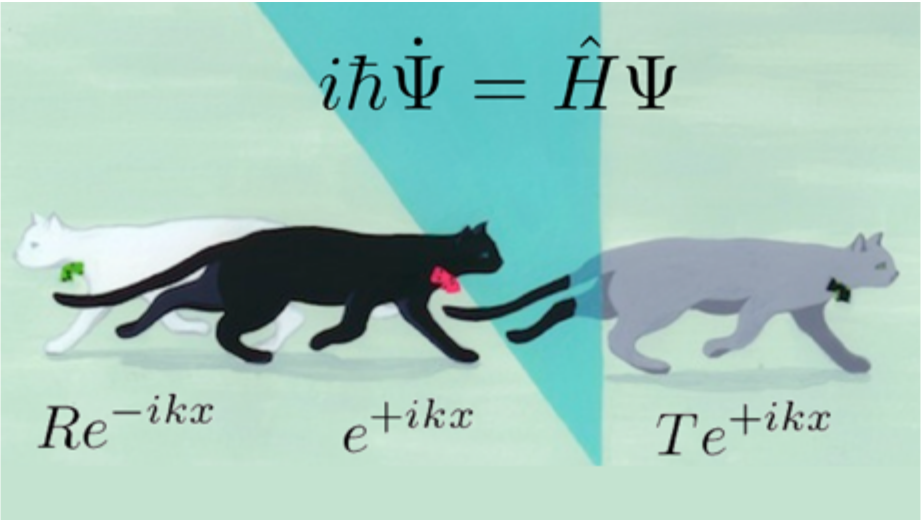
Exploring Quantum Physics

Coursera, Spring 2013   Instructors: Charles W. Clark and Victor Galitski

Quantum harmonic oscillator

Part III: Generating the energy spectrum



Commutation relations

- We just proved that

$$\hat{H} = \frac{\hat{p}^2}{2m} + \frac{m\omega^2\hat{x}^2}{2} = \hbar\omega\left(\hat{a}^\dagger\hat{a} - \frac{i}{2\hbar}[\hat{x}, \hat{p}]\right)$$

- with $\hat{a} = \sqrt{\frac{m\omega}{2\hbar}}\hat{x} + \frac{i\hat{p}}{\sqrt{2m\omega\hbar}}$ and $\hat{a} = \sqrt{\frac{m\omega}{2\hbar}}\hat{x} - \frac{i\hat{p}}{\sqrt{2m\omega\hbar}}$

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Generating the spectrum