Spectroscopy

The pattern of states of a quantum system is a direct consequence of the force binding the system.



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Energy levels of the sodium atom.

$$V = k_e \frac{q_1 q_2}{r}$$



Energy levels of the nucleon.

$$V = -\frac{4}{3}\frac{\alpha_s \hbar c}{r} + kr$$

The Optical Spectrum of Hydrogen





Double-Slit Interference





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Double Slit Interference



Double Slit Interference





The Hydrogen Lines



The Gaussian Distribution



$$y = P(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\overline{x})^2}{2\sigma^2}}$$

Which Point is Best?



Which Point is Best?



Identifying Your Unknown

1. Pattern recognition first.





Identifying Your Unknown

1. Pattern recognition first.





2. Quantitative comparison in units of σ .

Line	My Results (Å)	NIST Results (Å)	Normalized Difference
lpha	$6.64\pm0.09\times10^3$	6.56272×10^{3}	0.95
eta	$4.85\pm0.15\times10^3$	4.86133×10^{3}	0.11
γ	$4.39\pm0.06\times10^3$	4.34047×10^3	0.9