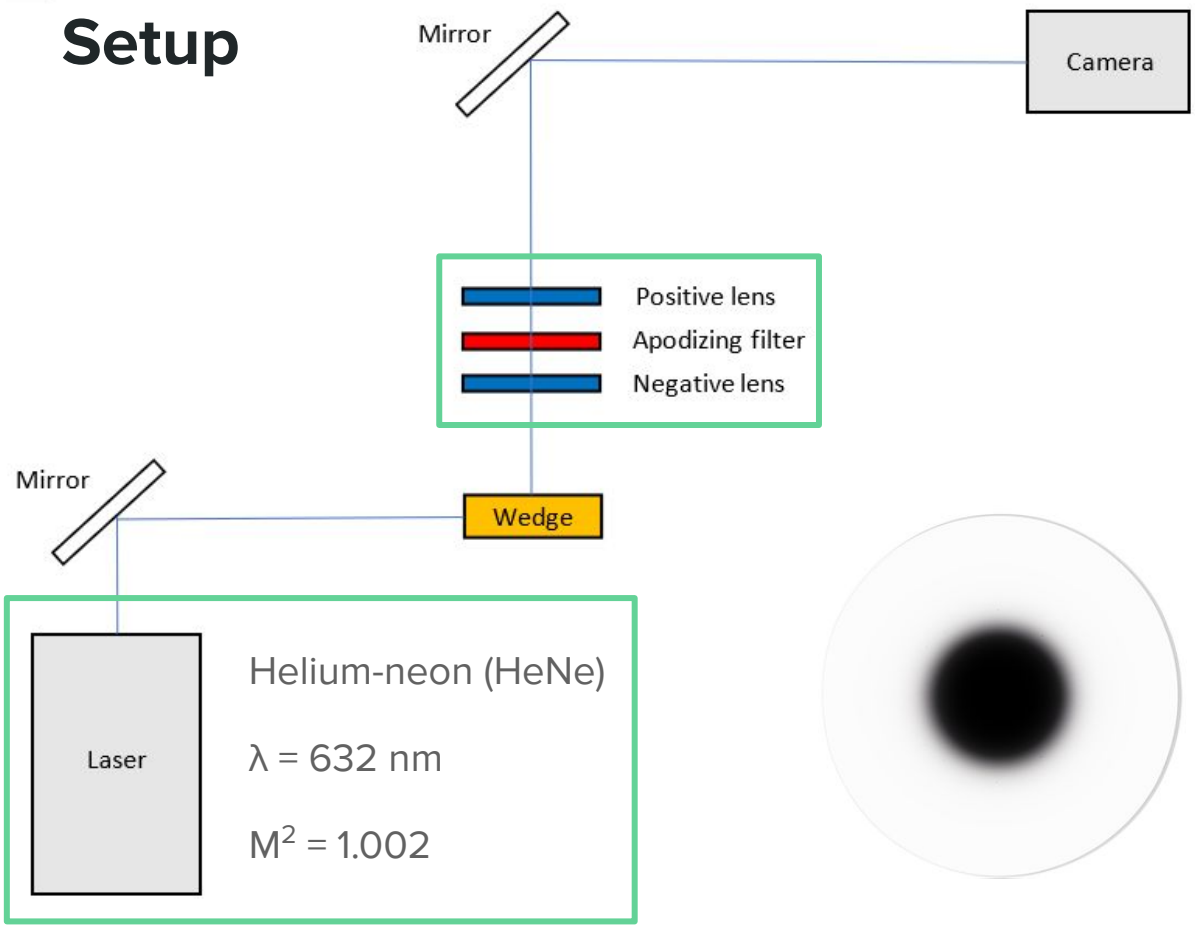
Hardware

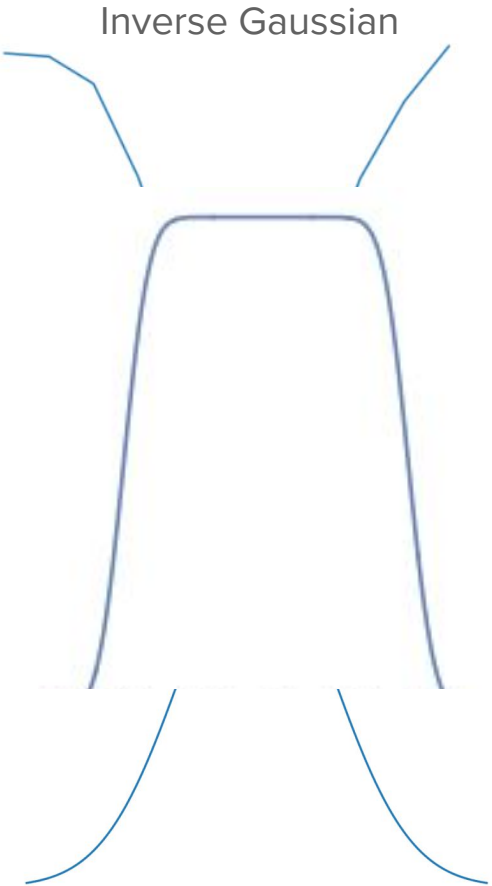


Radius ⬆ = Intensity ⬇

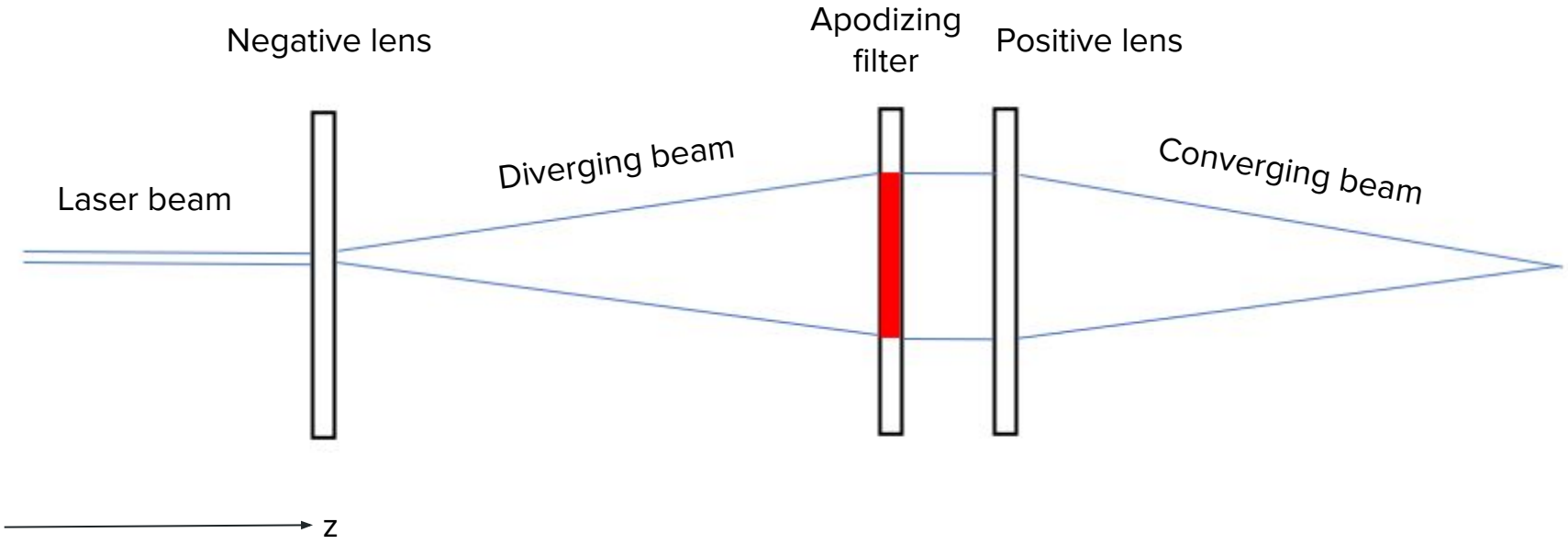


Setup

