

Answer on Question #68641, Physics / Quantum Mechanics |

Question

if A^\wedge and B^\wedge are hermitian and anti-hermitian operators respectively. check the hermiticity of the commutator $[A^\wedge, B^\wedge]$ of the two operators .

Solution

We have

\hat{A}^+ = \hat{A} — hermitian operator,

\hat{B}^+ = $-\hat{B}$ — anti-hermitian operator.

We remind the definition of the commutator

$$[\hat{A}, \hat{B}] = \hat{A}\hat{B} - \hat{B}\hat{A}$$

and the property of hermitian conjugation

$$(\hat{A}\hat{B})^+ = \hat{B}^+\hat{A}^+.$$

Now we can check the hermiticity of the commutator

$$[\hat{A}, \hat{B}]^+ = (\hat{A}\hat{B} - \hat{B}\hat{A})^+ = (\hat{A}\hat{B})^+ - (\hat{B}\hat{A})^+ = \hat{B}^+\hat{A}^+ - \hat{A}^+\hat{B}^+ = -\hat{B}\hat{A} + \hat{A}\hat{B} = [\hat{A}, \hat{B}].$$

Thus, commutator $[\hat{A}, \hat{B}]$ is hermitian.

Answer: commutator $[\hat{A}, \hat{B}]$ is hermitian.

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