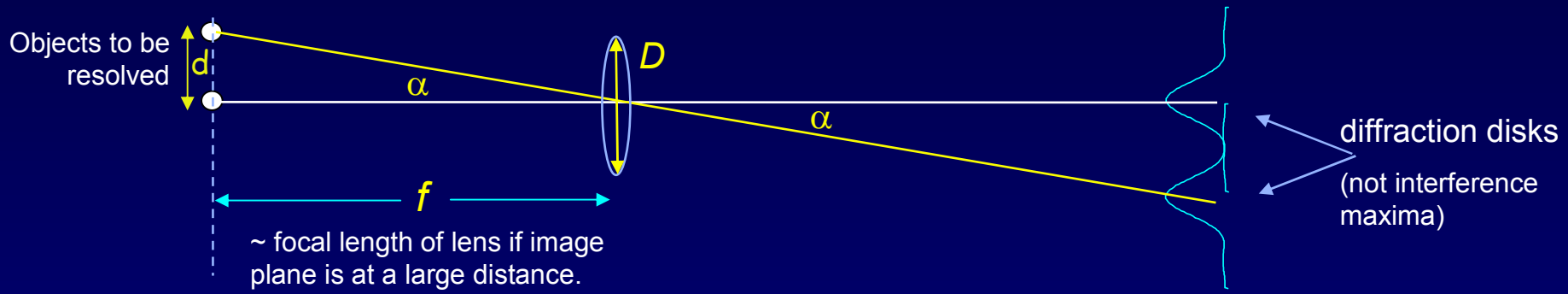
Application of Matter Waves:
Electron Microscopy

The ability to resolve tiny objects improves as the wavelength decreases. Consider the microscope:



Rayleigh's criterion: $\alpha_c = 1.22\frac{\lambda}{D}$

The minimum d for which we can still resolve two objects is α_c times the focal length: $d_{min} \approx f\alpha_c = 1.22\lambda\frac{f}{D}$

the "f-number"

The objective lens of a good optical microscope has f/D ≅ 2, so with λ ~ 500 nm the microscope has a resolution of d_{min} ~ 1 μm.

We can do much better with matter waves because electrons with energies of a few keV have wavelengths much less than 1 nm.

The instrument is known as an "electron microscope".