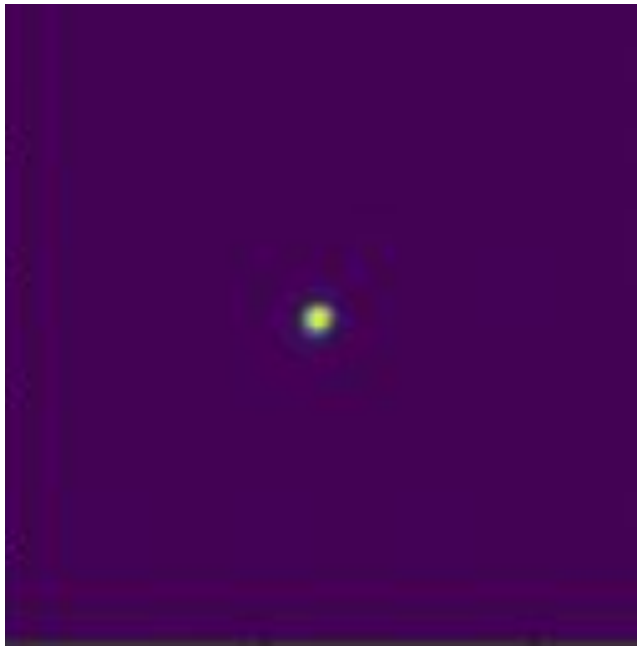

Mirror
Camera
Positive lens
Apodizing filter
Negative lens
Mirror
Wedge
Laser
Helium-neon (HeNe)
λ = 632 nm
M² = 1.002


