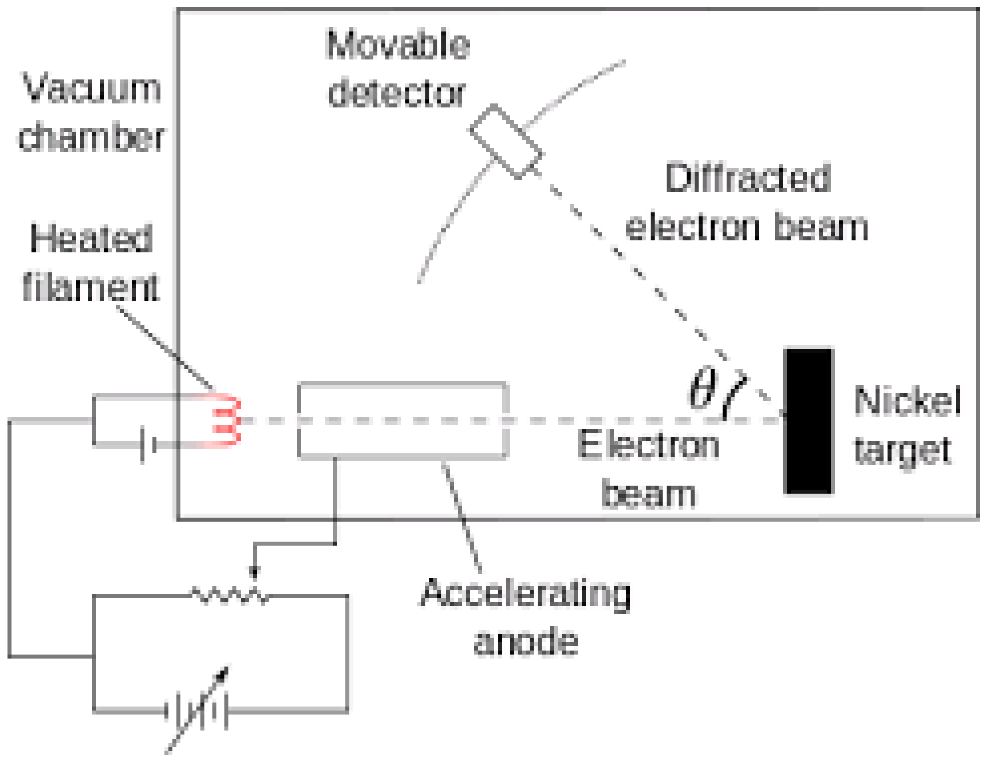
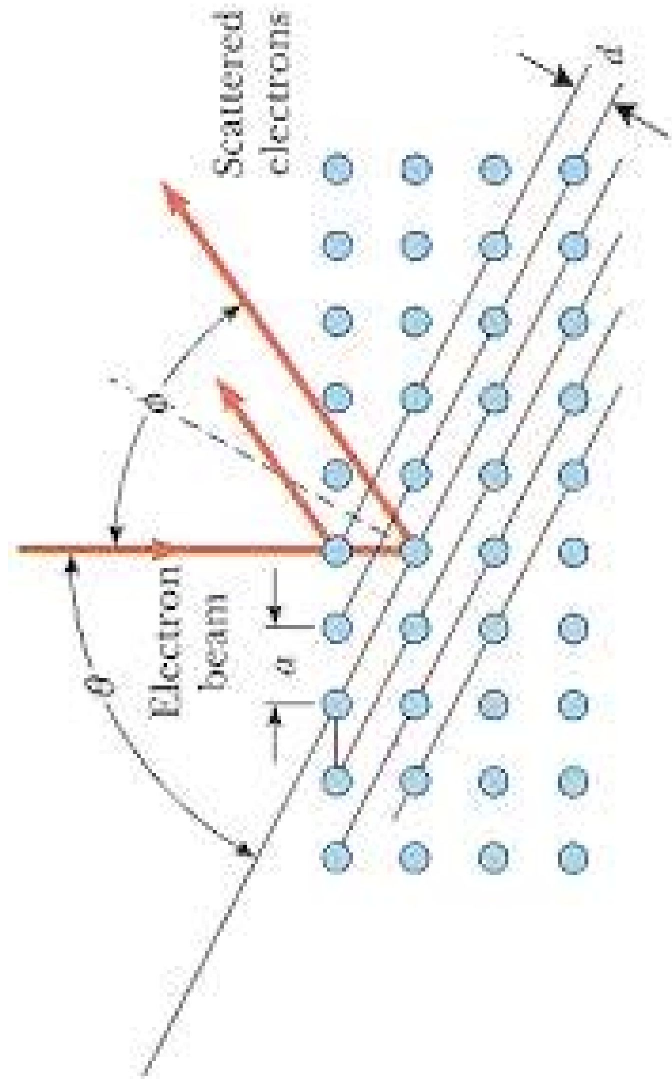
Davisson-Germer Experiment on Electron Diffraction from Ni Surfaces