Inverse Gaussian
Normal Gaussian

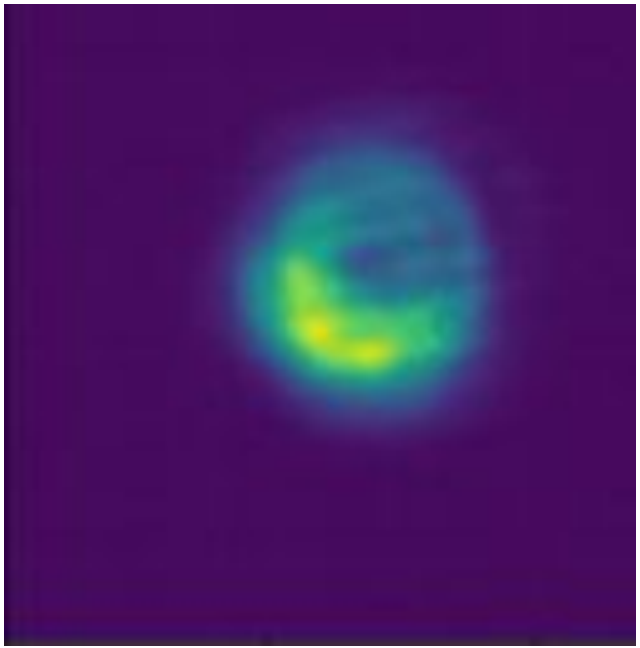
Lens setup


Negative lens
Apodizing filter
Positive lens
Laser beam
Diverging beam
Converging beam
z

Laser images



Focused



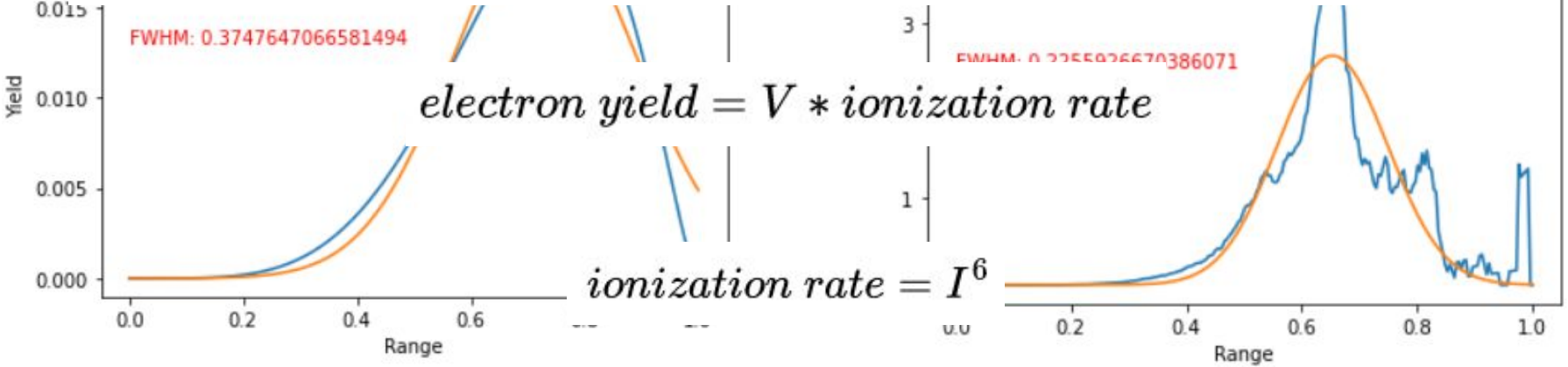
Not focused

Analysis

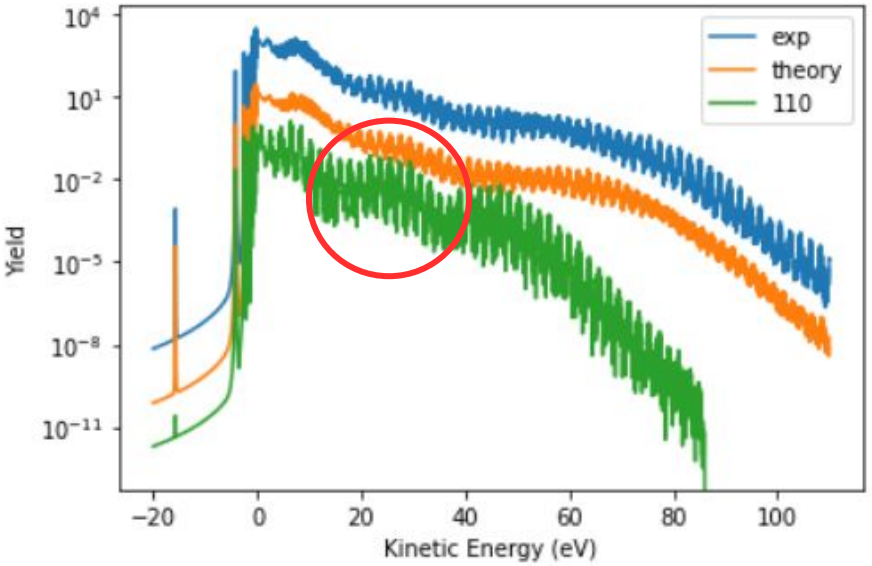
$$V(I_0, I_s) = \pi w_0^2 z_0 \{\frac{4}{3}[\frac{I_0}{I_s} - 1]^{1/2} + \frac{2}{9}[\frac{I_0}{I_s} - 1]^{3/2} - \frac{4}{3} arctan[(\frac{I_0}{I_s} - 1)^{1/2}]\}$$

$$electron\ yield = V * ionization\ rate$$

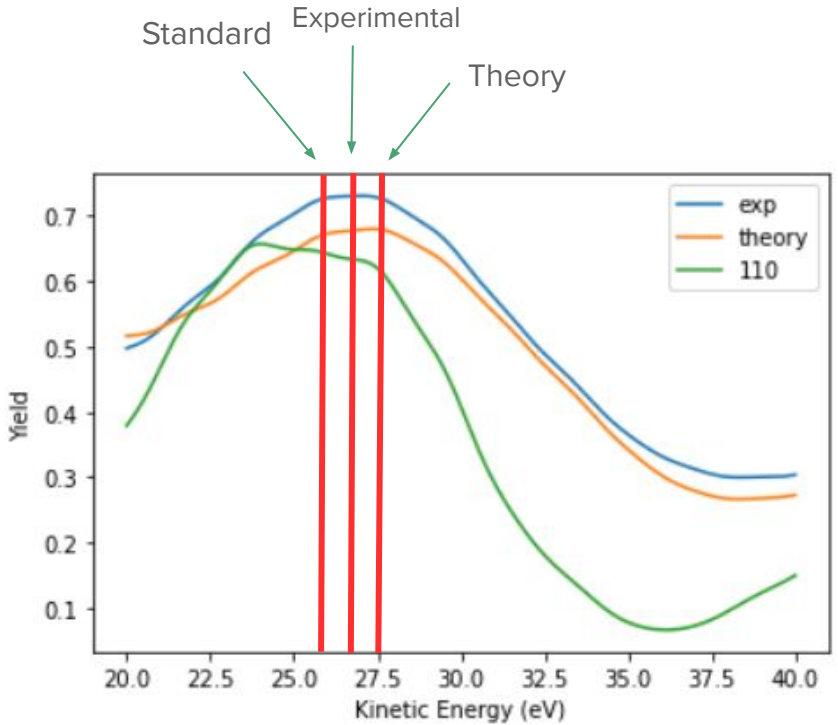
$$ionization\ rate = I^6$$



Photoelectron spectra

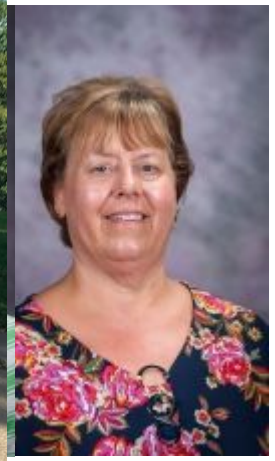


Raw



Filtered

Acknowled



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