Bell Labs, 1927

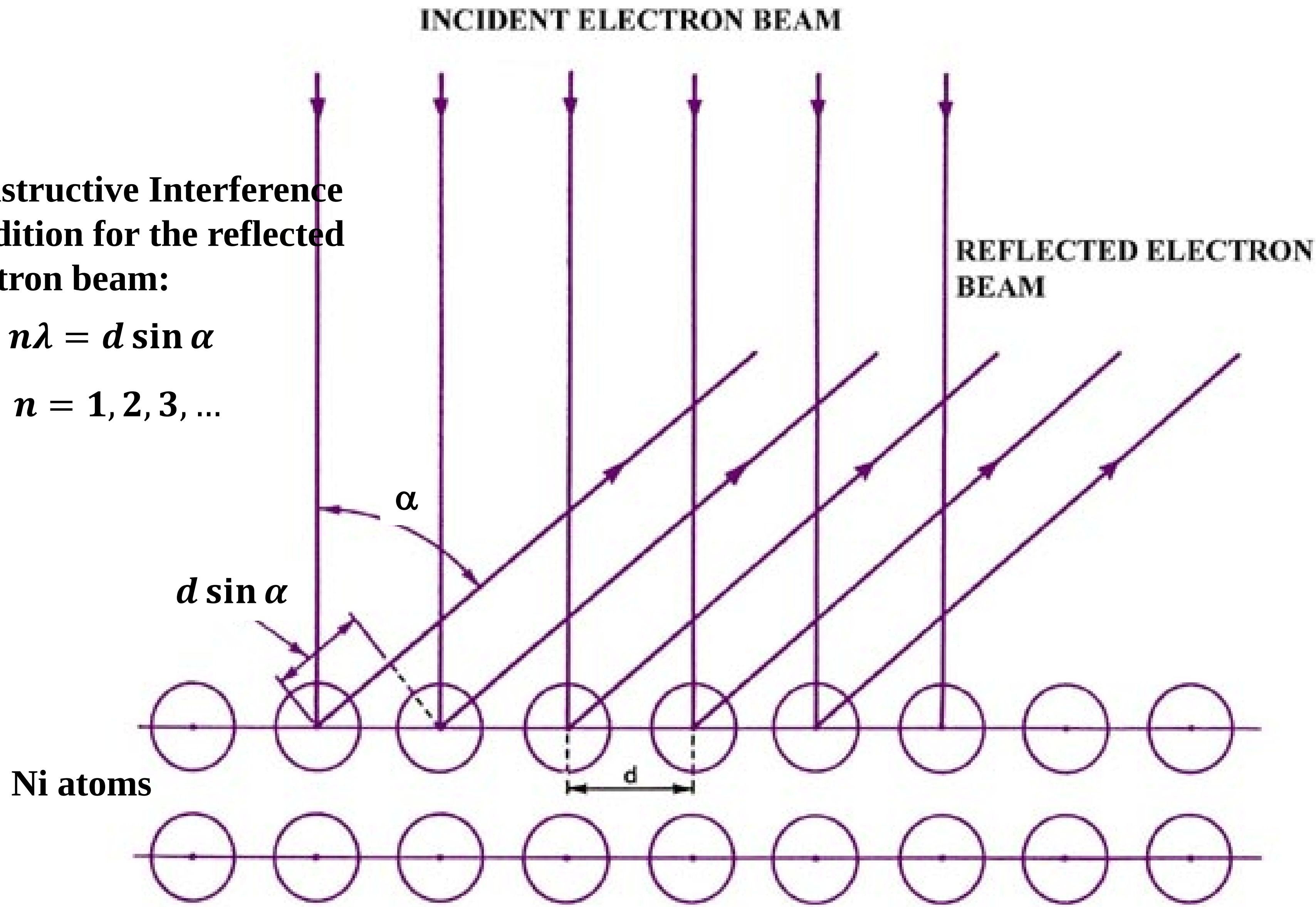




Constructive Interference condition for the reflected electron beam:

$$n\lambda = d \sin \alpha$$

$$n = 1, 2, 3, \ldots$$



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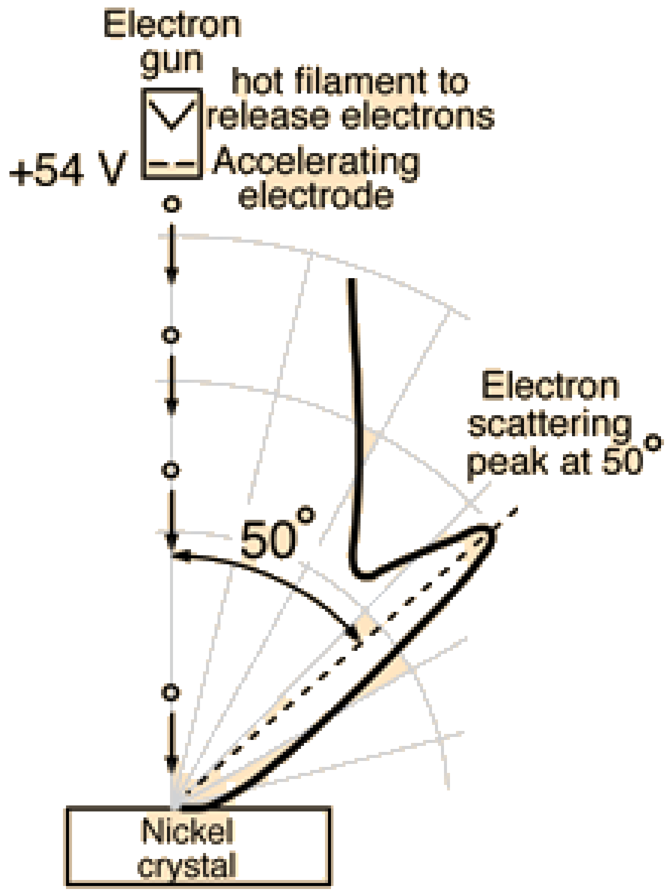


$$n\lambda = d \sin \alpha$$

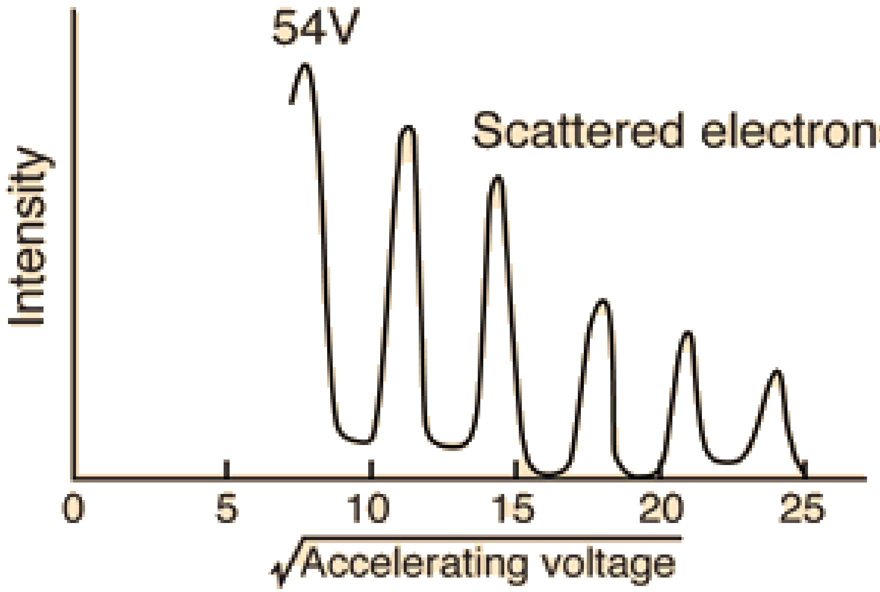
$$For\ Ni: d = 0.215\ nm$$

Davisson and Germer saw the first *diffraction peak at* $\alpha = 50°$

$$Hence\ 1\ \lambda = 0.215\ nm\ \sin 50°$$

$$So\ \lambda = 0.165\ nm$$

Meanwhile, deBroglie expects an electron wavelength for $V_0 = 54\ eV$ *of* $\lambda = \frac{1.226\ nm}{\sqrt{54}} = 0.167\ nm$



The experimental data above, reproduced above Davisson's article, shows repeated peaks of scattered electron intensity with increasing accelerating voltage. This data was collected at a fixed scattering angle. Using the Bragg law, the deBroglie wavelength expression, and the kinetic energy of the accelerated electrons gives the relationship

$$\frac{1}{\lambda} = \frac{n}{2d\sin\theta} = \frac{p}{h} = \frac{\sqrt{2mE}}{h} = \frac{\sqrt{2meV}}{h}$$

Electron wavelength — *Bragg law* — *deBroglie relationship* — *Acceleration through voltage V*

http://hyperphysics.phy-astr.gsu.edu/hbase/quantum/DavGer2.html#c1